

NIOSH EXTRAMURAL RESEARCH AND TRAINING PROGRAM

ANNUAL REPORT OF FISCAL YEAR 2020

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 share with you the fiscal year (FY) 2020 annual report on the National Institute for Occupational Safety and Health (NIOSH) Extramural Research and Training Program. NIOSH aims to lead and support national occupational safety and health research and training programs and reduce work-related injuries and illnesses through a diversified portfolio of high-quality extramural research, education, and training. The data in this report reflect the achievements of the extramural community of researchers supported by NIOSH and the Office of Extramural Programs (OEP).

In [Section II](#) of this report, we look at how NIOSH invested in our multidisciplinary centers, investigator-initiated research projects, and cooperative research agreements. We also report on our training project grants, state surveillance programs, and small business innovation research. We include links to the NIOSH website throughout the report for direct access to additional data and information.

[Section III](#) highlights how the NIOSH OEP and extramural researchers responded to the coronavirus disease 2019 (COVID-19) pandemic.

[Section IV](#) describes the public health relevance and accomplishments of our varied and multidisciplinary portfolios with program highlights from FY 2020. In addition, this report now includes data on the World Trade Center Health Program's extramural portfolio of cooperative agreements, which are shown in [Section V](#).

I would like to acknowledge the work of NIOSH OEP 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.



"The data in this report reflect the achievements of the extramural community of researchers supported by NIOSH and the Office of Extramural Programs."

John Howard, M.D.
Director, National Institute for
Occupational Safety and Health,
Centers for Disease Control and Prevention

AT-A-GLANCE: FY 2020 EXTRAMURAL AWARDS

In FY 2020, which spanned from October 1, 2019, through September 30, 2020, the National Institute for Occupational Safety and Health (NIOSH) funded 153 extramural awards totaling \$93,808,025 for extramural research and training. This compares with

the FY 2019 figure of \$94,896,043 for 167 awards. You can find more information on annual extramural funding and awards since 2012 at [Extramural Research and Training Program Annual Reports](#). This year's funding includes the following:



66%
Multidisciplinary centers



16%
Investigator-initiated research



9%
Cooperative research agreements



7%
Specialty training programs



2%
Small business innovation research

Summary of all awards by type of funding in FY 2020

Award Category	Award Mechanism	Number of Awards	Funding
Multidisciplinary Centers			
Education and Research Centers*	Training Grant (T42)	18	\$29,333,381
Centers for Agricultural Safety and Health	Cooperative Research Agreement (U54)	11	\$19,028,001
National Center for Construction Safety and Health Research and Translation	Cooperative Research Agreement (U60)	1	\$5,750,000
Centers of Excellence for <i>Total Worker Health</i> ®	Cooperative Research Agreement (U19)	6	\$8,004,593
Investigator-initiated Research Grants		49	\$15,174,357
Research Grants	Investigator-initiated (R01, R03, R21, R13, U13)	34	\$13,290,265
Career Developmental Research	Mentored Career Scientist (K01)	13	\$1,384,166
National Robotics Initiative	Interagency Research Grant Agreements	2	\$499,926
Cooperative Research Agreements		30	\$8,202,123
State Surveillance Program	Cooperative Research Agreement (U60)	26	\$6,536,879
Occupational Safety & Health Surveillance Collaboration, Education & Translation	Cooperative Research Agreement (U24)	1	\$225,000
National Mesothelioma Virtual Bank	Cooperative Research Agreement (U24)	1	\$1,068,089
Commercial Fishing Occupational Safety Research	Cooperative Research Agreement (U01)	2	\$372,155
Specialty Training Programs		32	\$6,465,790
Training Project Grants	Training Grant (T03)	28	\$5,076,944
Miner Safety and Health Training Program	Cooperative Research Agreement (U60)	2	\$970,154
Commercial Fishing Occupational Safety Training†	Training Grant (T03)	2	\$418,692
Small Business Innovation Research		6	\$1,849,780
Small Business Innovation Research	Phase I (R43) & Phase II (R44)	6	\$1,849,780
Total Extramural Funding		153	\$93,808,025

In addition to extramural research and training, the NIOSH Office of Extramural Programs (OEP) manages the extramural activities of the World Trade Center (WTC) Health Program. This extramural portfolio includes the WTC Health Registry and research projects. Data for the WTC Health Program for 2011–2020 are in [Section V](#) of this report, separate from all other extramural data. The total research funding for the WTC Health Registry and the 84 research projects was \$195 million for 2011–2020. Specifically, for FY 2020, that figure was \$23.7 million for the WTC Health Registry and 29 research projects. This compares to FY 2019 figures of \$24.1 million for the WTC Health Registry and 29 research projects.

In FY 2020, NIOSH extramural researchers wrote 460 peer-reviewed articles in 211 journals. Education and Research Centers published the most articles (215), followed by investigator-initiated (R01) research (90). These articles appeared most often in the *Journal of Occupational and Environmental Medicine*. Altmetrics data—which measure the extent that the public is influenced by, exposed to, promotes, and engages with research online, in the media and beyond—show the following:

Out of 460 extramural articles, 310 (67%) were mentioned or cited. Collectively, these articles were cited 5,826 times in social media, media, research articles, policy documents, and other sources.

- 9% (41) of the FY 2020 articles ranked in the top 5% of more than 32.9 million research outputs scored by altmetric.com
- 310 (67%) of the articles were mentioned or cited in various ways, including in online research forums, blogs, social media sites, and mainstream media

See [Extramural Research Impact: Top Articles by Altmetric Score](#) for additional information on altmetrics data for extramural publications over more than a decade.

[Section IV](#) has more information on publications and program successes from extramural research and training during FY 2020, including the following:

- U.S. Surgeon General highlighting the NIOSH *Total Worker Health*[®] approach and Centers of Excellence for *Total Worker Health* (TWH)
- First National Stand-Down to Prevent Struck-by Incidents in Construction
- Study predicting wear on shoes to prevent slips, trips, and falls widely shared with footwear companies and standards organization

The above highlights do not include those from the WTC Health Program. For information on peer-reviewed publications and other outputs or products from the WTC Health Program, see [Section V](#) of this report.

During the coronavirus disease 2019 (COVID-19) pandemic, NIOSH extramural grantees contributed in various ways. Staff from 28 extramurally funded institutions provided their expertise to help NIOSH in the COVID-19 response effort through Interagency Personnel Agreements (IPAs). Additionally, some state surveillance programs requested to redirect their funding and staff towards COVID-19 activities. For more details, see [Section III](#) of this report.

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LIST OF ABBREVIATIONS

SECTOR PROGRAMS

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

CROSS-SECTOR PROGRAMS

CRC	Cancer, Reproductive, Cardiovascular, and Other Chronic Disease Prevention
HLP	Hearing Loss Prevention
HWD	Healthy Work Design and Well-Being
IID	Immune, Infectious, and Dermal Disease Prevention
MUS	Musculoskeletal Health
RHP	Respiratory Health
TIP	Traumatic Injury Prevention

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I. NIOSH EXTRAMURAL RESEARCH AND TRAINING PROGRAM

The National Institute for Occupational Safety and Health (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, the Commercial Fishing Occupational Safety Research and Training Program, and new funding for the National Robotics Initiative, in collaboration with the National Science Foundation, enhance the breadth and depth of extramural research and training at NIOSH. The NIOSH Extramural Research and Training Program webpage describes these programs. The peer review and program management of the extramural research and training program portfolios are managed by the Office of Extramural Programs (OEP). The office also manages the extramural portfolio of cooperative agreements for the WTC Health Program. This portfolio includes the WTC Health Registry and research projects and is discussed separately in [Section V](#) of this report. The National Institutes of Health (NIH) publishes extramural funding opportunity announcements in the [NIH Guide for Grants and Contracts](#). This information also appears in the [Funding Opportunities](#) listed on the NIOSH Extramural Research and Training Programs webpage. The [Appendix](#) of this report lists all the NIOSH funding opportunity announcements published in FY 2020.

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 FY 2017, 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. In addition, NIOSH has core and specialty program areas, which represent essential activities, mandates, special focus areas, and methods to use in research that support the sector and cross-sector programs. Research priorities are organized by program area and outlined in the [NIOSH Strategic Plan for FY 2019–2024](#). These goals are used for extramural program and projects by researchers outside of NIOSH, except for those under the WTC Health Program.

Table 1 provides links to more information about these program areas and research priorities.

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	Health Hazard Evaluations
Center for Direct Reading and Sensor Technologies	Nanotechnology
Center for Maritime Safety and Health Studies	National Center for Productive Aging and Work
Center for Motor Vehicle Safety	Occupational Health Equity
Center for Occupational Robotics Research	Personal Protective Technology
Center for Work and Fatigue Research	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

II. NIOSH EXTRAMURAL RESEARCH

FUNDING DISTRIBUTION FY 2020

In FY 2020, NIOSH awarded \$93,808,025 in extramural funding for 153 projects. Data for the WTC Health Program are reported separately in [Section V](#). Figure 1 shows the distribution of awards by activity for FY 2020. The majority (66%) of extramural funding went to [multidisciplinary centers](#), followed by 16% for [investigator-initiated and career development research grants](#). Other [cooperative research agreements](#) made up 9% of the FY 2020 grant distributions, followed by [specialty training programs](#) (7%), and [small business innovation research projects](#) (2%).

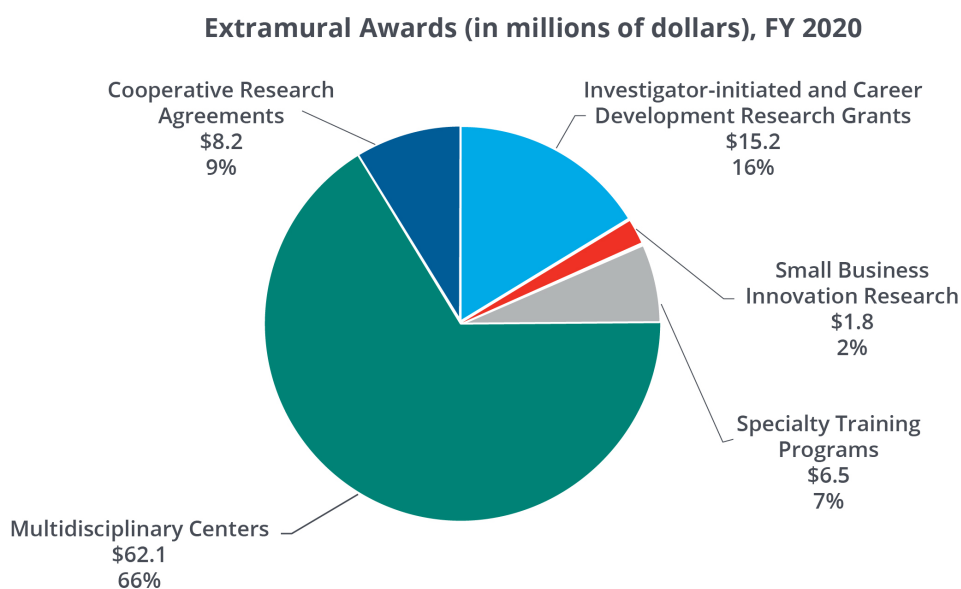


Figure 1. NIOSH extramural grant distribution, FY 2020

In FY 2020, NIOSH presented 153 awards: 40 (26%) for new projects and 113 (74%) for continuing awards. Table 2 summarizes all NIOSH extramural awards for FY 2020. Of these awards,

- 49 (32%) funded investigator-initiated research and career development;
- 36 (24%) funded multidisciplinary research and training centers, which include Education and Research Centers (ERCs), Centers for Agricultural Safety and Health (Ag Centers), National Center for Construction Safety and Health Research and Translation (NCC), and Centers of Excellence for *Total Worker Health*[®];
- 32 (21%) funded specialty training programs;
- 30 (20%) funded cooperative research agreements; and
- 6 (4%) funded small business innovation research.

The OEP webpage has a searchable list of all [active awards](#) funded by NIOSH and [NIOSH funding opportunity announcements](#).

SUMMARY OF ALL AWARDS BY TYPE OF FUNDING

Table 2. Summary of all awards by type of funding in FY 2020

Award Category	Award Mechanism	Number of Awards	Funding
Multidisciplinary Centers		36	\$62,115,975
Education and Research Centers*	Training Grant (T42)	18	\$29,333,381
Centers for Agricultural Safety and Health	Cooperative Research Agreement (U54)	11	\$19,028,001
National Center for Construction Safety and Health Research and Translation	Cooperative Research Agreement (U60)	1	\$5,750,000
Centers of Excellence for <i>Total Worker Health</i> [®]	Cooperative Research Agreement (U19)	6	\$8,004,593
Investigator-initiated Research Grants		49	\$15,174,357
Research Grants	Investigator-initiated (R01, R03, R21, R13, U13)	34	\$13,290,265
Career Developmental Research	Mentored Career Scientist (K01)	13	\$1,384,166
National Robotics Initiative	Interagency Research Grant Agreements	2	\$499,926
Cooperative Research Agreements		30	\$8,202,123
State Surveillance Program	Cooperative Research Agreement (U60)	26	\$6,536,879
Occupational Safety & Health Surveillance Collaboration, Education & Translation	Cooperative Research Agreement (U24)	1	\$225,000
National Mesothelioma Virtual Bank	Cooperative Research Agreement (U24)	1	\$1,068,089
Commercial Fishing Occupational Safety Research	Cooperative Research Agreement (U01)	2	\$372,155
Specialty Training Programs		32	\$6,465,790
Training Project Grants	Training Grant (T03)	28	\$5,076,944
Miner Safety and Health Training Program	Cooperative Research Agreement (U60)	2	\$970,154
Commercial Fishing Occupational Safety Training [†]	Training Grant (T03)	2	\$418,692

Award Category	Award Mechanism	Number of Awards	Funding
Small Business Innovation Research		6	\$1,849,780
Small Business Innovation Research	Phase I (R43) & Phase II (R44)	6	\$1,849,780
Total Extramural Funding		153	\$93,808,025

Note: This summary of awards by funding type does not include information for the World Trade Center Health Program. These data are shown in [Section V](#) of this report.

*\$20,000 of ERC funds were obligated using Total Worker Health program funds during FY 2020. However, as the grant operated out of the ERC, the entirety of the grant is reported under the ERC total.

†During FY 2020, no financial obligations were made towards four Commercial Fishing Research Occupational Safety Research cooperative agreements and five Commercial Fishing Occupational Safety Training grants. These projects received all funding in FY 2019 and remained active in FY 2020 using FY 2019 funds.

EXTRAMURAL RESEARCH PORTFOLIO FY 2020

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

Multidisciplinary Centers

NIOSH funds targeted research and outreach activities through multidisciplinary centers, which focus on high-risk industries that contribute disproportionately to work-related injury and illness in the United States. A variety of grant mechanisms, including cooperative research agreements and center training grants, fund these centers. The [Ag Centers](#) and the [NCC](#) perform critical research and training into the many safety and health hazards in agriculture and construction.

Other centers, the [Centers of Excellence for Total Worker Health \(TWH\)](#), conduct research on [TWH](#) concepts. The Centers of Excellence advance TWH knowledge by building the scientific evidence base through multidisciplinary research, intervention, and outreach 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 [ERCs](#) carries out multidisciplinary education and research training activities. These university-based centers offer graduate and postgraduate 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 \$62.1 million to 36 multidisciplinary centers in FY 2020 (see [Figure 2](#)).

[Section IV](#) describes each of these center portfolios and lists individual center grants.



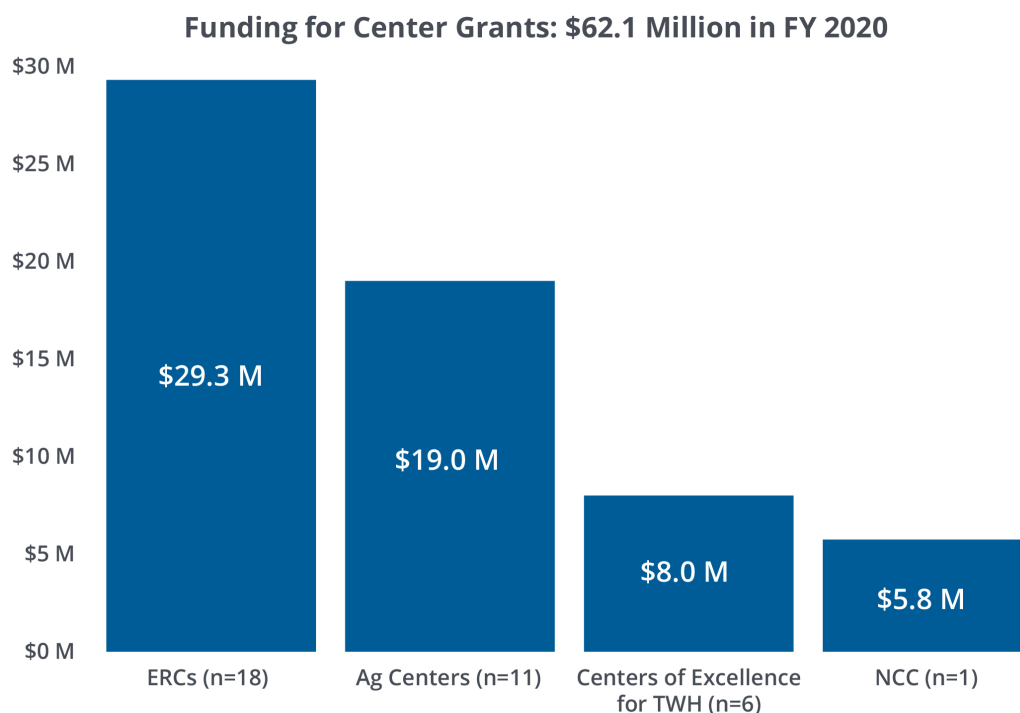


Figure 2. Multidisciplinary center awards, FY 2020



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)
- Exploratory occupational safety and health research grants (R21)
- Research scientist career development awards offer up to 3 years of funding and a scientific focus and training designed to develop the skills and productivity of new career scientists (K01)

National Robotics Initiative

In FY 2020, NIOSH [awarded](#) \$1.5 million to fund studies of collaborative robots, or co-robots, in the workplace through a partnership with the National Science Foundation (NSF) and its [National Robotics Initiative 2.0](#). The Initiative supports research in the United States that will accelerate the development and use of co-robots, an emerging robotic technology that complements, not replaces, human workers.

