Cancer in the Fire Service: What We Know and Where to Go from Here

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Co-Lead of the Fire Fighter Cancer Cohort Study
IARC MONOGRAPHS VOL. 132: OCCUPATIONAL EXPOSURE AS A FIREFIGHTER

Occupational exposure as a firefighter is carcinogenic to humans (Group 1) on the basis of sufficient evidence for cancer in humans.

The IARC Monographs classification indicates the level of certainty that an agent can cause cancer (hazard identification).

Higher level of certainty

- Cancer types with sufficient evidence for cancer in humans:
  - Mesothelioma
  - Bladder cancer

Lower level of certainty

- Cancer types with limited evidence for cancer in humans:
  - Colon cancer
  - Prostate cancer
  - Testicular cancer
  - Melanoma of the skin
  - Non-Hodgkin lymphoma

Strong mechanistic evidence in exposed firefighters:

- Genotoxicity
- Epigenetic alterations
- Oxidative stress
- Chronic inflammation
- Modulation of receptor-mediated effects

Exposures of firefighters include combustion products, diesel exhaust, building materials, asbestos, chemicals, shift work, ultraviolet radiation.

Firefighters respond to various types of fire:

- Structure
- Wildland
- Vehicle
Ongoing Needs after IARC to Understand and Prevent Firefighter Cancer

- Most evidence was based on structural or municipal firefighters
- **Unique risks** of firefighters responding to certain fire types (i.e., wildland and wildland-urban interface fires) not well understood
- Could not evaluate unique risks for firefighters **underrepresented** in most studies (women, non-white racial backgrounds, volunteers)
- **Mechanisms** of carcinogenicity observed in firefighters (epigenetics, genotoxicity, etc.) can develop well before disease. Can we reverse or prevent these?
- What **interventions or screening tools** can be developed to protect firefighters at risk?
Mission
To conduct community-engaged research with the fire service to advance firefighter cancer control and prevention, as well as evaluation and prevention of other health conditions.

TARGET GOAL
10,000 firefighters enrolled and followed over 30 years.

FIRE SERVICE PARTNERSHIP
Fire Service Oversight and Planning Board and firefighter research champions in each research project.

BIOLOGICAL SAMPLES
Collect blood, urine, and other biological samples at enrollment, every two years, and as needed after exposures. Report back results to firefighters.

EXPOSURE DATA
Collect exposure data from firefighters at the fireground, during training activities, and at other locations.

DATA INTEGRATION
Integrate exposure, biological and health survey data through a centralized data center. Data protected by a Certificate of Confidentiality.
>5,000 total participants
>100 departments
29 states

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Research centers

Participating states

FFCCS Enrollment (as of March 2024)
**FFCCS: Research Concepts**

**Prevention**

Exposures → Reduction

Treatment → Biomarkers of effect → Cancer & other outcomes

**Early detection**

Early detection of effects

Epigenetic biomarkers

Ovarian reserve (AMH)

- Blood/plasma donation
- Broccoli extract

**Exposure Reduction**

- Improved respirator use
- Dermal decontamination

**Broccoli Seed & Sprout Extract**
FFCCS: Contact Information

Contact:
Jackie Goodrich, PhD
gaydojac@umich.edu

Website: ffccs.org

Director:
Jeff Burgess, MD, MS, MPH
jburgess@arizona.edu

Mental Health Among Firefighters

Sara Jahnke, Ph.D.
Center for Fire, Rescue & EMS Health Research
NDRI-USA, Inc.
Science to the Station
Stresses of the Job

- Acute Exposures
- Chronic Repeated Exposure to Trauma
- Injury & Disability
- Home/Life Stressors
- Circadian Rhythm Disruption
- Substance Use/Misuse
- Epigenetic Changes
- Cancer & CVD
Outcomes

- **Depression**
  - 12-27% in the range of concern in fire service samples
  - Typically <10% in general population

