

A. COVER PAGE

Project Title: Longitudinally-assessed health impacts of wildland firefighting	
Grant Number: 5R21OH011385-02	Project/Grant Period: 09/01/2018 - 08/31/2020
Reporting Period: 09/01/2019 - 08/31/2020	Requested Budget Period: 09/01/2019 - 08/31/2020
Report Term Frequency: Annual	Date Submitted: 11/24/2021
Program Director/Principal Investigator Information: ERIN OBRIEN SEMMENS , AB MPH PHD Phone Number: 406-243-4446 Email: Erin.Semmens@umontana.edu	Recipient Organization: UNIVERSITY OF MONTANA OFFICE OF SPONSORED PROGRAMS 32 CAMPUS DRIVE, 4104 MISSOULA, MT 598124104 DUNS: 010379790 EIN: 1816001713A1 RECIPIENT ID:
Change of Contact PD/PI: No	
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Human Subjects: NA	Vertebrate Animals: NA
hESC: No	Inventions/Patents: No

B. ACCOMPLISHMENTS

B.1 WHAT ARE THE MAJOR GOALS OF THE PROJECT?

1. Investigate cross-sectional relationships between occupational exposure to wildland firefighting and markers of cardiovascular and respiratory health and hearing assessed in DOI MSP medical screening examinations between 2014 and 2016. Specifically, we will evaluate the impact of accumulated days on wildland fires, years in arduous duty wildland firefighting, and specific wildland firefighting tasks on: a) Electrocardiogram (ECG) findings: overall normal/abnormal, QT interval prolongation, and QRS widening; b) Blood pressure: systolic, diastolic, pulse, mean arterial pressure, and hypertension; c) Pulmonary function: forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), and the FEV1 / FVC ratio; and d) hearing impairment: World Health Organization criteria.
2. Evaluate longitudinal impacts of wildland firefighting prior to the first available examination and between examinations on the markers of cardiovascular and respiratory health and hearing described in Aim 1. Collection of repeated measures of WFF health will be achieved through reconstruction of past DOI MSP medical screening history including examinations occurring between 2004-2011 and 2014-2016.

B.1.a Have the major goals changed since the initial competing award or previous report?

No

B.2 WHAT WAS ACCOMPLISHED UNDER THESE GOALS?

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B.3 COMPETITIVE REVISIONS/ADMINISTRATIVE SUPPLEMENTS

For this reporting period, is there one or more Revision/Supplement associated with this award for which reporting is required?

No

B.4 WHAT OPPORTUNITIES FOR TRAINING AND PROFESSIONAL DEVELOPMENT HAS THE PROJECT PROVIDED?

File Uploaded : Final RPPR B.4 TrainingR21OH011385.pdf

B.5 HOW HAVE THE RESULTS BEEN DISSEMINATED TO COMMUNITIES OF INTEREST?

We have met approximately quarterly with our partner at the Department of the Interior Medical Standards Program. In addition, we have presented twice to journalists attending the annual workshop hosted by the Institute for Journalism and Natural Resources. Of note, our work was featured on a National Public Radio story on health impacts of wildland firefighting. (<https://www.npr.org/2019/06/12/731435003/more-wildfires-bring-focus-on-how-all-that-smoke-may-harm-firefighters>)

B.6 WHAT DO YOU PLAN TO DO DURING THE NEXT REPORTING PERIOD TO ACCOMPLISH THE GOALS?

Not Applicable

B.2 WHAT WAS ACCOMPLISHED UNDER THESE GOALS?

We were able to accomplish several major activities during the reporting period, including:

- New team members completed IMT, FISSA and Rules of Behavior training on handling of sensitive Department of the Interior Medical Standards Program (DOI MSP) data.
- We obtained medical screening information from DOI MSP 2014-2017 examinations. We have cleaned the dataset and developed a data dictionary for use in future research on repeated measures of wildland firefighter health. Analyses of long-term health are in progress and being led by doctoral student, Md Zahid Hasan.
- We obtained, cleaned, and developed a data dictionary for wildland firefighting occupational history (i.e., Incident Qualification and Certification System, IQCS) data. We have merged IQCS data with DOI MSP medical screening data. We were able to link only 41% of wildland firefighters who had a medical screening exam to an IQCS record, pointing to the need to utilize alternative methods for exposure assessment. To that end, we are partnering with NIOSH and U.S. Forest Service researchers to develop a job-exposure matrix aimed at estimating smoke exposures based on firefighter reported task.
- We have characterized wildland firefighter health on numerous health measures and presented a poster, “Linkage of occupational history records and medical screening examinations as a tool for assessing the long-term health impacts of wildland firefighting,” at the 32nd Annual Conference of the International Society for Environmental Epidemiology in August of 2020. In the presentation, we reported that:
 - Over half of wildland firefighters may have hypertension compared to 45% of U.S. adults (American College of Cardiology and American Heart Association Clinical Practice Guidelines applied to the 2013-2016 National Health and Nutrition Examination Survey (NHANES)), indicating further research targeting cardiovascular health in wildland firefighters is needed.
 - Mental health conditions appear low in wildland firefighters relative to adults in the U.S. (National Health Interview Survey, 2010-2011). This may be an underestimate as wildland firefighters may be hesitant to report mental health conditions in an exam conducted to determine fitness for arduous duty wildland firefighting.
- We also presented “Assessing the long-term health in wildland firefighters” in an oral session at the Rocky Mountain Regional Wildfire Smoke Symposium in November of 2020.
- Our team has developed a REDCap database for historical DOI MSP data from 2004-2011 screening exams. This was a major effort that required harmonization of numerous versions of the screening exams that occurred during this time period. Although efforts were delayed due to the pandemic, we have now completed data entry for selected wildland firefighters who had at least one exam between 2004-2011 and another between 2014-2017.
- We published a comment on “Heat-related illness among wildland firefighters” in *Occupational and Environmental Medicine* in 2020.
- We published the manuscript, “Carbon monoxide exposures in wildland firefighters in the United States and targets for exposure reduction,” in the *Journal of Exposure Science & Environmental Epidemiology* in 2021.

B.4 WHAT OPPORTUNITIES FOR TRAINING AND PROFESSIONAL DEVELOPMENT HAS THE PROJECT PROVIDED?

Md Zahid Hasan is a third year doctoral student in the School of Public and Community Health Sciences at the University of Montana. He has led analyses summarizing occupational history information obtained from the Incident Qualifications and Certifications System. He is also leading the following analyses:

- comparing wildland firefighters to the general population on cardiovascular risk
- assessing the impact of occupational experience as a wildland firefighter and cardiovascular risk.

He meets with the study PIs weekly on this project, which will be a major component of his dissertation. He also participated in the Rocky Mountain Regional Wildfire Smoke Symposium 2021, co-organized by MPI Noonan.

C. PRODUCTS

C.1 PUBLICATIONS

Are there publications or manuscripts accepted for publication in a journal or other publication (e.g., book, one-time publication, monograph) during the reporting period resulting directly from this award?

Yes

Publications Reported for this Reporting Period

Public Access Compliance	Citation
N/A: Not NIH Funded	Noonan CW, Semmens EO. Heat-related illness among wildland firefighters. Occupational and environmental medicine. 2020 July;77(7):431-432. PubMed PMID: 32295820; PubMed Central PMCID: PMC7679056; DOI: 10.1136/oemed-2019-106391.
N/A: Not NIH Funded	Noonan CW, Semmens EO. Heat-related illness among wildland firefighters. Occupational and environmental medicine. 2020 July;77(7):431-432. PubMed PMID: 32295820; PubMed Central PMCID: PMC7679056; DOI: 10.1136/oemed-2019-106391.
N/A: Not NIH Funded	Semmens EO, Leary CS, West MR, Noonan CW, Navarro KM, Domitrovich JW. Carbon monoxide exposures in wildland firefighters in the United States and targets for exposure reduction. Journal of exposure science & environmental epidemiology. 2021 September;31(5):923-929. PubMed PMID: 34285366; PubMed Central PMCID: PMC8448930; DOI: 10.1038/s41370-021-00371-z.
N/A: Not NIH Funded	Semmens EO, Leary CS, West MR, Noonan CW, Navarro KM, Domitrovich JW. Carbon monoxide exposures in wildland firefighters in the United States and targets for exposure reduction. Journal of exposure science & environmental epidemiology. 2021 September;31(5):923-929. PubMed PMID: 34285366; PubMed Central PMCID: PMC8448930; DOI: 10.1038/s41370-021-00371-z.

C.2 WEBSITE(S) OR OTHER INTERNET SITE(S)

NOTHING TO REPORT

C.3 TECHNOLOGIES OR TECHNIQUES

NOTHING TO REPORT

C.4 INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES

Have inventions, patent applications and/or licenses resulted from the award during the reporting period? No

If yes, has this information been previously provided to the PHS or to the official responsible for patent matters at the grantee organization?