Through this funding mechanism, two academic institutions—University of Illinois at Chicago and Worcester Polytechnic Institute—will receive \$1.5 million over a 3-year funding period. Their projects aim to reduce workers' exposures to hazards through the development and use of co-robots and are described below:

- **University of Illinois at Chicago**

Project Title: Customizable Lower-limb Wearable Robot Using Soft-wearable Sensor to Assist Occupational Workers

In manufacturing, lifting heavy objects can lead to costly and disabling work-related musculoskeletal disorders. Wearable robots, which provide mechanical assistance to the user's joints, have the potential to reduce injuries from heavy lifting. Researchers at the University of Illinois Chicago will develop and investigate the effectiveness of a personalized wearable robot worn on the lower body that senses the wearer's physical effort and responds accordingly using soft-wearable electronics. Research objectives include improving customization, enhancing soft-wearable electronics with the goal of improving on and replacing conventional sensors, and integrating and evaluating the personalized assistance achieved using soft-wearable sensor measurements in a physically intensive activity, such as lifting using an ankle exoskeleton. More information on this project can be found on the [NSF webpage](#).

- **Worcester Polytechnic Institute**

Project Title: Transparent and Intuitive Teleoperation Interfaces for the Future Nursing Robots and Workers

In healthcare, remote-controlled nursing robots have the potential to reduce workload and risk of infection, especially in quarantine and intensive care environments. Researchers at Worcester Polytechnic Institute will develop and evaluate a more intuitive interface to make it easier for nurses to operate robots from a distance. Researchers also will investigate the psychological and social impacts on workers in the nursing field, educators, and students as well as best practices for integrating robots into current nursing education. More information on this project can be found on the [NSF webpage](#).

Conference Grants

NIOSH values quality scientific meetings, which often result in new information to help prevent injuries, illnesses, and fatalities caused by workplace hazards. NIOSH awards conference grants under research grant mechanisms (R13 and U13). In FY 2020, NIOSH funded one R13 conference grant and three U13 cooperative agreement conference grants (see Table 3).

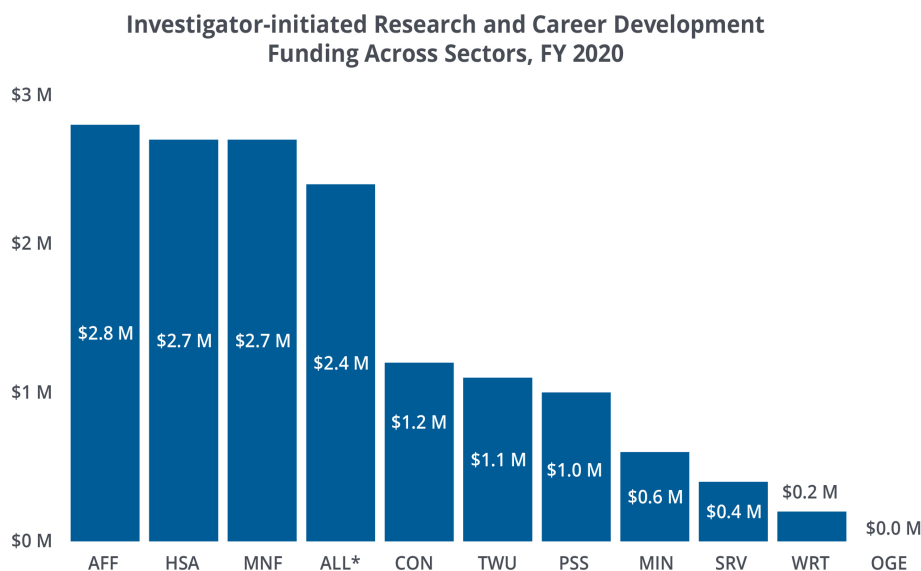
Table 3. Investigator-initiated research and conference grant funding, FY 2020

Grant Type	New Awards	New Funding	Continuing Awards	Continuing Funding	Total Funding
R01	4	\$2,012,228	18	\$9,558,404	\$11,570,632
R21	6	\$1,322,626	4	\$722,589	\$2,045,215
K01	3	\$323,991	10	\$1,060,175	\$1,384,166
R03	0	\$0	0	\$0	\$0
R13	0	\$0	1	\$19,438	\$19,438
U13	0	\$0	3	\$154,906	\$154,906
Total	13	\$3,658,845	36	\$11,515,512	\$15,174,357

NIOSH awarded \$15.2 million to new and continuing research projects, mentored scientist grants, and conference grants in FY 2020 (see Table 3). Section IV describes investigator-initiated research outputs.

Extramural Research Activity by Industry Sector

NIOSH has research programs for each of the ten industry sectors of NORA. Figure 3 shows FY 2020 funding for investigator-initiated research and career development research across the sectors. Extramural research in FY 2020 took place across most of the NIOSH sector program areas except Oil and Gas Extraction (OGE). Agriculture, Forestry and Fishing (AFF), Healthcare and Social Assistance (HSA), and Manufacturing (MNF) received the most funding, followed by All Sectors* (ALL).



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

Figure 3. Research funding by sector program, FY 2020



Cooperative Agreements

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

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

Cooperative research agreements funded in FY 2020 totaled \$8.2 million and included long-standing state surveillance programs and funding for Occupational Safety and Health Surveillance Collaboration, Education, and Translation. The National Mesothelioma Virtual Bank and the Commercial Fishing Occupational Safety Research and Training Program also received funding. Figure 4 shows how NIOSH distributed funds and how many cooperative research agreements received funding.

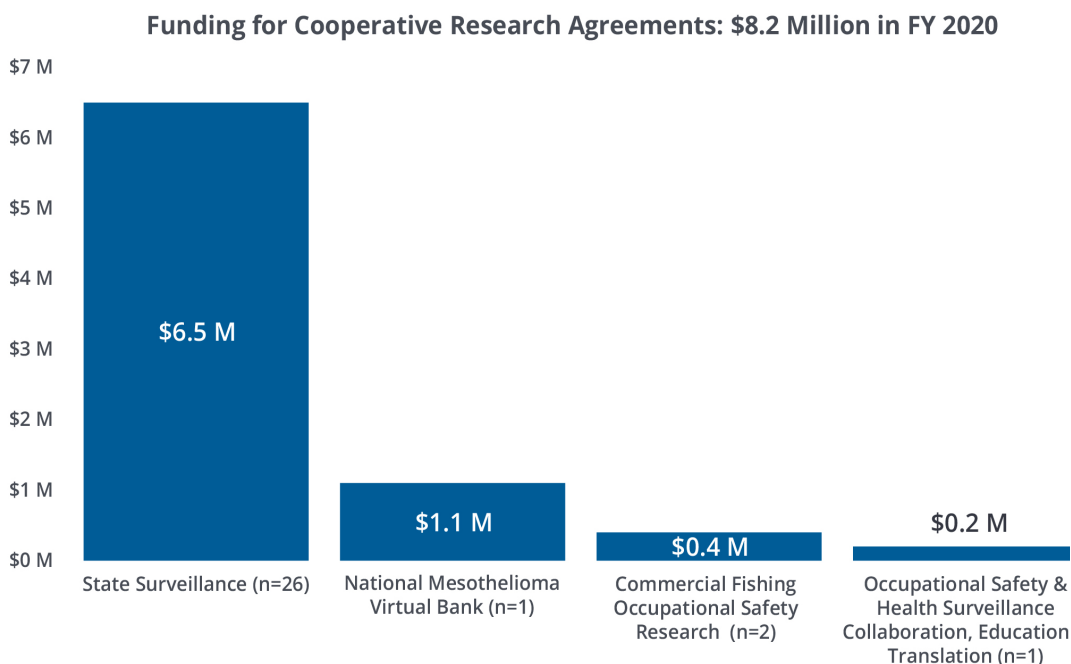


Figure 4. Cooperative agreements, FY 2020

State Surveillance Program

The state surveillance program supports states to develop their ability to monitor work-related injuries, illnesses, exposures, and fatalities. This program helps expand the role of states in conducting in-depth surveillance and follow-up through investigations and interventions. These 26 NIOSH-sponsored programs contribute to a national occupational health surveillance strategy and create opportunities for research and intervention. The [State Surveillance Program](#) webpage focuses on these state-based initiatives. Table 2 reports the total number and funding for all state surveillance awards for FY 2020.

Occupational Safety and Health Surveillance Collaboration, Education, and Translation

This cooperative agreement focuses on communication, education, and translational practice for occupational safety and health surveillance through a mix of approaches and strategies. The recipient of this funding is expected to lead the United States in the coordination and collaboration of occupational safety and health surveillance and communications, in partnership with federal and state agencies. Examples include managing an open-access, online repository for occupational safety and health information and surveillance data and resources. Through this funding, states and nongovernmental organizations are also able to leverage current relationships and new partnerships to use and promote surveillance data for action. For example, these nongovernmental organizations will monitor statistical and other trends and progress over time (i.e., burden and impact); propose pilot and evaluation activities for addressing disease, burden, or impact; conduct educational and outreach activities; and develop targeted prevention and intervention recommendations.

In FY 2020, NIOSH funded one cooperative agreement related to occupational safety and health surveillance collaboration, education, and translation for \$225,000 (Table 2).

National Mesothelioma Virtual Bank

The [National Mesothelioma Virtual Bank \(NMVB\) for Translational Research](#) advances translational research for the scientific community by collecting quality data and biospecimens, or human body materials, for mesothelioma research. Participating institutions share independent collections of tissues and other relevant information through this virtual registry and tissue bank, and the research community uses these resources as a network of collaborators in the registry. Developed in 2006, NMVB continues advancing biomedical research for malignant mesothelioma by expanding the collection of biospecimens, related data, and other information. NMVB gives researchers access to clinical data associated with a multitude of biospecimens and provides associated demographic data such as age, sex, race, occupational history, and other epidemiologic information. It also serves as a repository, providing a library of information on substances, chemical compounds, and other data related to mesothelioma that can be shared among investigators. NMVB supports scientific discovery, identifies and develops early markers of the disease, improves detection, and helps develop effective treatments for mesothelioma. This work supports research that addresses the complex mechanisms and biological changes associated with mesothelioma and its disease progression. NMVB may ultimately help improve the quality of life of current and former workers who have malignant mesothelioma.

Commercial Fishing Occupational Safety Research and Training Program

Commercial fishing is one of the most dangerous occupations in the United States, but the hazards that fishermen face can vary widely by vessel and fishery. Research and training that address what works best in a specific fleet or region is critical to ensuring U.S. fishermen are getting the best possible occupational safety information and training. Despite some recent successes in reducing fatal work-related injuries within the commercial fishing industry, the need for targeted safety research and training remains essential.

The [Commercial Fishing Occupational Safety Research and Training Program](#) is a partnership between the U.S. Coast Guard and NIOSH that provides funding to qualified individuals in academia, members of nonprofit organizations, municipalities, and businesses involved in the U.S. commercial fishing industry. The funding supports research on improving the occupational safety of commercial fishermen and provides critical training for this high-risk occupation. In FY 2019–2020, the Commercial Fishing Occupational Safety Research and Training Program paid up to 50% of an organization's costs. Each award ranged from \$150 thousand to \$650 thousand over a 2-year funding period. In FY 2020, NIOSH and the U.S. Coast Guard had six active research cooperative agreements and seven training projects. We note that no financial obligations were made towards four of the cooperative agreements and five training grants during FY 2020. These projects received all funding in FY 2019 and remained active in FY 2020 using FY 2019 funds. You can find a list of all commercial fishing research projects below and the training projects are discussed at the end of the next section under [Specialty Training Programs](#).

- **Fishing Partnership Health Plan (Burlington, MA)**

Project Title: A Feasibility Study to Inform a Multi-year Comprehensive Health and Safety Initiative for Commercial Fishermen in the Northeastern United States

Project Title: Evaluating the Benefits and Costs of Broadband VMS+ IoT Solutions for Fishing Vessel Performance, Diagnostics, and Safety at Sea in New England

- **Northeast Center for Occupational Health and Safety in Agriculture, Forestry, and Fishing (Cooperstown, NY)**

Project Title: Assessments of Sleep Deprivation and Associated Health and Cognitive Impacts in Commercial Fishermen

- **Mississippi State University**

Project Title: Trawler Fishermen's Personal Flotation Devices: Wear Assessment and Prototype Development

- **Oregon State University**

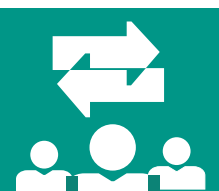
Project Title: Improving Vessel Equipment: Evaluating Fishermen-led Safety Design Ideas

- **University of Texas Health Center at Tyler**

Project Title: Improving Crew Overboard Recovery for Commercial Fishing Vessels in the Gulf of Mexico

Specialty Training Programs

NIOSH supports training in occupational safety and health through [Training Project Grants](#) (TPGs). The majority of TPGs are academic programs that support undergraduate, graduate, and



postgraduate training, including the Association of Occupational and Environmental Clinics, which has a unique TPG through its Occupational Health Internship Program. Other TPGs reach targeted worker populations to meet their education needs. For example, the Alaska Marine Education Association has a grant focused on training a national network of fishing safety instructors in a Marine Safety Instructor-training course to address high fatality rates in commercial fishing. The [Emergency Responder Training Program](#) is another TPG through the [International Association of Fire Fighters \(IAFF\)](#). This grant supports a comprehensive, nationwide hazardous materials training program for firefighters, paramedics, and other emergency responders across the United States.

The [Miner Safety and Health Training Program—Western United States](#), which is also a funded cooperative agreement, enhances the quality and complements the availability of health and safety training for mineworkers in the Western United States. It aims to address the significant challenges of the mining industry. 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.

The following seven training projects are funded under the partnership between NIOSH and the U.S. Coast Guard through the [Commercial Fishing Occupational Safety Research and Training Program](#). You can find more information on this program, which also includes research projects, under [Cooperative Agreements](#).

- **Alaska Marine Safety Education Association**
Project Title: National Fishing Safety Training Infrastructure
Project Title: Commercial Fishing Safety Training and Materials Development
- **Fishing Partnership Health Plan (Burlington, MA)**
Project Title: Community-based Safety Training for the Mid-Atlantic Fishing Industry
Project Title: Community-based Safety Training for the New England Fishing Industry
Project Title: Improving Monthly Drills and Instruction in East Coast Fisheries by Developing Relevant Training Aids
- **Maine Center for Coastal Fisheries**
Project Title: A Comprehensive Safety, Wellness, and Change Program for New Entrants and Existing Persons in the Commercial Fishing Industry in Down East Maine
- **Oregon State University**
Project Title: Building Capacity for Fishermen First Aid Safety Training (FFAST)

Table 2 shows the number and funding of all specialty training grants (new and continuing) awarded in FY 2020.

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 FY 2020 SBIR grants.

EXTRAMURAL RESEARCH TREND DATA

Extramural Research and Training Funding and Awards, FY 2015–2020

Figure 5 shows the total amount of extramural funding for each fiscal year from FY 2015 through FY 2020, along with the number of funded projects per year. These data include funding for all grants and cooperative agreements in the NIOSH extramural portfolio, including multidisciplinary centers, other cooperative agreements, investigator-initiated and career development research grants, and training grants. This information shows how NIOSH invested in its extramural research and training over time. You can find more information on annual extramural funding and awards at [Extramural Research and Training Program Annual Reports](#).

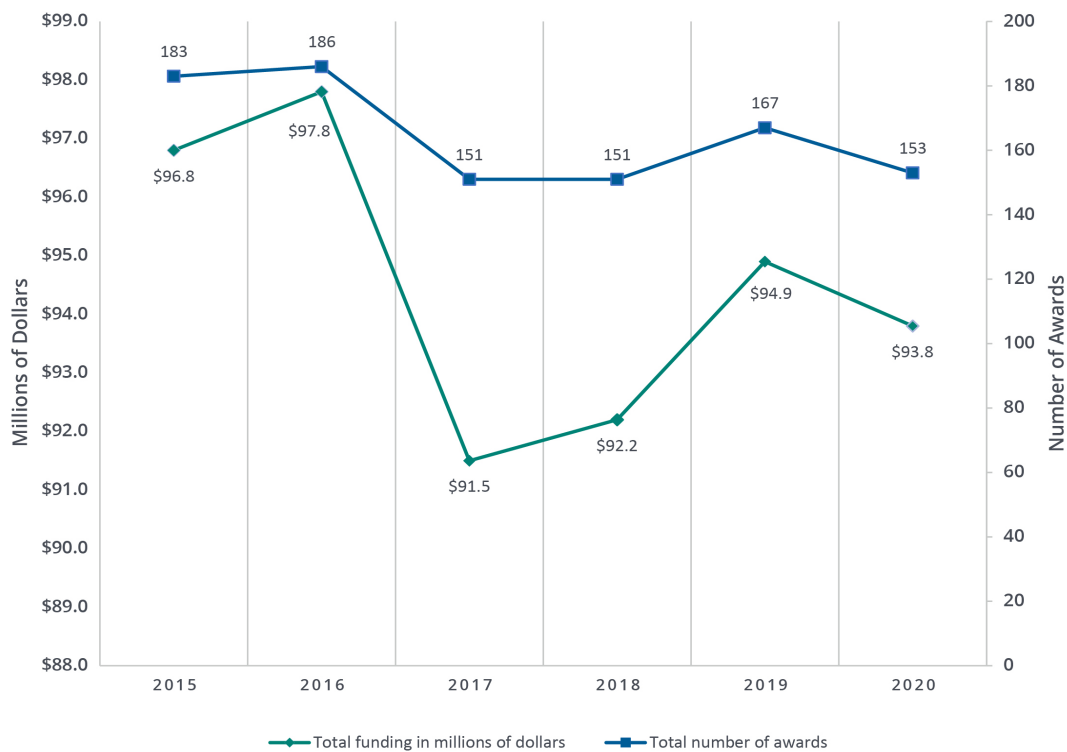


Figure 5. NIOSH extramural funding and awards, FY 2015–2020

Success Rates for Research Project Grants, FY 2010–2020

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 6 shows that throughout FY 2010–2020, the success rate remained stable until FY 2013, when it decreased from 23% to 1% in FY 2017 due to funding shortages. However, in FY 2018, the success rate increased to 10% and remained stable before slightly declining to 4% this year. For FY 2010–2020, the mean annual number of applications was 170, the mean number of awards was 20, and the mean annual success rate was 12%. Figures 7–9 show the success rates for each research mechanism.