- **PTSD**
  - Wide range but as high as 13-22%
  - 3.5% in general population
Shifts in Understanding Mental Health: Heart Attack to Hypertension
Shifts in Understanding Mental Health: Challenges to Existing Paradigm

- Different incidents effect people differently
- Intervention is not the same for all
- Impact not always immediate
- Sometimes, it’s more harmful than helpful
Shifts in Understanding Mental Health: What We Know Now

- Long-term problem, long-term solution
- Shift in lifestyle/culture
- Awareness
- Monitor symptoms
- Treat as appropriate
- Appropriate level of intervention
• Camaraderie
• Dark humor
• Social support
• Debriefing
• Family support
• Sharing experiences
• Fire service identity
TODAY’S FIRE SERVICE

Our Health
Impacts of discrimination & harassment on women’s mental health

Increased Discrimination & Harassment = Worse Health

Frequency and Severity of Discrimination/Harassment
- Never
- Moderate
- Often

Source: 2022 ALTS & Human Relations Conference, Women in the Fire Service
Dr. S. Jahnke, Dr. B. Hollerbach, Dr. M. Koeppel
At the end of the day...

The Magic is Us.

It's the best job in the world.
Firefighters Do Strenuous Work, In Dangerous Environments, While Wearing Heavy PPE
Cardiovascular Strain of Firefighting

Cardiac
- Heart rate
- Cardiac work

Vascular
- Arterial stiffness
- Blood flow

Blood/Coagulatory
- Plasma volume
- Clotting potential
- Electrolyte changes

RECOVER
CVD Risks/Burden

Deaths

CVD

Acute Events

CVD – Interventions

CVD – Disability, Retirement

Needlessly Shortened Retirement
Research Framework

Cardiovascular Strain of Firefighting

- Cardiac Stress
- Vascular Changes
- Blood Thickens

Coronary HD
- Plaque Rupture and Thrombus Formation
- Arrhythmia

Hypertensive HD

Sudden Cardiac Event

Recovery

Smith et al., 2013

Extreme Physiology & Medicine
### Who is at Risk of Cardiac Death?

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<th>Risk Factor</th>
<th>On-duty CHD Fatalities</th>
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<td>Age ≥ 45 years old</td>
<td>18.0</td>
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<tr>
<td>Current Smoking</td>
<td>8.6</td>
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<tr>
<td>Hypertension</td>
<td>12.0</td>
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<tr>
<td>Obesity, BMI ≥ 30 kg·m⁻²</td>
<td>3.1</td>
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<tr>
<td>Cholesterol ≥ 5.18 mmol·L⁻¹</td>
<td>4.4</td>
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<td>Diabetes mellitus</td>
<td>10.2</td>
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<tr>
<td>Prior diagnosis of CHD</td>
<td>35.0</td>
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Source: Soteraides et al., Cardiovascular Disease in US Firefighters, Cardiology in Review, 2011.
Strategies to Improve CV Health & Safety

• Medical Evaluations – detect underlying cardiovascular conditions to aid in prevention and treatment
• Aggressively address risk factors
• Improve Fitness – cardiorespiratory fitness increases work capacity, decreases cardiovascular and cancer risk
• Targeted Research
Cardiovascular Risks Associated with Firefighting

Denise L. Smith
United States Fire Administration
Director, National Fire Data Center and Research Division
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Recruitment and Retention

Jennifer A. Taylor, PhD, MPH, CPPS
Director
Center for Firefighter Injury Research and Safety Trends (FIRST)
What does your current organizational culture look like?
2021 National Fire Service Research Agenda

Recommendations Report

January 2022
What does that culture look like in the future?
Who does that culture include (DEI)?
How do you engage those groups (recruitment)?
How do you keep those groups engaged (retention)?
How do you measure your progress?
What Data Do you Have?

Define the Problem with Data

Identify Change Levers

Develop and test Strategies

Measure Progress with Data and Share
Recruitment and Retention

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