C.5 OTHER PRODUCTS AND RESOURCE SHARING

NOTHING TO REPORT

D. PARTICIPANTS

D.1 WHAT INDIVIDUALS HAVE WORKED ON THE PROJECT?

Commons ID	S/K	Name	Degree(s)	Role	Cal	Aca	Sum	Foreign Org	Country	SS
O'BRIENE	Y	Semmens, Erin O'Brien	AB,MPH,PHD	PD/PI	1.0	0.0	0.0			NA
CNOONAN	Y	Noonan, Curtis William	BA,MA,PHD	PD/PI	1.0	0.0	0.0			NA
KATHERINECONWAY	N	Conway, Kathrene	BS	Database Support	2.0	0.0	0.0			NA
CLEARY	N	Leary, Cindy	BA, MA	Statistician	5.0	0.0	0.0			NA

Glossary of acronyms:

S/K - Senior/Key

DOB - Date of Birth

Cal - Person Months (Calendar)

Aca - Person Months (Academic)

Sum - Person Months (Summer)

Foreign Org - Foreign Organization Affiliation

SS - Supplement Support

RE - Reentry Supplement

DI - Diversity Supplement

OT - Other

NA - Not Applicable

D.2 PERSONNEL UPDATES

D.2.a Level of Effort

Not Applicable

D.2.b New Senior/Key Personnel

Not Applicable

D.2.c Changes in Other Support

Not Applicable

D.2.d New Other Significant Contributors

Not Applicable

D.2.e Multi-PI (MPI) Leadership Plan

Not Applicable

E. IMPACT**E.1 WHAT IS THE IMPACT ON THE DEVELOPMENT OF HUMAN RESOURCES?**

Not Applicable

E.2 WHAT IS THE IMPACT ON PHYSICAL, INSTITUTIONAL, OR INFORMATION RESOURCES THAT FORM INFRASTRUCTURE?

NOTHING TO REPORT

E.3 WHAT IS THE IMPACT ON TECHNOLOGY TRANSFER?

Not Applicable

E.4 WHAT DOLLAR AMOUNT OF THE AWARD'S BUDGET IS BEING SPENT IN FOREIGN COUNTRY(IES)?

NOTHING TO REPORT

G. SPECIAL REPORTING REQUIREMENTS SPECIAL REPORTING REQUIREMENTS

G.1 SPECIAL NOTICE OF AWARD TERMS AND FUNDING OPPORTUNITIES ANNOUNCEMENT REPORTING REQUIREMENTS

NOTHING TO REPORT

G.2 RESPONSIBLE CONDUCT OF RESEARCH

Not Applicable

G.3 MENTOR'S REPORT OR SPONSOR COMMENTS

Not Applicable

G.4 HUMAN SUBJECTS

G.4.a Does the project involve human subjects?

Not Applicable

G.4.b Inclusion Enrollment Data

File(s) uploaded:
CumulativeInclusionEnrollmentReport.pdf

G.4.c ClinicalTrials.gov

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

G.5 HUMAN SUBJECTS EDUCATION REQUIREMENT

NOT APPLICABLE

G.6 HUMAN EMBRYONIC STEM CELLS (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 VERTEBRATE ANIMALS

Not Applicable

G.8 PROJECT/PERFORMANCE SITES

Not Applicable

G.9 FOREIGN COMPONENT No foreign component
G.10 ESTIMATED UNOBLIGATED BALANCE Not Applicable
G.11 PROGRAM INCOME Not Applicable
G.12 F&A COSTS Not Applicable

Cumulative Inclusion Enrollment Report

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

Study Title:

Comments:

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/Not Reported	Female	Male	Unknown/Not Reported	Female	Male	Unknown/Not Reported	
American Indian/Alaska Native										
Asian										
Native Hawaiian or Other Pacific Islander										
Black or African American										
White										
More Than One Race										
Unknown or Not Reported										
Total										

I. OUTCOMES

I.1 What were the outcomes of the award?

- The primary outcome of this work is a data-informed framework for longitudinal analyses of wildland firefighter health. Although some of this work was delayed due to the pandemic, the award has facilitated the development of a database of repeated measures of wildland firefighter health.
- We have an established partnership with DOI MSP for future work in wildland firefighters. Specifically, we aim to build on our retrospective study of the long-term impacts of wildland firefighting to prospectively evaluate wildland firefighter health. This will allow us to obtain more detailed information on occupational history as well as more robust indicators of health including mental health.
- We now have a team of researchers in the School of Public and Community Health Sciences at the University of Montana who are trained in occupational epidemiology studies and the data management and interpretation issues specific to this field.