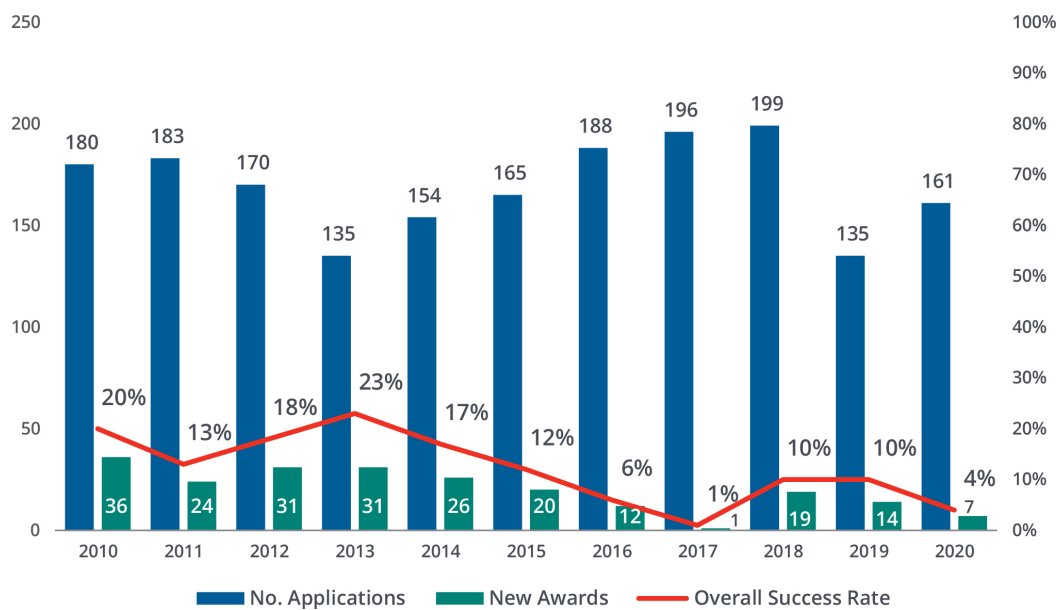


Figure 6. Overall success rates for research project grants, FY 2010–2020

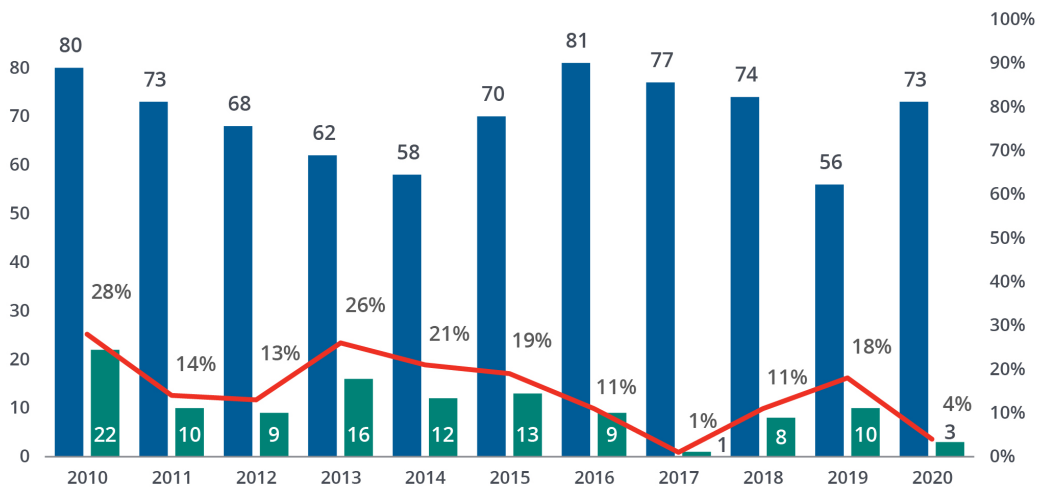


Figure 7. Success rates for R01 applications, FY 2010–2020

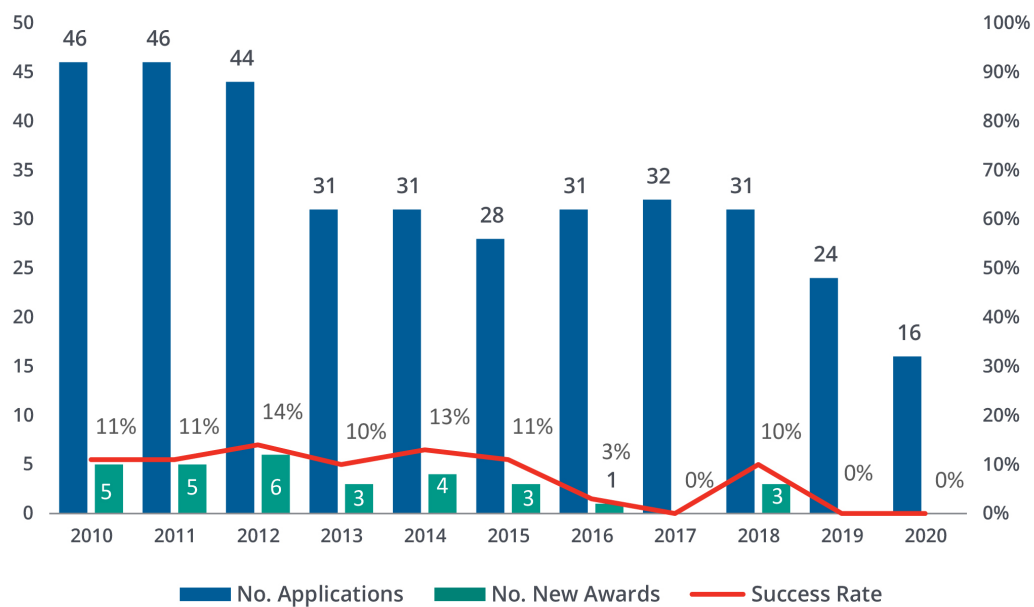


Figure 8. Success rates for R03 applications, FY 2010–2020

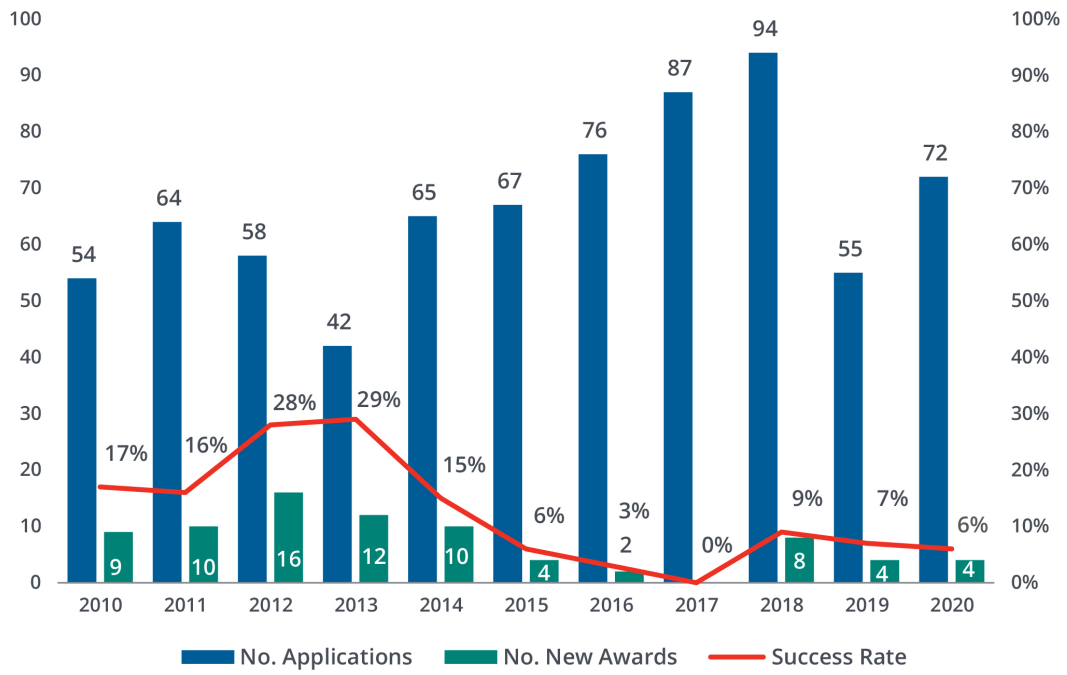


Figure 9. Success rates for R21 applications, FY 2010–2020

III. COVID-19



In FY 2020, the world faced the global coronavirus disease 2019 (COVID-19) pandemic. For the Centers for Disease Control and Prevention (CDC), this was the largest emergency response in its 74-year history. Along with many NIOSH employees, nearly one third of OEP staff contributed to CDC's COVID-19 response through varied roles.

Additionally, early in the COVID-19 response effort, NIOSH identified a need to increase the national capacity for occupational technical assistance to employers, workers, and public health officials for workplaces. To address this need, NIOSH utilized existing extramural partnerships to obtain Interagency Personnel Agreements (IPAs) with occupational safety and health experts across the United States as a mechanism to increase the national capacity for occupational technical assistance. NIOSH grantees responded to requests to contribute their expertise in various areas, including return-to-work, to help NIOSH with various activities that support industries as employees return to the workplace. NIOSH used the IPA mechanism to partner with 47 individuals from 28 academic institutions. These included staff from NIOSH-funded multidisciplinary centers and state surveillance programs and extramural scientists with investigator-initiated research projects. Established in August 2020, the NIOSH IPA program is highly successfully at providing occupational technical assistance in a wide variety of workplaces and has significant impact at national and local levels.

Two of the 26 NIOSH-funded state surveillance programs also requested permission from Health and Human Services (HHS)/CDC to redirect their extramural funding towards COVID-19 activities. They reassigned staff to support varied COVID-19 related roles within their states, including activities such as contact tracing; COVID-19 surveillance and epidemiology; infection control and mitigation; COVID-19 communication initiatives; food and medical delivery; management of COVID-19 hotlines; support of healthcare systems with data, guidance, education, personal protective equipment, medical personnel, and ventilators; and education and training for government leadership, media, and the public.

IV. FY 2020 EXTRAMURAL RESEARCH PROGRAM HIGHLIGHTS

Selected outputs, outcomes, and accomplishments of NIOSH-funded extramural research and training during FY 2020 are described in this section. The outputs or products include publications, reports, conference proceedings, presentations/posters, databases, tools, methods, guidelines, recommendations, education and training materials, inventions, and patents.

In FY 2020, extramural researchers wrote 460 articles published in 211 peer-reviewed journals, most frequently in the *Journal of Occupational and Environmental Medicine*.

From October 1, 2019, through September 30, 2020, NIOSH-funded extramural research led to 460 peer-reviewed publications in 211 journals. 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=37), followed by the *American Journal of Industrial Medicine* (n=26), the *Journal of Agromedicine* (n=23), and the *International Journal of Environmental Research and Public Health* (n=21). OEP collected publications by extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. NIOSHTIC-2 is a searchable database of NIOSH publications, which includes grantee final reports and publications.

Out of 460 extramural articles, 310 (67%) were mentioned or cited. Collectively, these articles were cited 5,826 times in social media, media, research articles, policy documents, and other sources.

In addition, altmetrics are data that are complementary to traditional, citation-based metrics and are an emerging measure of research outcomes. These data give insight into the extent that the public is influenced by, exposed to, promotes, and engages with research online, in the media and beyond. Examples of altmetric data include the number of times a journal article is discussed in online research forums, blogs, and social media sites like Twitter, as well as in

mainstream media coverage. Altmetrics also include data on the numbers of times an article has been viewed and cited in other research articles and policy documents. Of the 460 extramural articles, 310 (67%) were mentioned or cited in the ways described 5,826 times, most often on Twitter and in the news media. There was an average of 19 mentions per article, and 41 (9%) of the articles ranked in the top 5% of more than 32.9 million research outputs (journal articles, white papers, reports, etc.) scored by altmetric.com. Data from altmetric were obtained July 21, 2021.

Program highlights or successes of extramural research and training are included in this part of the report.

In addition to publications, the following sections describe other significant outputs or products and successes of NIOSH-funded extramural research funded by grant mechanism during FY 2020.

MULTIDISCIPLINARY CENTERS

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

CENTERS FOR AGRICULTURAL SAFETY AND HEALTH

■ Overview

The **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. Currently, 10 regional Ag Centers throughout the country work on regional safety and health issues unique to each area. NIOSH also supports the **National Children's Center for Rural and Agricultural Safety and Health (Child Ag Center)** within the National Farm Medicine Center in Marshfield, Wisconsin. With a national focus, the Child Ag Center strives to enhance the safety of all children exposed to hazards associated with agricultural work.

■ Public Health Relevance

In 1990, Congress established a national initiative in agricultural safety and health under [Public Law 101-517](#). The intention of this initiative, "when sustained over a

period of time, would result in a significant and measurable impact on ... health effects among rural Americans." In response, NIOSH began funding Ag Centers in 1991. These centers strive to improve worker safety and health in the agriculture, forestry, and fishing industries—jobs that consistently ranked among the most dangerous in the United States. Although they still rank as some of the most dangerous, in the more than 30 years since the initiative took effect, there have been significant decreases in injuries, illnesses, and fatalities among farm workers. The work of the Ag Centers has contributed to this decline in injuries and deaths.

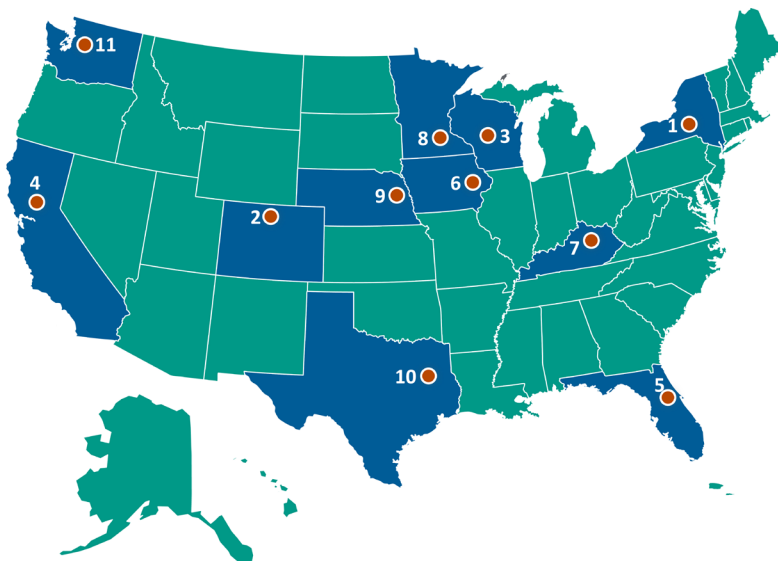
The Ag Centers' work spans the full research-to-practice continuum. First, they conduct basic science to evaluate and quantify an issue. Researchers then transfer the results into engineering controls, educational outreach efforts, or policy changes aimed at preventing or mitigating the problem. The 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.

The Ag Centers made significant contributions to public health in FY 2020:

- Integrating skill and know-how from multiple disciplines, institutions, and community partners to solve complex problems.



NIOSH Centers for Agricultural Safety and Health



- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Northeast Center for Occupational Health and Safety (Bassett Healthcare Network) 2. High Plains Intermountain Center for Agricultural Health and Safety (Colorado State University) 3. National Children's Center for Rural and Agricultural Health and Safety (National Farm Medicine Center) 4. Western Center for Agricultural Health and Safety (University of California, Davis) 5. Southeastern Coastal Center for Agricultural Health and Safety (University of Florida) 6. Great Plains Center for Agricultural Health (University of Iowa) | <ol style="list-style-type: none"> 7. Southeast Center for Agricultural Health and Injury Prevention (University of Kentucky) 8. Upper Midwest Agricultural Safety and Health Center (University of Minnesota) 9. Central States Center for Agricultural Safety and Health (University of Nebraska Medical Center) 10. Southwest Center for Agricultural Health, Injury Prevention and Education (University of Texas Health Science Center at Houston) 11. Pacific Northwest Agricultural Safety and Health Center (University of Washington) |
|---|---|

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

■ Research Outputs: Publications in FY 2020

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, 2019, through September 30, 2020, Ag Centers published 59 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 FY 2020

Cross-center Collaborations to Protect the Safety and Health of Workers

The NIOSH-supported Ag Centers have a long history of cross-center collaboration, including outreach, educational, evaluation, and research activities. These partnerships among the centers have created a strong, nationwide network of academic and medical research institutions devoted to addressing morbidity and mortality among AFF workers, and their families. While housed in 11 institutions across the country, this network is driven and maintained by a large group of interconnected researchers, communicators, educators, evaluators, and other contributors. Many of these individuals train and work at other institutions in the network outside of their own. The camaraderie created through the shared histories and experiences of those in the network strengthens their collective approach and impact while improving the lives of people working in AFF.

Additionally, many of the collaborations and connections between the Ag Centers develop through their outreach efforts. The Centers have numerous long-standing collaborative initiatives. Evaluation, coordination, and outreach staff at the centers network through regular meetings and support each other in various aspects of their center's outreach activities. These meetings and connections improve efficiency and create synergies in areas where centers are working on the same topic or with similar target populations. Examples include fact sheets created by one center and used by others, and the coordination and sharing of multilingual materials and educational campaigns. Next are examples how the Ag Centers work together to respond to particular workforce needs.

Using YouTube for Widespread Reach and Awareness in Agriculture, Forestry, and Fishing

In 2013, the Ag Centers partnered to start a YouTube channel that uses videos to raise awareness of hazards and provides information to prevent injuries and illnesses in AFF. The videos are posted in multiple languages including English, Spanish, and K'iche. Through YouTube, the centers also aim to increase their visibility and sphere of influence and create a model of collaborative work that can be used by other organizations. The centers set up policies, procedures, and a standard review process for videos posted on its YouTube page to ensure high scientific standards. They have a joint marketing plan to promote the channel to agricultural cooperative extension agents, educators, producers, owners, operators, first responders, families, and community organizations. The centers disseminate this information through email, social media, conference presentations, and outreach exhibits.

The YouTube channel currently features 167 videos, which are the total number that have been posted since 2013. People watched the videos 426,764 times from 2013 through 2020. The videos with the most views are on safe use of chain saws and grain bin safety. In FY 2020, people viewed the videos 108,050 times. You can find more information on this project at the links below.

Details:

- [U.S. Agricultural Safety and Health Centers](#)
- [Development of an Educational YouTube Channel: A Collaboration Between U.S. Agricultural Safety and Health Centers](#)

Preventing Injuries and Death Through the Rollover Protective Structures Program

Tractor overturns, a long-standing concern in agriculture, are the leading cause of farm-related fatalities. Recognizing this problem,

the Ag Centers have been active since their beginning to try to lessen the circumstances that lead to these tragic incidents. Rollover protective structures, or ROPS, which became standard tractor equipment in 1985, help prevent injuries from tractor overturns. However, many tractors made before that time are still in use. The Ag Centers proposed the National Agricultural Tractor Safety Initiative in 2004, a broad plan of action to bolster ROPS efforts. Since this time, the centers have worked individually on specific research or technical ROPS issues while also cooperating and supporting each other collectively on varied ROPS-related projects including education and outreach. Notably, the Northeast Center for Occupational Health and Safety created a successful ROPS Rebate Program in New York State, addressing barriers that farmers face related to retrofitting or adding ROPS on tractors. The program relies on state funding to provide incentives, such as a rebate of approximately 70% of the cost to retrofit a tractor (including purchase of the ROPS kit, shipping, and installation). A cost-inclusive evaluation of the program showed ROPS saved more than \$4 million in prevented deaths and injuries among New York State farm workers from 2007 through 2017.

In 2017, the Northeast Center started building on National Tractor Safety Coalition (NTSC) efforts to launch a National ROPS Rebate Program. The center collaborates with NTSC partners to address manufacturing design and supply concerns related to ROPS. They also work together to increase interest among agricultural partners related to expanding the National ROPS Rebate Program. To support this effort, Northeast Center researchers recently conducted a study on how interested groups in agriculture perceive the expansion of the ROPS Rebate Program and the use of media as an implementation strategy for agricultural safety. In FY 2020, the research team analyzed their results and developed recommendations, published in *BMC Public*

Health. The study showed the importance of using media before, during, and after implementation of a ROPS program to get and sustain support. Scientists also received a NIOSH-funded investigator-initiated research grant (R01) in FY 2020 to put strategies into place from the study to create a ROPS Rebate Program in states at high risk for overturn fatalities. This new project will focus on three high-risk states—Kansas, Iowa, and Missouri.

The previously mentioned ROPS efforts show how coordination and collaboration among the Ag Centers can be topic focused. These also illustrate how each center's involvement can fall on varied points of the research to practice (r2p) spectrum.

Details:

- [Northeast Center for Occupational Health and Safety Agriculture, Forestry, and Fishing: Summary Annual Report Fiscal Year 2020](#)
- [Stakeholder Experiences Implementing a National ROPS Rebate Program: A Grounded Theory Situational Analysis](#)
- [An Exploration of Rollover Protective Structures \(ROPS\) Rebate Program Media Coverage: Strategies for Implementation and Sustainment](#)
- [Outside NIOSH: Costs From Injuries and Deaths Decrease After State Program Promotes Rollover Protective Structures for Tractors](#)
- [NIOSH Agricultural Safety and Health Centers: National Agricultural Tractor Safety Initiative January 2004](#)

National Farm Safety and Health Week

In 1944, the National Safety Council began recognizing National Farm Safety and Health Week (NFSHW). The same year, U.S. President Franklin D. Roosevelt proclaimed it as a nationally recognized week, and every president since then has done the same. During this third week in September, the goal is to widely promote messages and resources on a range of farm safety and health topics.

Each day of the week has a different theme, and the weekly theme changes annually. Because agriculture ranks among the most hazardous industries, with farmers remaining at very high risk for fatal and nonfatal injuries, NFSHW continues to remain relevant in the AFF sector. Since 2014, the Ag Centers have collaborated on an annual NFSHW campaign, partnering to create and disseminate a campaign communication toolkit that includes resources aligned with the NFSHW daily themes that amplify useful communication tools, like the National YouTube Channel. The toolkit also highlights best practices and offers guidance and other critical information related to agricultural safety and health. The centers designed the toolkit for users to share via multiple communication channels, including social media, websites, and print and broadcast media.

NFSHW 2020 featured the overall theme of Every Farmer Counts, and the Ag Centers shared their toolkit resources, which fit with each daily theme during the week, via social media channels. Data collected from 9 of 11 centers on Twitter and Facebook (FB) metrics showed that people viewed their FB posts more than 11,000 times. More than 1,500 FB users engaged with these posts by either liking, sharing, or commenting on them. Centers estimate that all Twitter posts combined reached more than 12,000 users.

Details:

- [Upper Midwest Agricultural Safety and Health Center – National Farm Safety and Health Week 2020](#)

Saving Lives Through Telling the Story

“We don’t want this to happen to anyone else” is the basic message of the Telling The Story Project. It uses personal stories and first-hand experiences from farmers and other agricultural workers, along with their families and community members, to reach at-risk populations in the agricultural industry. This project is based on [research](#)

from public health, psychology, sociology, and organizational development that supports the use of storytelling as an effective communication and marketing approach.

Through storytelling, the individuals featured in the Telling The Story Project discuss ways they have been impacted by injuries, fatalities, and close calls or circumstances where they could have been hurt. Their narratives are told in their own words and provide valuable information and insight to help prevent others from having similar incidents in the future. The Telling The Story Project started in 2016 and is a collaborative outreach and educational campaign between four centers in the Midwest—the Central States Center for Agricultural Safety and Health, Great Plains Center for Agricultural Health, Upper Midwest Agricultural Safety and Health Center, and National Farm Medicine Center.

More information about this project is available at the website shown below, which has over 18,000 views. Created by the Telling The Story team, the website highlights the personal narratives, along with videos, educational resources, safety vignettes, and study or discussion guides related to safety and health in AFF. Web visitors downloaded the study guides more than 300 times since their creation in 2018. These resources provide additional information on the hazards outlined in each featured story. Multiple news outlets in the agricultural industry have featured stories from the Telling The Story Project. These include the *Angus Beef Bulletin*, *Wisconsin State Farmer*, *Morning Ag Clips*, and *AgNet West*.

Details:

- [Telling The Story: Tell a Story, Save a Life](#)
- [Being in a Hurry Is No Excuse for an Unsafe Act](#)
- [New Project Helps Farmers Share Safety Messages](#)
- [Telling The Story Project Saving Lives](#)

Developing a National Model of Agricultural Safety and Health Education

In 1987, the Agricultural Health and Safety Course started at the University of Iowa (UI) College of Public Health. Originally focused on medical professionals, the course expanded to include safety professionals and others working with agricultural communities. This educational program focuses on key health and safety issues for rural and agricultural workers and includes presentations relevant to those working in occupational safety and health, health care, public health, and education. In 2007, the NIOSH-funded Great Plains Center for Agricultural Health (GPCAH) at UI started disseminating the course nationally and internationally. GPCAH later partnered with two other Ag Centers on the project—the Central States Center for Agricultural Safety and Health and Southwest Center for Agricultural Health, Injury Prevention, and Education.

Other organizations across the United States have also adopted the course, as shown on the [Agricultural Safety and Health: The Core Course](#) webpage. A consensus process with national and international experts guides the development and continuous revisions of the content for this week-long course. The course focuses on prevention and the hierarchy of controls for occupational hazards. It includes live lectures, small-group discussions, online modules, podcasts, case studies, homework assignments, and interactive exercises.

Course topics include safety and industrial hygiene, respiratory diseases, children and aging workers on farms, traumatic injury, zoonotic diseases, livestock handling, behavioral health, pesticides, ergonomics and musculoskeletal disorders, and personal protective equipment. The course provides the information and skills to help individuals anticipate, identify, and prevent workplace injuries and illnesses in the agricultural industry. Individuals completing the course

can receive academic credit, continuing education, and a certificate of completion.

Since 2011, 1,391 trainees from the United States and Australia participated in 39 courses. In FY 2020, the course occurred five times, and a total of 285 people participated. A survey completed by course participants six months later showed 80% of them believed their ability to anticipate, diagnose, treat, or prevent agricultural injuries and illnesses improved. Almost 90% indicated the course information helped them address occupational hazards, and 70% felt confident when recommending personal protective equipment for the farming population.

GPCAH also created separate online education from the Agricultural Health and Safety Course that includes some of its course topics. These [online modules](#) are freely available and offer a certificate of completion. The Agricultural Health and Safety Course has become a national model of effective agricultural safety and health education.

Details:

- [Agricultural Health and Safety Course for Medical and Safety Professionals](#)
- [Annual Report September 2019–August 2020: Central States Center for Agricultural Safety and Health](#)
- [Online Training Agricultural Safety and Health](#)

Building Capacity for Effective Evaluation

In FY 2020, the Ag Centers collaborated with NIOSH to start building evaluation capacity across the AFF Program. NIOSH recently developed an [Evaluation Capacity-Building Plan \(2021–2025\)](#) outlining institute evaluation needs and steps to address those needs over a five-year period. As a part of the plan, NIOSH staff collaborated with Ag Centers to develop a shared understanding of evaluation concepts, definitions, and frameworks which we can apply to our programs and research projects. This includes definitions for common evaluative terms such as outputs,

intermediate outcomes, and end outcomes, as well as an introduction to the framework that NIOSH uses to guide its program reviews. This has allowed the centers to work together with NIOSH to develop shared logic models on common AFF health and safety topics, including heat-related illness and rollover protective equipment. These models will enable Ag Centers and NIOSH AFF Program leaders to assess the progress made to date, identify gaps that may still exist, and make informed decisions about the future direction of the program.

NATIONAL CENTER FOR CONSTRUCTION SAFETY AND HEALTH RESEARCH AND TRANSLATION

■ Overview

CPWR—The Center for Construction Research and Training received a NIOSH cooperative agreement to be the [National Center for Construction Safety and Health Research and Translation](#) for 2019–2024. CPWR received this funding through an extramural competition and has received NIOSH funding for the past 30 years through a series of competitive funding announcements. The center, with its diverse construction community, leads in the field of 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 Construction Sector Program research goals as well as emerging issues.

■ Public Health Relevance

CPWR's work has 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. The center has cultivated and optimized external partnerships for prevention, protections, research, and research translation for protecting U.S. construction workers. A recent [evaluation](#) of the NIOSH Construction Program recognized CPWR for the value of its research translation focused efforts in construction.

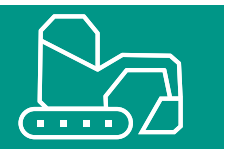
■ Research Outputs: Publications in FY 2020

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, 2019, through September 30, 2020, CPWR published 13 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 FY 2020

National Stand-Down to Prevent Struck-by Incidents

In the construction industry, struck-by incidents are a leading cause of death and have topped the leading cause of nonfatal injuries since 1992. Most workers are struck by flying, swinging, or rolling objects, according to the Occupational Safety and Health Administration. In FY 2020, CPWR joined the [NORA Construction Sector Council](#) in launching the first-ever National Stand-Down to Prevent Struck-by Incidents.



This inaugural event aimed to increase awareness of both struck-by hazards, as well as approaches for preventing these incidents. Held during National Zone Awareness Week in April, the event featured a virtual [question and answer \(Q&A\) panel](#) with experts who talked about struck-by hazards in work zones and ways to prevent these from occurring on job sites. A variety of resources for the National Stand-Down to Prevent Struck-by Incidents were also available, including training materials, toolbox talks, and webpage. Almost 700 people attended the virtual event, and 1,708 people viewed the virtual Q&A from April 22, 2020, through August 31, 2020. In addition, 386 people accessed CPWR's Struck-by-Injuries webpage and additional materials from September 1, 2019, through August 31, 2020.

Details:

- [Struck-by Hazards](#)

New Tool to Support Construction Companies in Improving Safety Climate

A key leading indicator of a company's jobsite safety is having a strong positive safety climate—defined as employees' shared perceptions that a company's stated safety policies and procedures are consistent with actual jobsite practices. In 2016, CPWR developed the Safety Climate Assessment Tool (S-CAT) to help construction companies evaluate their jobsite safety climate maturity across eight leading safety climate indicators. In 2018, they also developed the Safety Climate Assessment Tool for Small Contractors (S-CAT^{sc}), which is a simple needs assessment based on the S-CAT's eight leading indicators. While both provide guidance on how to strengthen jobsite safety climate, neither offer actual safety management resources companies can use to improve their climate scores.

To fill this gap, CPWR is creating a new interactive online tool called the Safety

Climate-Safety Management Information System (SC-SMIS). SC-SMIS users will be able to (1) conduct jobsite safety climate assessments using the S-CAT and/or S-CAT^{sc}, (2) select from over 80 evidence-based safety management resources to target and improve low-scoring safety climate indicators, (3) develop plans to put the resources into action, (4) schedule reminders to conduct periodic assessments, and (5) implement new resources for continuous safety climate improvement. CPWR expects to finalize and begin offering the SC-SMIS by the end of FY 2021. To complement the SC-SMIS, CPWR is developing a new Confidence to Implement scale to measure a safety professional's confidence to identify, implement, and evaluate the effectiveness of safety management resources. The center believes this tool will help these safety professionals better understand their strengths and needs in terms of safety climate and safety management improvement activities.

Details:

- [Safety Climate-Safety Management Information System \(SC-SMIS\)](#)
- [Outside NIOSH: Tool Helps Construction Companies Evaluate Jobsite Safety Climate](#)

Advancing Women in the Trades: New Mentoring Program to Improve Safety, Health, and Well-being

Women working in the trade industry face many challenges, including a higher likelihood of discrimination and harassment compared with men, and their skills are often under-utilized, according to research. More so in the construction industry, women represent a small portion of the workforce and leave construction apprenticeship programs at high rates, possibly due to these challenges. Researchers funded by CPWR at the University of Washington are now developing and testing a mentoring program for women in construction, promoting safety, health well-being. They are partnering with a labor union

on this project—the International Association of Sheet Metal, Air, Rail, and Transportation Workers (SMART).

The goal of the program is to increase these construction workers' self-knowledge, self-efficacy, and skills related to advocating for safety, ultimately reducing injury risks and psychological stressors at work. Journey-level, or skilled, construction workers from local SMART unions in the study will mentor female apprentices. The mentors will get training on effective mentoring techniques and program content. A group of 100 women will receive mentoring while another group of 100 female apprentices will not during a two-year period. Throughout the study, researchers will assess both groups to measure the program's impact, with a focus on changes in their stress levels, coping mechanisms, safety climate at work, and job retention.

Details:

- [Women in the Trades](#)

CENTERS OF EXCELLENCE FOR TOTAL WORKER HEALTH®

■ Overview

In FY 2020, NIOSH funded six **Centers of Excellence for TWH**, located throughout the United States, to explore and research TWH-related concepts. NIOSH defines TWH as policies, programs, and practices that integrate protection from work-related safety and health hazards with the promotion of injury and illness prevention efforts to advance worker well-being. TWH principles aim to broadly integrate workplace systems to control hazards and exposures, organization of work, compensation and benefits, work-life balance, and organizational change management.

Their approach works toward a hazard-free workplace for all workers.

The centers made important efforts toward TWH-related research and practice:

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

■ Public Health Relevance

The Centers of Excellence develop and evaluate interventions to improve safety, health, and well-being—TWH approaches—in high-risk industries that can reduce healthcare costs when adopted on a broad scale. The centers engage in the following:

- Multidisciplinary research on the effects and outcomes of policies, program, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being;
- Development and dissemination of evidence-based research and recommendations for workplace programs, policies, and practices;
- Production of audience-specific educational materials, outreach, and capacity-building resources for optimizing their uptake or adoption or adaptation for protecting workers and improving worker well-being; and



- Evaluation of results to determine the impact on occupational safety and health and reduction in burden.

■ Research Outputs: Publications in FY 2020

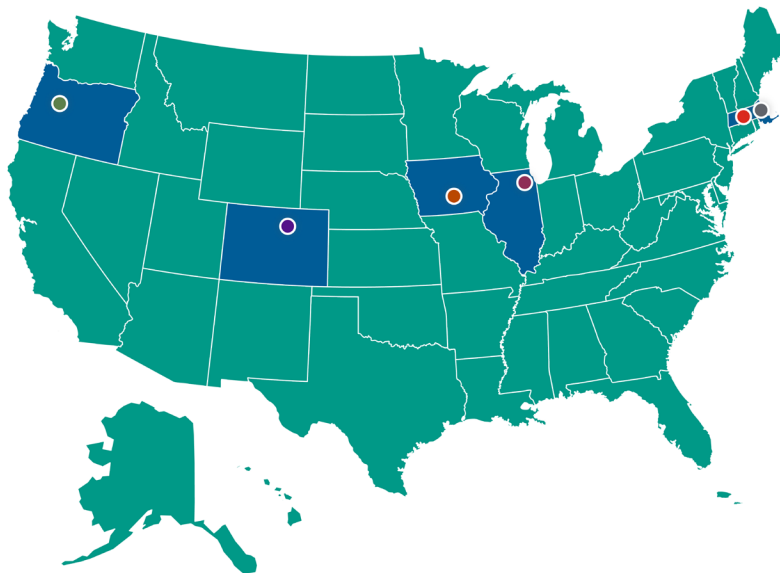
The centers' outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2019, through September 30, 2020, the Centers of Excellence published 50 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 FY 2020

U.S. Surgeon General Highlights NIOSH TWH Approach

In an article in *Public Health Reports*, the U.S. Surgeon General, Vice Admiral (VADM) Jerome Adams, MD, MPH, highlighted the Centers of Excellence for TWH, along with the NIOSH Office of TWH and NIOSH TWH affiliates. The article focused on the important relationship between employment and health. The U.S. Surgeon General recommended that employers and companies ensure that worker well-being programs are implemented more broadly and meet the needs of workers—an approach that can lead to better health and business outcomes. He mentioned successful research and practice for worker well-being from the NIOSH Office of TWH and the Centers of Excellence for TWH. One center project he mentioned included the Health

Centers of Excellence for *Total Worker Health*®



- Oregon Healthy Workforce Center (OHWC)
- 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

Improvement Through Training & Employee Control Program from the Center for the Promotion of Health in the New England Workplace (CPH-NEW). However, while the article acknowledged the centers' work and NIOSH, it noted that more research is needed on workplace well-being interventions across varied settings that shows the positive impacts on multiple health, human capital, and financial outcomes. Through partnerships among public health leaders, academia, employers, and other interested parties—like the one between NIOSH and the Centers of Excellence for TWH—the U.S. Surgeon General believes we can help workers achieve their highest potential.

Details:

- [The Value of Worker Well-being](#)
- [U.S. Surgeon General Highlights the Value of Worker Well-being and the NIOSH Total Worker Health® Approach](#)

Connecticut Department of Corrections Adopts TWH-Oriented Training Programs

Based on past studies, CPH-NEW found that correctional officers developed high risks factors for chronic disease within the first five years of working. They often experienced obesity, hypertension, physical inactivity, and high levels of depression, along with poor sleep and nutritional habits. To address this issue, CPH-NEW researchers conducted a study focused on peer health mentoring for new cadet correctional officers known as "Health Improvement through Training & Employee Control (HITEC II)." HITEC II researchers and the Connecticut Department of Corrections developed design teams combining a Kaizen design approach and CPH-NEW's [IDEAS process](#). Correctional officers and supervisors on the teams created TWH interventions for workplace safety and health concerns. The teams created intervention programs, including educational trainings on

mental health, prevention of substance use and misuse, and nutrition.

The supervisors involved are also a part of the Correction Supervisors Unit (NP-8) of the Service Employees International Union, Local 2001. In FY 2020, the Connecticut Department of Corrections started permanently funding and offering the trainings to employees as part of a union collective bargaining agreement. Employees now have formal training days to participate in the programs, but their involvement is voluntary. So far, more than 40% of all corrections supervisors have participated in the trainings.

Details:

- [History of Health Improvement Through Training & Employee Control \(HITEC\) I & II](#)

You OK? Center Develops National Suicide Prevention Campaign for Construction Trade Association

In the United States, suicide is the 10th leading cause of death, claiming the lives of nearly 48,000 people in 2019, according to the [National Institute of Mental Health](#). More so, the construction industry has one of the highest suicide rates compared with other industries. To address this issue, the Association of General Contractors (AGC), a construction industry trade association, developed a suicide prevention campaign with the Healthier Workforce Center of the Midwest. Before the campaign, the center worked with the AGC chapter in Missouri and center-funded researchers at Washington University at St. Louis on projects to improve the safety, health, and well-being of construction apprentices. The collaboration led national AGC leadership to recruit this group to work on its suicide prevention campaign for construction workers. They joined a small team of union safety professionals and representatives from large contractors for the project.

The suicide prevention campaign called “You OK?” launched in September 2019 during National Suicide Prevention Week. This ongoing campaign includes freely accessible materials including medallions, hard hat stickers, posters, and toolbox talk handouts. Throughout FY 2020, 185 individuals requested campaign materials and several large Missouri construction companies have shared this information with hundreds of employees during Safety Stand-Down events. The Healthier Workforce Center of the Midwest now has plans to nationally expand the campaign.

Details:

- [Suicide Prevention Campaign for the Workplace](#)
- [Partnering to Prevent Suicide in the Construction Industry—Building Hope and a Road to Recovery](#)

The Oregon Healthy Workforce Center Dissemination Workgroup

The Dissemination Workgroup at the Oregon Healthy Workforce Center focuses on the center’s use of best practices for disseminating, or sharing, its intervention research. The Workgroup developed multiple products including the Health Impacts Safety toolbox and safety meeting guides, which are given out at conferences and available online. Through these resources, organizations can learn more about the center’s TWH-related work and use this information to integrate workplace safety, health, and well-being. In FY 2020, more than 400 people downloaded the Health Impacts Safety materials online. The workgroup also created a webpage, [YourWorkpath.com](#), to share all the center’s toolkits and TWH-related resources in one space. In FY 2020, 1,264 individuals visited the page.

Two organizations, the State Accident Insurance Fund Corporation (SAIF) in Oregon and Eskenazi Health in Indiana, developed partnerships with the center after their staff

visited the page and will adopt or use the center’s Safety and Health Improvement Program (SHIP). Eskenazi has plans to roll out the SHIP training program throughout its hospital system, and SAIF will include SHIP in its series of manager-focused training programs, called “Leadership Project.” The Dissemination Workgroup also built a collaboration between the Oregon Healthy Workforce Center and a community college in the Midwest, focused on the Promoting U through Safety & Health toolkit. The college plans to first distribute the toolkit to workers and students from ages 18 through 45 years on two of its four campuses. After this, it will eventually roll out the toolkit to more than 3,000 individuals across all four of its campuses and satellite locations.

Details:

- [Health Impacts Safety](#)
- [YourWorkpath.com](#)
- [Celebrating the Relaunch of Our Safety and Health Improvement Program \(SHIP\) Toolkit](#)
- [Total Worker Health in Young Workers](#)

Study Identifies Policy Recommendations and Gaps From TWH Research

The Center for Work, Health, and Well-being has conducted the first literature review of TWH research articles, focused on identifying policy implications. As a part of its Policy Working Group, the center’s researchers analyzed its peer-reviewed publications over 7½ years that focused on links between work conditions and health outcomes. They looked at the literature for scientific findings addressing organizational or public policies and identified common themes or topics. The scientists reviewed 32 of 57 peer-reviewed articles published from 2011 through mid-2019 that fit the study’s inclusion criteria and found 12 cross-cutting or broad themes focused on policies. These included (1) ergonomic practices, (2) harassment and abuse, (3) safety practices, (4) social support, (5) staffing levels, (6) work-family conflict, (7) work schedules, (8) work stress, job

demands and decision-making, (9) injuries and injury reporting, (10) mental health, (11) physical activity, and (12) sleep deficiency. The themes were grouped and reported in two categories—working conditions and related health outcomes—categories that researchers report influence each other. This finding supports a core component of the TWH concept that multiple working conditions can interact and influence one another and health outcomes.

Beyond being the first of its kind, this study is significant because policies are key to the integration of TWH practices in the workplace and its influence on worker well-being. The research identified themes for policy recommendations from TWH research, as well as gaps where future research is needed on policies. In FY 2020, the *Journal of Occupational and Environmental Medicine* published these findings.

Details:

- [Literature Review of Policy Implications From Findings of the Center for Work, Health, and Well-being](#)
- [Harvard T.H. Chan, School of Public Health: Center for Work, Health & Well-being](#)

Launch of the Get Outdoors Employer Toolkit

In FY 2020, the Center for Health, Work & Environment created the Get Outdoors Employer Toolkit, in partnership with the Office of Outdoor Recreation at the Colorado Office of Economic Development and International Trade. The toolkit includes free resources for businesses to support a healthier employee lifestyle through integrating and promoting nature experiences and outdoor recreation into workplace initiatives. A workplace focused wellness and health survey is included in the toolkit. Those who complete this assessment receive a set of recommendations on ways their company can improve health and wellness programs through outdoor activities. Through

the assessment and resources, the Center for Health, Work & Environment expects to improve the health and well-being of diverse Colorado workforces. The toolkit also aligns with the Colorado Governor's Health Initiative to lower healthcare cost by encouraging state residents to get outside.

The center promoted the toolkit to leading Colorado employers in the manufacturing, healthcare, construction, and retail industries, and the media also widely promoted it. So far, 51 companies of varied sizes and industries have completed the assessment in the toolkit and received guidance on how to support employee well-being. The center plans to launch the first Get Outdoors Healthy Workplace Award in October 2020, recognizing companies based on their assessment results.

Details:

- [Outdoor Recreation Industry Office Launches Get Outdoors Employer Toolkit—Employers Encouraged to Take the Get Outdoors Survey](#)

Community Interventions for Safer and Healthier Work

Building on data from a past [assessment](#) of two Chicago neighborhoods with high levels of unemployment and/or residents in precarious work, the University of Illinois at Chicago (UIC) Center for Healthy Work is developing community interventions. The center is using the assessment results, and a theory of change and strategic road map resulting from it, to create a healthy work culture within the community. The four interventions are a part of the Greater Lawndale Healthy Work (GLHW) Project and focus on community perceptions and strong community infrastructure that support healthy work, along with fair work opportunities within neighborhoods.

Members of the GLHW Council are creating and will pilot test the following interventions within Chicago's Greater Lawndale area:

- An educational campaign that includes an interactive bingo/lotería game, art, and events focused on changing beliefs on work and health among community members, workers, employers, and policy makers through highlighting work as a human rights and social justice priority.
- Training and outreach materials on workers' rights that will be distributed to temporary staffing agencies and then customized and widely shared by these companies.
- Education and advocacy for policies that increase opportunities to build community wealth and spending through more support of local entrepreneurship, small businesses, and cooperative businesses.
- Characterization of COVID-19 impact on communities and related resident needs and use of this information to modify GLHW interventions.

Through the GLHW Project, UIC Center for Healthy Work continues to explore ways to implement safer and healthier approaches to work that extend into the community.

Details:

- [Greater Lawndale Healthy Work Project](#)
- [NIOSH Extramural Research and Training Program Annual Report of Fiscal Year 2019](#)

EDUCATION AND RESEARCH CENTERS

■ Overview

NIOSH is mandated to provide an adequate supply of qualified personnel to carry out the purposes of the Occupational Safety and Health Act ([Public Law 91-596](#)), and the ERCs are one of the principal means for meeting this mandate. ERCs are academic institutions that provide high-quality interdisciplinary graduate and post-graduate training, research

training, education, and outreach in the core occupational safety and health disciplines of industrial hygiene, occupational health nursing, occupational medicine residency, and occupational safety, as well as allied disciplines. Research and research training are integral components of ERCs, with ERC faculty and NIOSH trainees conducting research on issues related to the [NIOSH Strategic Plan: FYs 2019–2024](#) and emerging issues. ERCs serve as regional resources for industry, labor, government, and the public through training, research to practice, education, and outreach.

■ Public Health Relevance

NIOSH-funded ERCs serve a vital role in protecting the health and safety of the nation's workforce. Aligning with the goals of Healthy People 2030—to promote the health and well-being of the workforce—ERCs improve occupational safety and health through education, research, and collaboration. They serve as regional, national, and global resources 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.

ERCs published 215 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.

■ Research Outputs: Publications in FY 2020

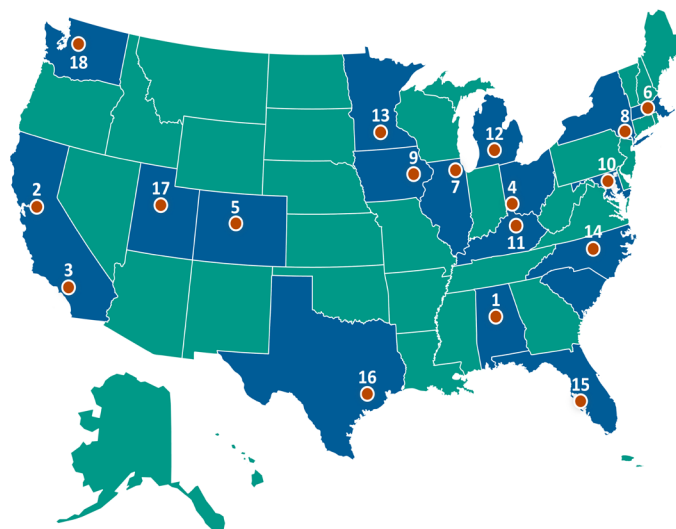
ERC outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2019, through September 30, 2020, the

■ Program Highlights FY 2020

Trainees, Graduates, and Employment of Graduates

In academic year 2019–2020, more than 300 students graduated from ERC programs with specialized training in disciplines including industrial hygiene, occupational health nursing, occupational medicine, occupational

NIOSH Education and Research Centers



- | | | |
|---|---|---|
| 1. Deep South Center for Occupational Health and Safety (University of Alabama at Birmingham) | 7. Great Lakes Center for Occupational Health and Safety (University of Illinois at Chicago) | 13. Midwest Center for Occupational Health and Safety (University of Minnesota) |
| 2. Northern California Education and Research Center (University of California, Berkeley) | 8. New York and New Jersey Education and Research Center (Icahn Mount Sinai School of Medicine) | 14. North Carolina Occupational Safety and Health Education and Research Center (University of North Carolina at Chapel Hill) |
| 3. Southern California Education and Research Center (University of California, Los Angeles) | 9. Heartland Center for Occupational Health and Safety (University of Iowa) | 15. Sunshine Education and Research Center (University of South Florida) |
| 4. University of Cincinnati Education and Research Center (University of Cincinnati) | 10. Johns Hopkins Education and Research Center for Occupational Safety and Health (Johns Hopkins University) | 16. Southwest Center for Occupational and Environmental Health (University of Texas Health Science Center at Houston) |
| 5. Mountain and Plains Education and Research Center (University of Colorado Denver) | 11. Central Appalachian Regional Education and Research Center (University of Kentucky) | 17. Rocky Mountain Center for Occupational and Environmental Health (University of Utah) |
| 6. Harvard Education and Research Center (Harvard T.H. Chan School of Public Health) | 12. The University of Michigan Center for Occupational Health and Safety Engineering (University of Michigan) | 18. Northwest Center for Occupational Health and Safety (University of Washington) |

safety, and other closely related occupational safety and health fields. The number of students enrolled increased from 978 in FY 2019 to 997 in FY 2020. Table 4 shows the number of students enrolled, graduates, and employment status during FY 2020.

Table 5 shows the placement of FY 2020 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 4. ERC trainees, graduates, and employment, FY 2020

Program Area	Enrolled	Graduates	Employed or seeking occupational safety and health employment (%)
Industrial Hygiene	292	115	108 (94)
Occupational Health Nursing	137	30	28 (93)
Occupational Medicine	129	34	33 (97)
Occupational Safety	161	53	53 (100)
Other Related Disciplines	278	71	63 (89)
Total	997	303	285 (94)

Table 5. ERC graduate employment by work setting, FY 2020

Work Setting/ Program Area	Industrial Hygiene	Occupational Health Nursing	Occupational Medicine	Occupational Safety	Other	Total
Private Industry	48	0	2	34	21	105
Federal/State/ Local Government	22	3	3	1	13	42
Academic Institution	13	4	1	5	13	36
Clinic/Hospital	3	14	23	4	1	45
Other OSH Employment	1	0	2	1	2	6
Seeking Advanced OSH Degree	5	2	0	5	12	24
Seeking OSH Employment	16	5	2	3	1	27
Total	108	28	33	53	63	285

Continuing Education Outputs

Continuing education of occupational safety and health professionals is a required part of ERC funding. Each year, NIOSH ERCs train thousands of these professionals around the United States through course offerings in the occupational safety and health core and related disciplines. The following table shows

the continuing education activity by discipline. In FY 2020, ERCs provided 306,952 person hours of training to 73,695 occupational safety and health professionals who took 1,543 courses. This compares with FY 2019 when the ERCs offered more courses (1,562) and more hours of training (348,390) but had a lower number of trainees (51,153).

Table 6. Continuing education courses by discipline, FY 2020

Discipline	Number of Courses	Number of Trainees	Person-Hours of Training
Industrial Hygiene	159	4,928	32,331
Occupational Health Nursing	129	8,176	34,254
Occupational Medicine	209	28,270	40,342
Occupational Safety	805	20,837	143,954
Other	241	11,484	56,071
Total	1,543	73,695	306,952

ERC Program Achievements

Center Focuses on Work Ability Among Older Nurses

Many older nurses in the United States are working in direct care and facing safety and health hazards, but research is limited on their ability to safely perform at work. Researchers at the New York and New Jersey ERCs recently looked at the factors influencing aging nurses' work ability. They interviewed 17 female registered nurses, with an average age of 59 years, by phone or in person at a large academic medical center. Guided by a [NIOSH Organization of Work Framework](#), the questions focused on the framework's principles that include work context, or characteristics of the job like work tasks and roles, and organizational context, like workplace practices and policies.

The participants' main motivations were internal factors like experiencing joy from nursing and feeling connected to patients at

their bedside. Other aspects that increased their ability to work included having a preferred work schedule that supported work-life balance, a work environment filled with camaraderie and teamwork, and organizational leaders who valued workers' input. These nurses also identified health issues, including knee replacement surgery, as one barrier to work performance—especially related to their desire to work future. Most expected to continue working for 5–10 more years.

While researchers say future research needs to reflect a wider population and range of healthcare systems, these findings support the need for managers of aging nurses to focus on schedules, workload, and enhancement of overall health. *The Western Journal of Nursing Research* featured this study, as did a NIOSH Science Blog in FY 2020 commemorating nurses during the Year of the Nurse. So far, more than 400 people have read about the study.

Details:

- [NIOSH TIC-2 Publications Search: Organization of Work Factors Associated With Work Ability Among Aging Nurses](#)
- [New York-New Jersey Occupational Safety & Health Center](#)
- [Work Ability Among Older Nurses](#)

The Widespread Reach and Influence of Harvard's Continuing Professional Education

Continuing professional education and outreach at the Harvard ERC offers a varied slate of courses that meet regional, national, and global occupational safety and health needs. These Executive and Continuing Professional Education Courses (ECPE) are short classes, ranging from two to five days, taught by staff in the Harvard T.H. Chan School of Public Health. Course participants include current and aspiring global leaders in healthcare and public health, with up to 55 individuals participating in each class.

Topics can range from leading in healthcare systems and organizations to applied risk communication to health outcomes research. These four topics are typically included each year and were the only classes offered in-person in FY 2020 due to the COVID-19 pandemic:

- [Comprehensive Industrial Hygiene](#)
- [In-place Filter Testing Workshop](#)
- [Ergonomics and Human Work Factors](#)
- [Radiological Emergency Planning](#)

The Harvard ERC offered 46 courses attended by 1,763 people in FY 2020. Participants included state police, firefighters, and first responders, along with hospital and university staff. Representatives from the U.S. Air Force, U.S. Navy, Federal Emergency Management Agency, and U.S. Nuclear Regulatory Commission also participated. Class evaluations showed most participants thought the courses would improve their job performance. When asked to rate the overall quality, participants gave the courses an average score of high quality. Looking

forward to FY 2021, ECPE courses will be held online. The Harvard ERC hopes this approach will make the program more accessible to new participants.

Details:

- [Harvard Education and Research Center](#)
- [About ECPE](#)

Symposium Highlights Key Topics Related to Wildfires

The Southern California ERC, located jointly at University of California Los Angeles and University of California Irvine, hosted a symposium on wildfires—an issue that continues to increase in severity and length in the Western United States. This event, entitled “Hot Topics in Wildfires: Present and Future Health Risk,” focused on varied topics such as health effects from wildfires, regulations for worker protection from wildfire smoke, and the impact of climate change on wildfires. Presentations also highlighted past and current NIOSH research on wildland firefighters. Additionally, sessions focused on exposure assessment in wildfire research including biomonitoring, exposure monitoring, and computer modeling. Presenters represented universities, state health departments, and other organizations, including the University of California San Francisco, University of Arizona, and California Department of Public Health. Symposium attendees included local government officials from Los Angeles and Irvine, along with staff at the Irvine Police Department and Orange County Fire Authority.

This February 2020 event aligned with the Southern California ERC's efforts to provide professional education, research, and outreach that positively impacts regional and national occupational health and safety practice.

Details:

- [Hot Topics in Wildfires: Present and Future Health Risks](#)
- [UCLA-UCI: Southern California NIOSH Education and Research Center](#)

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

■ Overview

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

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

transition between postdoctoral training and independent research careers.

NIOSH awards conference and scientific meeting grants under two research grant mechanisms: R13 and U13. Both grants support high quality, scientific conferences and 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 FY 2020

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, 2019, through September 30, 2020, R01 grant-funded researchers published 90 articles in peer-reviewed journals. The numbers of peer-reviewed publications for the other investigator-initiated research mechanisms are 3 (R03), 1 (U13), 8 (R21), and 12 (K01). Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the [NIOSHTIC-2 publications search](#).

■ Program Highlights FY 2020

Preventing Slips, Trips, and Falls by Predicting Wear on Shoes

Project Title: Impact of Worn Shoes on Slipping (R01 Grant).

Principal Investigator: Kurt Beschorner

Slip and fall accidents are a leading and quickly growing cause of U.S work-related injuries. According to the [NIOSH Traumatic Occupational Injuries](#) webpage, 27% of nonfatal work injuries resulting in lost workdays in 2018 were linked to slips, trips, and falls. An important part of preventing slips and falls is the shoes' tread, which provides friction with the floor. However, not all treads are the same. Some treads have patterns that create strong traction with the floor surface. Other tread designs have difficulty gripping the floor during walking, especially around water and other liquids, due to reduced coefficient of friction. Heavily worn shoes increase the risk of slipping. Worn shoes lose traction when they come into contact with fluids and can no longer release these liquids. The fluid becomes trapped in the shoe and pressurized, decreasing the shoe's coefficient of friction and increasing the risk of slipping.

Before this study, limited knowledge existed about the rate at which shoe tread becomes worn and how shoe wear causes a reduced coefficient of friction. To address this issue, investigators at the University of Pittsburgh looked at key causes of worn shoe tread

and the tread thresholds or points where shoes become unsafe. Looking at the size of the shoes' treads and the worn regions, researchers determined how friction or traction are linked to the size of the worn regions—a finding not previously reported in studies. Using this information, they created the battery test that indicates the threshold when the friction of shoes has deteriorated and can be used for inspecting shoes. They also developed virtual computer models that predict the wear patterns over time and the deterioration in friction of shoe treads as a shoe became worn. Scientists calculated the impact of worn regions on friction. They validated one of these computer models by comparing its results with real-life workers wearing different shoes on the job, as well as tested workers' shoes on flooring covered in liquid. The studies' findings highlight the usefulness of this type of computer model in designing slip-resistant shoes to decrease work-related slips and falls.

Information about this project has been widely shared with varied footwear companies, Grainger industrial supply company, and a committee within the ASTM International standards organization focused on pedestrian/walkway safety and footwear. Researchers also highlighted their findings via 12 journal articles, 22 conference presentations, and a keynote speech at the Slips, Trips & Falls Conference Madrid 2020. The NORA Traumatic Injury Cross-Sector Council also partnered with researchers to create posters for restaurant and healthcare workers on using the battery test for shoe inspections to determine slipping risk.

Details:

- [Impact of Worn Shoes on Slipping](#)
- [How to Inspect Your Shoes: A Guide for When to Replace Slip-resistant Shoes Using a AA battery](#)
- [Influence of Averaging Time-interval on Shoe-floor-contaminant Available Coefficient of Friction Measurements](#)

- [Changes in Under-shoe Traction and Fluid Drainage for Progressively Worn Shoe Tread](#)
- [Predicting Slips Based on the STM 603 Whole-footwear Tribometer Under Different Coefficient of Friction Testing Conditions](#)
- [Outside NIOSH: Computer Model Predicts Wear on Shoes](#)
- [NORA Traumatic Injury Prevention Cross-Sector Council, Posters: Slip Resistant Shoe Tread Wear](#)

Study Examines Effects of Work-hour Restrictions on Physician Safety and Health

Project Title: Impact of Lifting Work Hour Restrictions on First-year Resident Safety, Health, and Well-Being (R01 Grant).

Principal Investigator: Laura Barger

Some of the leading occupational hazards that resident physicians face are associated with extended work shifts, according to research. These include motor vehicle crashes, which can occur as these workers commute to and from work, and percutaneous injuries, such as injuries from a needlestick or other sharp objects. The Accreditation Council for Graduate Medical Education (ACGME) changed its policy on work hour restrictions for resident physicians in 2011 from 24–28 hours to 16 hours. In this study, researchers at Brigham and Women’s Hospital found a link between this work-hour limit and improvements in physician safety and health.

These scientists examined the effect of ACGME’s work-hour regulations on the safety of first-year resident physicians, focusing on varied outcomes, including motor vehicle crashes, near crashes, and percutaneous injuries. They collected and analyzed safety outcome data from 15,276 first-year resident physicians, which included reported work hours, extended shifts, and hours of sleep. Participants in the study included physicians in a residency program from 2002 through 2007, and another group who were resident

physicians from 2014 through 2017 after the ACGME restriction.

Researchers found that, following the ACGME regulation, resident physicians had a considerably lower risk of motor vehicle crashes, percutaneous injuries, and attentional failures, or injuries caused by lack of attention. The average hours of nightly sleep also increased for this group of workers. In contrast, extended shifts and prolonged or long weekly work hours were linked to negative safety outcomes. These findings are important because ACGME lifted the 16-hour work limit in 2017, and first-year resident physicians can now work 24–28 consecutive hours. The *American Journal of Medicine* featured this study in FY 2020, and it was highlighted in several news outlets in the healthcare field including Becker’s Hospital Review and Medical Xpress. Researchers at Brigham and Women’s Hospital plan to continue examining changes in resident physicians’ health outcomes, following the latest ACGME policy change.

Details:

- [The Association Between Resident Physician Work-hour Regulations and Physician Safety and Health](#)
- [Impact of Lifting Work Hour Restrictions on First-year Resident Safety, Health, and Well-Being](#)

Factors Linked to Low Back Pain for Manufacturing and Warehousing Workers

Project Title: Exposure Response Relationships for Low Back Pain From Pooled Data (R01 Grant).

Principal Investigator: Jay Kapellusch

Low back pain (LBP) is a leading cause of global disability and a frequent cause of limited activity and lost workdays. Research shows that risk factors for LBP may vary across many studies due to lack of a standard case definition for LBP. Past studies use

different definitions, resulting in varying risk factors. Many studies also have limited or imprecise measures of exposures for LBP in the workplace, especially related to health outcomes. Because of these challenges and other limited research methods, there is not a clear link between biomechanical risk factors related to physical movement and LBP.

Researchers at the University of Wisconsin Milwaukee aimed to understand the occurrence, risk factors, and health effects of LBP among workers. In this study, scientists combined and analyzed data from multiple past studies, looking at differences in their prevalence or frequency of LBP and risk factors for this health issue. They also examined connections between biomechanical or physical stressors for various work tasks, personal factors like demographics, psychosocial factors, LBP prevalence, and LBP incidence or rate of new cases. This project focused on LBP cases, in general, and those that resulted in workers seeking medical treatment and having lost workdays. Scientists analyzed data for 1,650 workers from 82 facilities, mostly in the manufacturing and warehousing industries. They measured biomechanical stressors related to workers' limits on lifting objects, including maximum weight, reach, and twisting. Researchers used the Revised NIOSH Lifting Equation (RNLE), a common tool to assess risk of lifting and lowering tasks at work. The RNLE focuses on an object's weight, the hand location, travel distance, angle of body twisting, lifting frequency, and length and type of grasp; measurements on these factors are combined for a single metric. For a comprehensive analysis, researchers compared the RNLE data to other identified physical exposure variables at work, including load moment and trunk posture.

Participants in this study had an average age of 35 years, and 75% were male and 68% non-Hispanic White. According to researchers, prevalence and incidence of LBP, along with health outcomes like seeking medical care

and having lost work time, were linked to biomechanical stressors measured via the RNLE and other physical exposure variables. Scientists also linked factors like advanced age, history of LBP, and psychosocial factors to either prevalence and/or incidence of LBP, health outcomes, or both. However, these factors did not impact the relationship found between biomechanical stressors, LBP, and health effects.

Researchers say these findings demonstrate biomechanical exposures are independent risk factors for LBP and health outcomes. This study, previously featured in *Journal of Occupational and Environmental Medicine* and *Human Factors* and other publications, is significant because it could potentially influence organizational and governmental policies on workplace physical exposures.

Details:

- [Exposure-Response Relationships for Low Back Pain From Pooled Data](#)
- [Prevalence of Low Back Pain, Seeking Medical Care, and Lost Time Due to Low Back Pain Among Manual Material Handling Workers in the United States](#)
- [Psychosocial Factors and Low Back Pain Outcomes in a Pooled Analysis of Low Back Pain Studies](#)
- [Evaluating Different Measures of Low Back Pain Among U.S. Manual Materials Handling Workers: Comparisons of Demographic, Psychosocial, and Job Physical Exposure](#)

Interventions for Vietnamese Nail Salon Workers

Project Title: A Feasibility Study to Develop a Multilevel Occupational Health Intervention Program for Nail Salon Employees and Owners (R21 Grant).

Principal Investigator: Tran Huynh

In the United States, more than half of nail salon workers identify as Vietnamese, and according to [research](#), they face various hazards. These include exposure to

dangerous chemicals from nail products, ergonomic hazards, and clients potentially spreading infectious diseases. The challenges facing Vietnamese nail salon workers are linked to barriers caused by social marginalization, a lack of health and safety training, gaps in policy, and economic pressures. The long-term exposure of chemicals from nail products puts nail salon workers at risk of health problems that include reproductive and cognitive developmental issues; cancer; allergies; irritation to the respiratory, dermatological, and central nervous systems; and musculoskeletal pain impacting the bones, muscles, tendons, ligaments, and soft tissues.

Research is lacking on evidenced-based interventions for Vietnamese nail salon workers, as well as studies on facilitators and barriers to their workplace settings adopting occupational health best practices. Building on a past NIOSH-funded K01 project, Drexel University researchers are using theory-based information to create a toolkit for salon owners and will test the effectiveness of this intervention in Philadelphia area Vietnamese nail salons. The toolkit will include trainings and self-assessment checklists, which allow salon owners to measure their work settings for chemical safety, infection control, and ergonomics. The toolkit will also include educational materials for salon owners, managers, and nail technicians on effective occupational safety and health practices and workers' rights.

So far, scientists have developed and pilot tested four online training modules with a small sample of seven salon owners and workers. The courses focus on infection control, chemical safety, ergonomics, and labor rights. Lessons learned from this effort will be used to improve training for the next cohort in the study. The principal investigator on this study also wrote an opinion article in the metro Philadelphia newspaper, *The Philadelphia Inquirer*, on workplace safety

and health issues facing immigrant nail salon workers.

Details:

- [An Immigrant Daughter's Call to Help Philadelphia's Nail Salons | Opinion](#)
- [A Feasibility Study to Develop a Multilevel Occupational Health Intervention Program for Nail Salon Employees and Owners](#)

Reducing the Impact of Client Death on Home Care Aides

Project Title: Exploring the Role of Client Death Support in Home Care Workers' Grief, Stress, and Job Satisfaction (K01 Grant).

Principal Investigator: Emma Tsui

Prior research shows that home care aides experience grief, burnout, and job insecurity following the death of a client. Because these workers typically help older clients with daily living activities and healthcare needs, the death of a client can be a harsh reality and work-associated stressor. When this occurs, studies found home care aides experience emotional strain and short-term job loss until they are reassigned to a new case. However, there is limited research focused on home care agencies' perspectives on this topic and how they address it and support their aides.

Scientists at The City University of New York Graduate School of Public Health and Health Policy studied this issue, interviewing leaders from a sample of eight New York City home care agencies on facilitators and barriers to how they handle client death. According to the study, the agencies mainly had a range of informal practices in reaction to a client dying and very few preventive efforts to help home care aides deal with the issue. In particular, after clients die, the organizations did not provide paid leave and lacked appropriate emotional support such as counseling or responsive case reassignment. They also provided limited to no training on end-of-life care and the emotional experiences surrounding client death. Rather, agencies

relied on their coordinators to informally handle home care aides' needs; however past studies have shown they often emphasize staffing priorities over the needs of aides.

While most leaders in this study recognized that home care aides need more support, they mentioned one major barrier to this happening is the lack of funding and available resources related to employment and healthcare policy. Nevertheless, researchers

note that policy changes leading to increased wages, paid time off, and emotional support services for aides can increase well-being and retention among this critical workforce. Their findings have been reported in the *Journal of Applied Gerontology*.

Details:

- [Interventions to Reduce the Impact of Client Death on Home Care Aides: Employers' Perspectives](#)

COOPERATIVE RESEARCH AGREEMENTS

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

In FY 2020, NIOSH funded the state surveillance program to support states in monitoring occupational injuries, diseases, exposures, and deaths. Other cooperative agreements awarded in FY 2020 included funding for occupational safety and health surveillance collaboration, education, and translation; National Mesothelioma Virtual Bank funding; and the Commercial Fishing Occupational Safety Research and Training Program. Selected highlights from the state surveillance program are provided below.

STATE SURVEILLANCE PROGRAM

■ Overview

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

■ Public Health Relevance

NIOSH values state programs and gives financial and technical support to state health and labor agencies, universities, and other eligible groups to develop and expand their

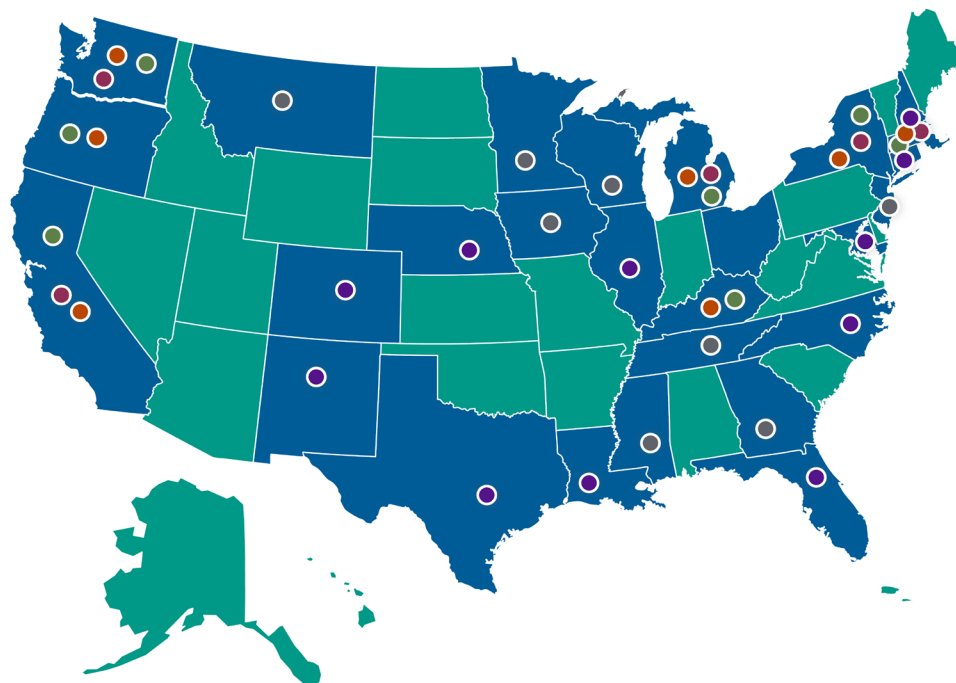
occupational health surveillance programs. The NIOSH extramural surveillance portfolio includes 26 state recipients composed of 49 projects focusing on work-related injuries and death, exposures and hazards, and worker populations of interest. These programs use and distribute surveillance data to find the incidences of job-related injuries, illnesses, exposures, 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 FY 2020

State surveillance program outputs are the products of both nonresearch and 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, 2019, through September 30, 2020, the state surveillance program 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](#).



NIOSH Sponsored State Occupational Health & Safety Surveillance Program



- **Fundamental Programs**
 - Georgia
 - Iowa
 - Minnesota
 - Mississippi
 - Montana
 - New Jersey
 - Tennessee
 - Wisconsin
- **Fundamental-Plus Programs**
 - Colorado
 - Connecticut
 - Florida
 - Illinois
 - Louisiana
 - Maryland
 - Nebraska
 - New Hampshire
 - New Mexico
 - North Carolina
 - Texas
- **Expanded Programs**
 - California
 - Kentucky
 - Massachusetts
 - Michigan
 - New York
 - Oregon
 - Washington
- **Respiratory Diseases Projects**
 - California
 - Massachusetts
 - Michigan
 - New York
 - Washington
- **Fatality Assessment & Control Evaluation**
 - California
 - Kentucky
 - Massachusetts
 - Michigan
 - New York
 - Oregon
 - Washington

■ Program Highlights FY 2020

Occupational Injury Added to Syndromic Surveillance System

EpiCenter—the New Jersey syndromic surveillance system that alerts local and state health officials of potential community outbreaks in near real time based on data from emergency department visits—now includes occupational injury classifiers. These classifiers allow cases of workplace

injuries and illnesses to be identified through keywords entered in the chief complaint field. This new addition to EpiCenter occurred through a partnership between the Occupational Health Surveillance (OHS) Unit and the Communicable Disease Service, Infectious, and Zoonotic Disease Program within the State of New Jersey Department of Health. Through the new classifiers, the OHS Unit receives alerts on potential occupational hazards, like chemical exposures, when three

or more cases are reported in 24 hours. The OHS Unit also notifies the appropriate groups when these alerts are received, including the health department's Public Employees Occupational Safety and Health, along with regional Occupational Safety and Health Administration (OSHA) offices, so immediate public health action can be taken.

Building on this milestone, staff in the health department's OHS Unit chaired an occupational Syndromic Surveillance Workgroup for the Council of State and Territorial Epidemiologists (CSTE). CSTE invited this state surveillance program to lead the workgroup, which eventually created a guidance document for other states to use to implement their own syndromic surveillance for occupational health. The guidance includes information on how states can use syndromic surveillance and develop their occupational health syndrome definitions. The report also describes some states' current syndromic surveillance systems, including details on their types of systems and what variables are collected. CSTE posted the guidance document on its website and featured it during its December 2019 Occupational Health Surveillance Subcommittee Meeting.

Details:

- [NJ Health: Syndromic Surveillance](#)
- [NJ Health: Workplace Health and Safety Occupational Health Surveillance](#)
- [Syndromic Surveillance for Occupational Health Surveillance: Guidance Document and Examples](#)

Effort to Prevent Opioid Exposure Reaches Thousands of Georgia First Responders

Carfentanil and other similar substances designed to mimic fentanyl—a synthetic, or manmade, opioid—can be harmful to public safety, first responder, and medical treatment and laboratory workers. Emergency responders are likely to come into contact

with illicit drugs on the job, including opioids such as fentanyl and fentanyl-related compounds like Carfentanil. These substances are increasingly linked to opioid overdose deaths. Fentanyl and substances that are compounds from its drug class have many forms, like powder or liquid, and exposed workers can accidentally inhale or absorb it through the skin. In 2018, emergency medical services (EMS) and law enforcement personnel completed a survey on opioid exposure, given by the Georgia Department of Public Health Occupational Health & Safety Surveillance Program (GA-OHS). Less than half of the workers knew about CDC/NIOSH recommendations for preventing opioid exposures among first responders, according to survey findings.

Based on these data, GA-OHS determined a need for more education and outreach on preventing opioid exposure. The program created a fact sheet in FY 2020 summarizing CDC/NIOSH recommendations entitled "First Responder Safety Precautions for Dealing With Unknown Opioids," and widely distributed the document. All licensed EMS personnel in Georgia received the fact sheet via email, totaling more than 20,000 workers. The program also hosted a booth at the 2019 Georgia EMS Association Providers and Educators Conference in October 2019, where GA-OHS staff talked with hundreds of EMS personnel. They handed out the fact sheets, along with information on the NIOSH illicit drug toolkit, and provided education on preventing opioid exposures, including use of personal protective equipment. The Georgia Association of Chiefs of Police also featured the fact sheet in its quarterly newsletter.

Details:

- [Opioid Epidemic: First Responders and EMS](#)
- [Preventing Emergency Responders' Exposures to Illicit Drugs](#)
- [Fentanyl](#)
- [Georgia Association of Chiefs of Police Online Quarterly News](#)

Identification of Top Occupational Injury Claims in Massachusetts

In a study examining workers' compensation claims from 2014 through 2016, the Massachusetts Department of Public Health, in collaboration with the Massachusetts Department of Industrial Accidents and the Massachusetts Department of Labor Standards, found state workers filed claims most often for strains and sprains. Investigators used previously unavailable data from the Massachusetts Department of Industrial Accidents and looked at trends of occupational injuries and illnesses for private sector workers. Analyzing 93,123 workers' compensation lost-wage claims, they identified common types of incidents leading to injuries and illnesses and reported demographics like gender, age, and industry. The claims were filed during 2014–2016 for employees working at least 40 hours weekly, equaling to an average of 31,041 claims per year.

The occupational sectors with the highest claim rates included Transportation and Warehousing, Construction, Healthcare and Social Assistance, and Wholesale and Retail Trade. Other key findings included that injuries accounted for 95% of all claims, with most of the workers experiencing strains and sprains (51%); contusions, crushings, bruises (12%); fractures (9%); and cuts, lacerations, and punctures (8%). Overexertion due to lifting and pushing marked the top cause of all injuries (38%), followed by slips, trips, and falls (29%), contact with an object or equipment (19%), and violence and transportation incidents (5%). Males filed the majority of claims, along with workers aged 55–64 years who mostly reported being injured from a fall on the same level. These findings can help guide research and prevention efforts—full results are available in a report released in November 2019.

Details:

- [Outside NIOSH: Strains and Sprains Lead Work-related Injury Claims in Massachusetts](#)
- [Occupational Health Surveillance Program](#)

Surveillance Uncovers Hazardous Lead Exposure at Small Business

The New York State Department of Health (NYSDOH) uses its Heavy Metals Registry (HMR) to collect surveillance data on adult exposures to lead, mercury, cadmium, and arsenic. The registry helped the NYSDOH surveillance program identify 27 workers at a small business who had the highest blood lead levels (BLLs) ever recorded in the HMR. They were subcontractor field technicians hired by a specialty company to remove and refurbish older windows in a commercial building under renovation. After looking into the situation, the program found the commercial building was older with lead paint on its interior and exterior surfaces, as well as its windows and doors. The investigation also revealed the company did not test the facility for lead, and employees reported safety rules were not enforced onsite, along with a lack of respiratory protection and guidance on sanitation and hygiene practices for lead exposure.

The business responded to the incident with several actions including putting their workers on a medical monitoring plan based on OSHA guidelines and setting up a Respiratory Protection Program. The workers must now wear personal protective equipment, including respirators, which they are fit tested for, when around lead or other harmful materials. The company also developed standard operating procedures (SOPs) that include the new safety and health changes. They trained all employees on the SOPs and now offer an annual lead training that includes a review of OSHA standards and lead hazards.

The NYSDOH surveillance program continues to monitor the workers' BLLs and tracks the company's progress in implementing the new safety and health changes. The program also offers follow-up medical care to the workers, when needed, through its Occupational Health Clinic Network, which assists thousands of patients annually for occupational illness and injuries.

Details:

- [Heavy Metals Surveillance: New York State Heavy Metals Registry](#)
- [Occupational Health Clinic Network—Prevention and Protection for the NYS Workforce](#)

Identification of Injury Risks Associated With Motor Vehicle Towing

Past data show that deaths related to managing the scene after motor vehicle crashes most likely involve commercial tow truck operators. Following roadway incidents, these workers coordinate with traffic incident managers in multiple ways to remove disabled or nonworking vehicles, clearing debris and cleaning up fallen cargo. Research shows these workers have a high likelihood of being struck by roadway traffic, also called pedestrian struck-by incidents, when performing these traffic incident management (TIM) activities. In fact, commercial tow truck operators are at greater risk than other first responders with TIM functions like fire, police, and emergency medical personnel.

Limited research exists on hazards related to motor vehicle towing (MVT) and effective safety strategies for this industry. To address this issue, the Kentucky Occupational Health and Safety Surveillance Program used OSHA data to describe factors linked to injuries among commercial tow truck operators as they provided roadside assistance. They analyzed information from OSHA investigation

files from 2002–2017, specifically the written descriptions of each injury event. They also examined separate data on weather conditions for each case.

In total, there were 106 cases where tow truck operators died or were severely hurt, but researchers could only get detailed descriptions for 41 cases. They focused on types of injury incidents and related causes. Most of the incidents were either struck-by incidents or caught-in or -between incidents, where workers were pinned beneath or between vehicles or caught in their moving parts.

According to researchers, these findings demonstrate the need for first-time and refresher safety trainings in the MVT industry on loading and unloading vehicles and defensive techniques while around roadway traffic. Researchers also recommended trainings on proper wheel chocking and braking procedures, advocating for states to add tow trucks to the list of first responder vehicles in “Move Over” laws. The *Journal of Safety Research* published this study in December 2019, and the Kentucky surveillance program shared its findings with the Towing and Recovery Association of America and Emergency Road Service Coalition of America.

Details:

- [Motor Vehicle Towing: An Analysis of Injuries in a High-risk yet Understudied Industry](#)
- [Kentucky Occupational Safety and Health Surveillance Program](#)

SPECIALTY TRAINING PROGRAMS

NIOSH funds the TPGs, the Commercial Fishing Occupational Safety Training Grants funded at the end of FY 2019, and the Miner Safety and Health Training Program—Western United States cooperative agreement. Selected highlights from TPGs and the Miner Safety and Health Training Program—Western United States are provided below.

TRAINING PROJECT GRANTS

■ Overview

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

Through a TPG, the Alaska Marine Safety Education Association expands the network of port-based fishing safety instructors

in Alaska and the United States. They achieve this through a train-the-trainer curriculum designed for the unique needs of the commercial fishing industry. NIOSH also provides funding for the [Emergency Responder Training Program](#) through the IAFF, which this report later discusses.

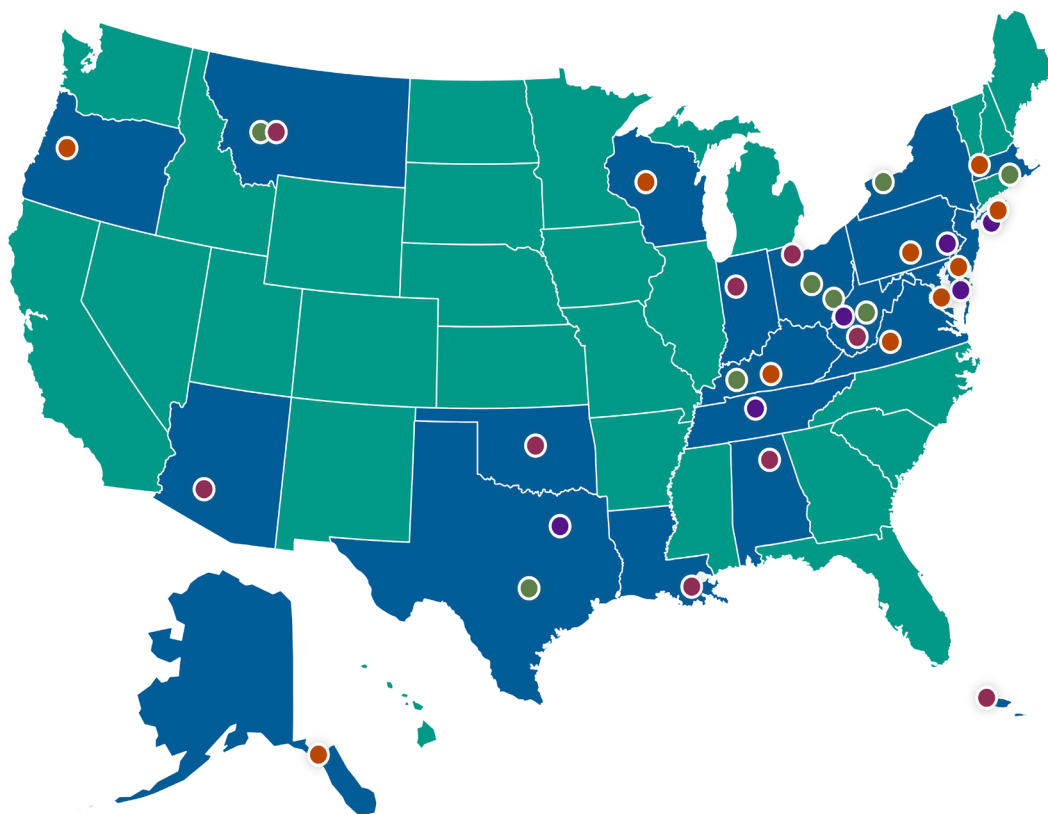
■ Public Health Relevance

TPGs offer an important service by providing enough qualified professionals to carry out the Occupational Health and Safety Act of 1970. TPGs 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 2030—to promote the health and well-being of the workforce. TPGs also serve as important resources on job-related safety and health issues for business, labor, government, and the public.

■ Research Outputs: Publications in FY 2020

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

NIOSH Training Project Grants



● Occupational Safety

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

● Industrial Hygiene

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

● Allied Occupational Safety & Health

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

● Occupational Medicine

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

Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2019, through September 30, 2020, the TPG researchers published 21 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 FY 2020

Training Project Grant Trainees, Graduates, and Employment by Discipline

In academic year 2019–2020, the TPG academic training programs had 859 trainees, of which 259 graduated 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. These current figures reflect an increase from the FY 2019 number of trainees (787) and graduates (256).

Training Project Grant (TPG) Program Achievements

Study on Indoor Portable Air Cleaners and Wildfire Safety

In the United States, the wildfire season continues to intensify in severity and duration, particularly out west. Wildfire smoke contains dangerous chemicals—mostly fine particulate matter or PM_{2.5}—a harmful substance that can stay in the air for long periods. People can inhale it deep into their lungs, and studies show PM_{2.5} is linked to systemic inflammation and disorders affecting the heart and lungs; it is linked to increased fatalities.

Public health recommendations for wildfires include using an indoor portable air cleaner that removes particulate matter from rooms by moving air through a filter. According to research, this type of device can decrease PM_{2.5} levels in homes caused by wildfire smoke. However, data are limited on exposure to wildfire-sourced PM_{2.5} in office settings. Led by one of its trainees, the Montana Technological University TPG studied the effectiveness of an indoor portable air cleaner in decreasing PM_{2.5} in offices and explored

Table 7. Training project grant trainees, graduates, and employment by discipline, FY 2020

Program Area	Trainees	Graduates	Employed in occupational safety and health field or seeking advanced training (%)
Industrial Hygiene	286	78	78 (100)
Occupational Safety	233	83	79 (95)
Occupational Medicine	42	22	22 (100)
Allied Disciplines	298	76	73 (96)
Total	859	259	252 (97)

connections between outdoor and indoor PM_{2.5} levels during wildfires. Researchers found concentrations of PM_{2.5} in offices were like those reported outside by a local National Ambient Air Quality Standards monitoring station during a Pacific Northwest wildfire. Scientists compared two identical offices—one with the device and one without it—during wildfire season. The portable air cleaner reduced the amount of PM_{2.5} inside the office by 73% during working hours and 92% during nonworking hours.

These findings show that indoor work areas, like offices, can have high PM_{2.5} levels during wildfires, but a portable air cleaner can lessen the problem and protect health. Researchers also created a method to improve their measuring instruments by correcting for overestimated PM_{2.5} levels. The *Journal of Occupational and Environmental Hygiene* featured this study in FY 2020, and more than 500 people have read about the project.

Details:

- [Control of Wildfire-sourced PM_{2.5} in an Office Setting Using a Commercially Available Portable Air Cleaner](#)
- [Outside NIOSH: Portable Air Cleaners: Making Indoor Work Safer During Wildfires](#)

Training Successes from Texas A&M University

The Occupational Safety and Health Training Program at the Texas A&M University Health Science Center School of Public Health is a TPG, offering graduate training with concentrations in worker safety, health, and ergonomics. Trainees gain knowledge and skills in varied occupational safety and health areas including workplace wellness, occupational disease, ergonomics, user-computer interaction, industrial hygiene, industrial process safety, epidemiology, and other areas.

In FY 2020, TPG trainees completed research and developed new tools related to the safety, design, and human factors of the workplace. They worked with the Texas A&M Ergo Center

and provided ergonomics task analysis and job description information, which allowed the center to examine university workers' varied postures on the job. Trainees also provided ergonomic evaluations at a local area hospital and for university employees who requested these to identify risks like repetitive tasks that can cause strains or other issues that cause musculoskeletal disorders. These types of professional practice experiences provide invaluable training and leads to employment opportunities. In FY 2020, all 21 TPG graduates from Texas A&M were hired in OSH positions at the time they obtained their degrees or shortly after. These graduates are also eligible to apply for the Certified Safety Professional® credential because the Occupational Safety and Health Training Program is accredited through the Board of Certified Safety Professionals.

Increasing Diversity in Occupational Safety and Environmental Health

Recruitment of minority students marks a key focus for the Western Kentucky University TPG. This grant helps to support undergraduate and graduate students in the university's Environmental and Occupational Health Science (EOHS) Program. These trainees gain knowledge and experience in public health, environmental health, occupational safety and health, environmental science and compliance, and injury and illness prevention. The Western Kentucky University TPG carried out strategies in FY 2020 to recruit, train, and retain minority trainees in the program, with the goal of increasing diversity in both occupational safety and health and environmental health. Key strategies for recruiting minority undergraduate students included participating in college recruitment fairs and promoting the program's scholarships and professional opportunities. The TPG targeted high school students taking college courses and college students taking general EOHS courses. To recruit minority graduate students, TPG staff gave presentations during EOHS upper-level

courses, promoted the program through the university's graduate school, and participated in the graduate school's recruitment events. Information that the Western Kentucky University TPG recently obtained from interested parties, including environmental and occupational health managers, revealed an ongoing regional need for EOHS professionals. Its past graduates are currently working in these types of positions and impacting worker health in Kentucky and beyond.

EMERGENCY RESPONDER TRAINING PROGRAM

■ Overview

Through the IAFF, NIOSH supports a nationwide program to enhance the capabilities of firefighters engaged in emergency response through training. The training is site- and trade-specific and aims to reduce on-the-job injuries, illnesses, and fatalities related to emergency response. Therefore, responders are better able to protect the communities they serve.

The IAFF has a long working relationship with NIOSH. IAFF's Emergency Responder Training Program is part of a complete first responder training plan. IAFF's teachings seek to improve knowledge, attitudes, and behaviors

so that first responders adopt a safer approach to emergency response throughout their career. IAFF training is a resource that directly affects decisions firefighters make each and every day.

■ Public Health Relevance

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

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

■ Program Highlights FY 2020

In FY 2020, IAFF delivered 63 classes to 1,231 students, totaling 21,608 contact hours.

Table 8. Emergency responder training classes, FY 2020

Class Title	Class Length	Total Classes	Total Students	Total Contact Hours
Confined Space Operations	24 hours	3	57	1,368
Emergency Response to Terrorism: Operations	8 hours	13	266	2,128
First Responder Operations	24 hours	34	678	16,272
Illicit Drug Labs	8 hours	13	230	1,840

MINER SAFETY AND HEALTH TRAINING PROGRAM

■ Overview

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

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

For FY 2020, two programs were funded in the Western United States: the Colorado School of Mines and the University of Arizona. This training provides a joint approach to reducing occupational illnesses, injuries, and fatalities 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

Recent [research](#) shows that 24 mining workers died in 2019—the lowest number of fatalities in MSHA’s 43-year history. In 2020, there were 29 mining deaths, making it the sixth consecutive year in the agency’s history that mining industry fatality numbers were below 30. While this improvement cannot be solely attributed to effective safety training, such interventions likely contribute to these outcomes. In a recent [evaluation](#) of the NIOSH Mining Program, it is noted that MSHA takes advantage of knowledge and products provided by the NIOSH-funded Miner Safety and Health Training Program—Western United States.

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

- Expanding the mission of NIOSH in protecting and promoting the health of mine workers. The trainings improved work practices, reduced work-related injury and illness, and increased the understanding of safety and health practices in Western mine worksites.
- Increasing the safety focus, total health awareness, and leadership competency of miners, frontline supervisors,

superintendents, and managers representing operations throughout the United States, spanning all major commodity sectors in surface and underground mining.

- Directing the focus of mine-rescue training toward learning actual rescue skills, resulting in team members being better prepared to respond to all kinds of emergencies.

The Miner Safety and Health Training Program fills an important regional need. During FY 2020, the program trained 984 mine workers through 84 courses. Due to challenges related to COVID-19, training numbers were lower than in FY 2019 when 1,538 mine workers received training through 67 courses.

Trainees included miners, supervisors, and undergraduate and graduate engineering and geology students. The program 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. Trainers across all mining service sectors throughout the Western United States have been taught ways to improve safety training. These activities improve the transfer of best safety practices to the workplace while increasing the number of workers served.

■ Program Highlights FY 2020

New Online Courses for Professionals in Mining Safety and Health

The Colorado School of Mines (CSM) offers a broad Professional Development Curriculum that aims to increase trainers' and safety and health professionals' capacity to train mining workers. The curriculum achieves this goal by increasing the technical skills and knowledge of trainers and other professionals and has been offered through the following ways since 2018:

- **Train-the-Trainer Presentations** on varied topics including engineering controls, exposure assessment and hazard recognition, instructor coaching, training methodologies, and adult education.
- **Short Courses** on topics required by MSHA to be taught during its 30 CFR Part 48 trainings.
- **Joint Industry Training** that links management and labor to participate in productive discussions on safety and health issues pertinent to their individual operations.
- **Safety and Health Training Courses** to improve the effectiveness of safety and health programs and/or safety management systems.
- **Webinar Series** that focuses on current relevant safety and health topics.

In FY 2020, CSM created four online courses under the Professional Development Curriculum and offers them on the CSM website. These classes are called (1) Hazardous Particulates, (2) Safety Management Systems [Part 1 and 2], (3) MSHA 101 [Part 1 and 2], and (4) Sleep: The Most Important Component of Safe Behavior. CSM also held other training activities that included some of these course topics, such as two presentations at the 15th Annual Mine Safety & Health Conference in October, 2019, in Reno, Nevada. More than 90 people attended the two presentations: "Sleep: The Most Important Component of Safe Behavior" and "Energy, Mining, and Construction Industry Safety (EMCIS) Training: Fun—Not Funny." CSM staff offered "EMCIS Training: Fun—Not Funny" and another presentation, "Your Brain on Stress and Fatigue," to nearly 50 members of the Society for Mining, Metallurgy & Exploration via a webinar. The CSM program reports many conference and webinar attendees requested slides following the events.

Details:

- [Online Training Modules & Presentations](#)

New Gaming Software Features Enhance Training and Evaluation of Performance

The University of Arizona added a new feature to its computer-based serious gaming software such as “Harry’s Hard Choices” and “Harry’s Hazardous Day” during FY 2020. This software is used to provide engaging training in miner safety and health through games that lead to increased knowledge transfer. The new feature is a series of game mechanics or computerized rules that guide trainees’ actions and tasks they are given while using the game, along with game advancement strategies. These mechanics provide a competency-based evaluation or assessment of trainees’ performance during the game, using this assessment to improve the training.

The gaming software is based on the university’s Mine Health and Safety Competency Model—a five-tiered approach

to occupational safety. The mechanics assess trainees’ performance on gaming tasks, providing measures in the areas of (1) skills and abilities, (2) derived attributes based on personality assessments, (3) core attributes based on behavioral tendencies and talents, and (4) class or knowledge of certain jobs or professions. University staff created these mechanics using methodology proven successful in the genre of role playing games, which includes the university’s serious games that train workers through avatars in simulated scenarios. Through this new feature, trainees’ choices and behaviors in the game determine their avatars’ assigned knowledge, skills, abilities, and other attributes, along with specific tasks they are asked to complete, and guide the feedback, rewards and penalties received during the game.

Details:

- [Harry’s Hazardous Day Game Mechanics](#)

V. WORLD TRADE CENTER (WTC) HEALTH PROGRAM

The terrorist attacks of September 11, 2001, have caused an array of acute and chronic adverse health conditions in the exposed population. According to [research](#), nearly 400,000 people are believed to be at an increased risk of adverse health effects from their exposure to physical, psychological, and emotional stressors from the event. There is considerable comorbidity in 9/11-related illnesses, resulting in further reduction in the quality of life in some people. Illnesses related to the 9/11 attacks persisted in many survivors while others presented long after their exposure; therefore, long-term follow up is needed.

Shortly after the attacks, CDC and NIOSH provided funding to support a variety of post-disaster activities including medically evaluating and monitoring responders, establishing the WTC Health Registry, and publishing treatment guidelines for adults and children exposed to the disaster. As a result of the combined efforts of researchers, physicians, responders, survivors, local governments, research institutions, and the community, Congress created the WTC Health Program with the passage of the James Zadroga 9/11 Health and Compensation Act of 2010 (Zadroga Act). The WTC Health Program provides medical monitoring and treatment for specific symptoms and health conditions for people who worked in response, recovery, and cleanup operations at the WTC, the Pentagon, and the passenger-jet crash site near Shanksville, Pennsylvania, as well as initial health evaluations, monitoring, and treatment for survivors of the attacks in New York City. Furthermore, the Zadroga Act (Public Law 111-347, as amended by Public Laws 114-113 and 116-59), requires ongoing research activities, maintenance of the WTC Health Registry, and outreach and education activities to potential enrollees. OEP manages the extramural portfolio of cooperative agreements for the WTC Health Program. This portfolio includes the WTC Health Registry and individual cooperative research agreements, as discussed in this section. For more information about the WTC Health Program, see the [Summary of WTC Health Program Research: NIOSH Research Compendium](#).

WTC HEALTH PROGRAM RESEARCH PORTFOLIO OVERVIEW

The WTC Health Program Research-to-Care Model conducts and assesses research in order to inform clinical care for the population of responders and survivors affected by the 9/11 attacks. To review the current WTC Health Program research agenda and the Research-to-Care Model, please visit the [WTC Health Program Research Agenda](#).

Each year since late 2011, the WTC Health Program has solicited applications for scientifically rigorous research to help answer critical questions about physical and mental health conditions related to the September 2001 terrorist attacks. From 2011 through 2020, the WTC Health Program reviewed a total of 300 research proposals (including contracts but excluding the initial and renewal awards of the WTC Health Registry) and selected 84 (28%) projects in addition to the WTC Health Registry for funding. Prior to switching to NIOSH in 2009, the Registry was administered by the Agency for Toxic Substances and Disease Registry and the National Center for Environmental Health.

The Registry sits within the New York City Department of Health and Mental Hygiene.

During FY 2011–2020, the WTC Health Program funded 84 research projects (excluding the WTC Health Registry) for a total of \$127.4 million. During FY 2011–2020, the WTC Health Program continued to fund the WTC Health Registry project for a total of \$67.6 million. Total research funding from 2011 through 2020 for the 84 research projects and the WTC Health Registry is shown in Figure 10. Additionally, see Table 9 for FY 2020 data. For a listing of all funded projects awarded and current status of funded projects, see the [Summary of WTC Health Program Research: NIOSH Research Compendium](#).

Table 9. World Trade Center Health Program funding, FY 2020

Award Category	Award Mechanism	Number of Awards	Funding
World Trade Center Health Program	—	30	\$23,717,253
World Trade Center Research	Cooperative Agreements (U01)	29	\$15,822,253
World Trade Center Health Registry	Health Registry	1	\$7,895,000

*The data in Table 9 do not include active projects funded with prior year funding through no cost extensions.

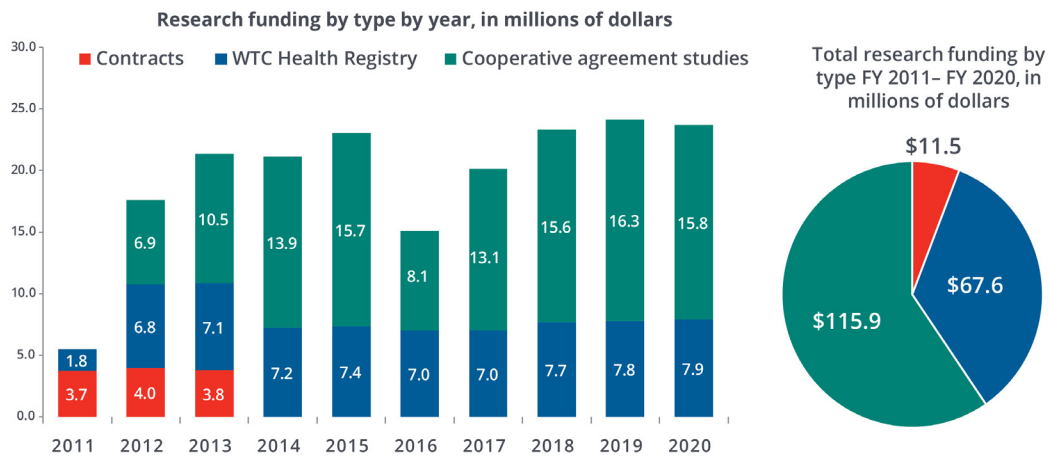
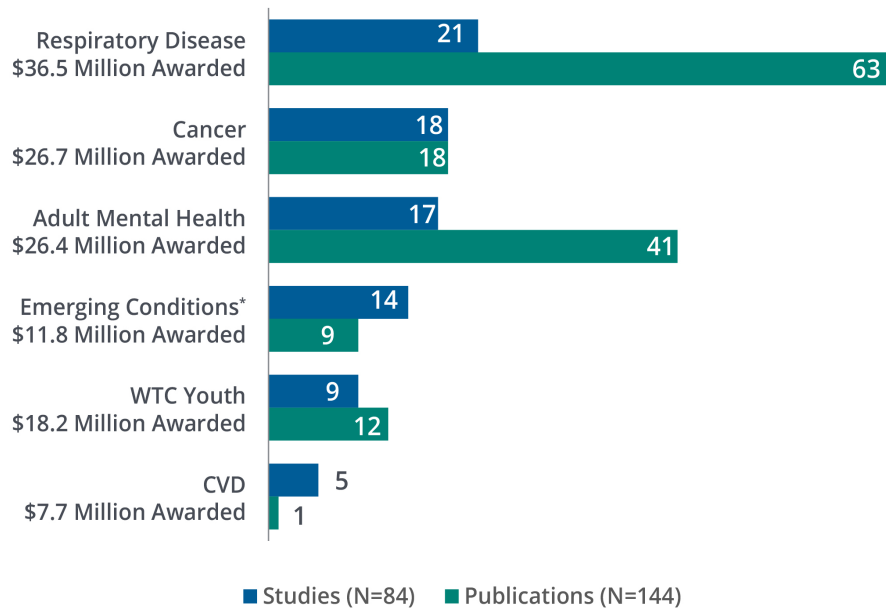


Figure 10. Research funding for 2011–2020 research cooperative agreements, WTC Health Registry, and research contracts

Of the 84 projects awarded since 2011, 38 (45%) are active and 46 (55%) are completed (closed). Thirteen of the active projects and 33 of the closed projects produced 144 publications. The WTC Health Program organizes its research projects and their outputs or products, including publications, into six primary focus areas: (1) Respiratory Disease, (2) Cancer, (3) Adult Mental Health, (4) Emerging Conditions, (5) WTC Youth, and (6) Cardiovascular Disease (CVD). External program partners, along with NIOSH leadership, contributed to the development of these focus areas. The categories were created based on 9/11-related illnesses identified by clinicians treating the impacted population, a review of research publications on WTC-related health conditions, and a

review of the physical and mental health conditions covered by the WTC Health Program. These latter conditions have been determined to be aggravated by, contributed to, or caused by exposure to the 9/11 terrorist attacks. For more information on the areas of health conditions reported following the disaster and treatments for those conditions, see the [Summary of WTC Health Program Research: NIOSH Research Compendium](#). This research compendium also includes a table listing of all funded projects, a listing of those studies with publications, and a bibliography of all research portfolio publications (excluding WTC Health Registry publications).

See Figure 11 for data on the publications resulting from WTC cooperative research agreements.



Note: Some projects involve more than one focus area, but publications are counted only toward the main area of focus.

*Emerging conditions: autoimmune disease, assessment of bias in WTC studies, cognitive function, neuropathic symptoms, kidney disease, general responder mortality, WTC exposure assessment-global DNA methylation, trace elements in autopsy tissues from WTC decedents, development of a comparison WTC occupational cohort, and hepatitis C.

Figure 11. Research studies and publications by primary focus area

WTC HEALTH REGISTRY

Established in 2002, the WTC Health Registry follows a diverse cohort of 71,431 persons who experienced a range of direct exposures during the September 11, 2001, terrorist attacks and in its aftermath. It is one of the longest running post-disaster registries worldwide. Based in the New York City Department of Health and Mental Hygiene, the WTC Health Registry is an essential public health resource for understanding the long-term (almost 20 years) physical and mental health effects of the September 11, 2001, terrorist attacks.

MISSION AND SERVICES

Data collected and analyzed by the Registry helps WTC responders, WTC survivors, and their clinicians make informed decisions about their or their patients' health and helps researchers and policy makers make informed decisions about the 9/11-exposed population, in general. Health resource information is disseminated by Registry staff via multiple channels, including a comprehensive website, annual reports, e-newsletters, brief research summaries, testimonials from responders and survivors, informational videos, social media, targeted mailings, health information sheets, press announcements, and meetings with interested parties/groups.

Communications with registrants are designed to keep them engaged with the Registry for the long term and to obtain registrants' updated contact information. These communications enhance registrants' participation in periodic follow-up health surveys and nested studies to track and understand long-term changes in physical and mental health, quality of life, and gaps in care. The Registry staff also helps connect registrants and their families with the WTC Health Program, where they can receive needed healthcare.

The Registry staff works with community, labor, and other partners to keep them informed and to receive input on various research studies, surveys, and other activities related to the 9/11 community. Registry researchers disseminate findings at scientific conferences, meetings, and through peer-reviewed journals. More information can be found at [WTC Health Registry](#).

ENROLLMENT

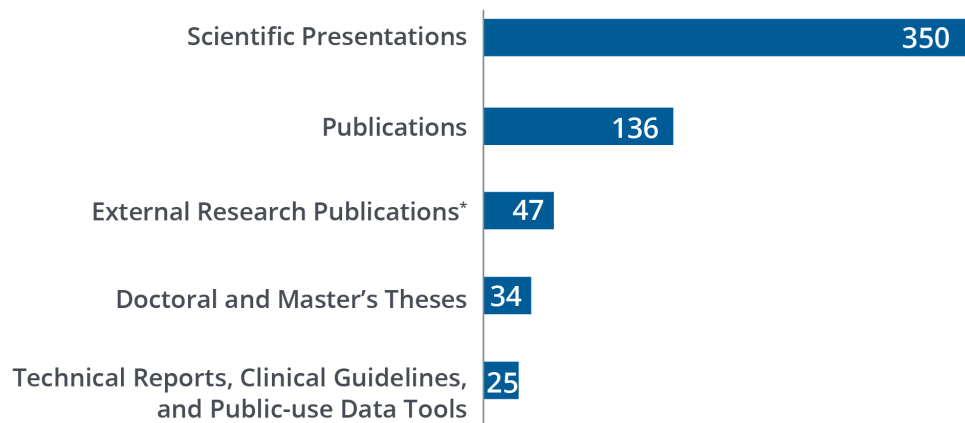
The Registry enrollment is now closed, but it includes 30,664 rescue and recovery workers and 49,732 survivors who lived, worked, attended school, or were present in lower Manhattan on September 11, 2001. Nearly 9,000 registrants are both survivors and rescue and recovery workers. Approximately 2,625 children under the age of 18 were registered during 2003–2004; all are now adults 18 years of age or older. Approximately 1,684 child registrants who have aged into adulthood have consented to remain in the Registry as young adults, including 152 in 2020. WTC Health Registry staff are conducting outreach to the remaining unconsented young adults.

SCIENTIFIC OUTPUTS

From 2004 through 2020, the WTC Health Registry had a total of 592 scientific outputs (publications, presentations, published guidelines, etc.). The distribution of outputs by type is presented in Figure 12.

A listing of the WTC Health Registry key accomplishments and a bibliography of Registry publications is available in the

[Summary of WTC Health Program Research: NIOSH Research Compendium](#). For summaries of the Registry's annual reports, peer-reviewed scientific publications, registry bibliography list, technical reports, and clinical guidelines, please visit [WTC Scientific Bibliography](#). The listing on this site will be updated periodically by the Registry staff. For Registry highlights and other 9/11 health information, please visit [NYC: 9/11 Health](#).



*Number of registry outputs for 2004-2020; publications resulting from registry-facilitated recruitment into external research studies or registry provided de-identified data.

Figure 12. WTC Health Registry key scientific outputs including publications* and presentations, 2004-2020

APPENDIX

FY 2020 NIOSH Funding Opportunity Announcements by Mechanism

Funding Opportunity	Mechanism	Title
Investigator-initiated Research		
PAR-13-245 PAR-18-799	K01	Mentored Research Scientist Development Award
PAR-13-129 PAR-18-812	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 PAR-18-798	R21	NIOSH Exploratory/Developmental Grant Program
PAR-14-229	U13	NIOSH Support for Conferences and Scientific Meetings
NSF-20-522	Interagency Agreement	National Robotics Initiative 2.0
Training Programs and Centers		
PAR-15-352	T03	Occupational Safety and Health Training Project Grants
RFA-OH-20-003	T03	Commercial Fishing Occupational Safety Training Project Grants
PAR-15-303	T42	Occupational Safety and Health Education and Research Centers
Cooperative Agreements		
RFA-OH-20-002	U01	Commercial Fishing Occupational Safety Research Cooperative Agreement
PAR-16-098	U01	Cooperative Research Agreements Related to the World Trade Center Health Programs
RFA-OH-16-001	U50	Extension of the World Trade Center Health Registry
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
RFA-OH-19-002	U24	Occupational Safety and Health Surveillance Collaboration, Education, and Translation
PAR-15-353	U54	Centers for Agricultural Safety and Health

Funding Opportunity	Mechanism	Title
RFA-OH-20-007	U54	National Center of Excellence for the Prevention of Childhood Agricultural Injury
PAR-14-275	U60	State Occupational Health and Safety Surveillance Program
RFA-OH-19-001	U60	National Center for Construction Safety and Health Research and Translation
RFA-OH-20-001	U60	Miner Safety and Health Training Program—Western United States
Cosponsored Research With the National Institutes of Health		
PA-19-272	R43, R44	PHS 2019-02 Omnibus Solicitation of the NIH, CDC, and FDA for Small Business Innovation Research Grant Applications



Promoting productive workplaces through safety and health research

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