Firefighter Cancer Initiative: Project Overview and Update

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“Cancer is the No. 1 health concern in the firefighting profession today”
Harold A. Schaitberger, General President, International Association of Fire Fighters
Occupational exposure as a firefighter is “possibly carcinogenic to humans”

Large variations in exposure across different types of fires and different groups of firefighters. RR’s consistently increased for:

• testicular
• prostate
• non-Hodgkin lymphoma
Relevant Epidemiologic Studies

- LeMasters, JOEM, 2006
  - Combined data in 32 studies of fire fighters for 20 different cancer types
    - Cancers probably elevated in firefighters are:
      - Multiple myeloma
      - Non-Hodgkin’s lymphoma
      - Prostate cancer
      - Testicular cancer
## Cancers Related to Firefighting

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>IARC Report</th>
<th>LeMasters Meta-Analysis</th>
<th>≥2 Recent Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testicular</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Prostate</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Multiple Myeloma</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Colon/Rectum</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Brain</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Lung</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Melanoma</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Kidney</td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Esophageal</td>
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</table>
Previous Florida Linkage

Cancer Incidence in Florida Professional Firefighters, 1981 to 1999

Fangchao Ma, MD, PhD
Lora E. Fleming, MD, PhD
David J. Lee, PhD
Edward Trapido, ScD
Terence A. Gerace, PhD

Objective: The objective of this study was to examine the cancer risk associated with firefighting. Methods: Standardized incidence ratio analysis (SIR) was used to determine the relative cancer risk for firefighters as compared with the Florida general population. Results: Among 34,796 male (413,022 person-years) and 2,017 female (18,843 person-years) firefighters, 970 male and 52 female cases of cancer were identified. Male firefighters had significantly increased incidence rates of bladder (SIR = 1.29; 95% confidence interval = 1.01–1.62), testicular (1.60; 1.20–2.09), and thyroid cancers (1.77; 1.08–2.73). Female firefighters had significantly increased incidence rates of overall cancer (1.63; 1.22–2.14), cervical (5.24; 2.93–8.65), and thyroid cancer (3.97; 1.45–8.65) and Hodgkin disease (6.25; 1.26–18.26). Conclusions: Firefighting may be associated with an increased risk of selected site-specific cancers in males and females, including an overall increased cancer risk in female firefighters. (J Occup Environ Med. 2006;48:883–888)
Male Firefighters were at increased risk of:
  • Bladder
  • Thyroid
  • Testicular

Female Firefighters were at increased risk of:
  • Thyroid
  • Cervical
  • Hodgkin’s Lymphoma
Sylvester Comprehensive Cancer Center

Part of UHealth – the University of Miami Health System and the University of Miami Miller School of Medicine

• More than 120 cancer researchers and 130 cancer specialists
• A member of the elite Alliance of Dedicated Cancer Centers
• South Florida’s only Cancer Center of Excellence
Firefighter Cancer Initiative

UM to study why so many PB firefighters get cancer
By age 60, twice as many firefighters die from cancer as heart attack.
SUN-SENTINEL.COM | BY SOUTH FLORIDA SUN-SENTINEL

Orange County Fire
In 2014, Orange County Fire Rescue had the highest cancer death rate.
ORLANDO.COM

Palm Beach County Fire
Palm Beach County Fire Rescue has the highest cancer death rate.
WPBF.COM | BY STEPHANIE BERNSI

UM Sylvester Cancer Center Teams Up With Firefighters To Study ‘Silent Killer’
Miami-Dade Fire Rescue and the UM Sylvester Comprehensive Cancer Center are joining... MAMI.COM | BY CBS MIAMI

Participate in Cancer Risk Study
Three years after losing a 24-year-old firefighter to cancer, Orange County Fire Rescue members are prepared to take part in a cancer risk study.
FIREFHOUSE.COM

Researchers study cancer in local firefighters
Battling fires is one thing - battling cancer however is a different story.
WPTV.COM | BY JASON HACKETT WPTV

Broward Firefighters Take Part In Cancer Research Study
Broward Sheriff Fire Rescue is one of several fire rescue departments in South Florida included in the U.M. Sylvester Comprehensive Cancer Center study investigating the higher-than-normal cancer rates among firefighters.
INHEART.COM
Firefighters and Cancer Risk

- Sylvester Comprehensive Cancer Center & University of Miami state legislative priority
- State Representative Jeanette Nuñez, District 119
  - Chair, Government Operations Appropriations Subcommittee

2015-2016: $965,000
- Miami Dade Fire Rescue
- Palm Beach County Fire Rescue
- City of Miami Fire Rescue
- Broward County Fire Rescue
- 31 municipal fire departments in South Florida

2016-2017: $1.5 million
- Expansion to Martin, Orange, Hillsborough, and Pasco Counties

2017-2018: $1 million
- Expansion to all fire departments in state of Florida (volunteer and career)
<table>
<thead>
<tr>
<th>Year One</th>
<th>Year Two</th>
<th>Year Three</th>
</tr>
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<tbody>
<tr>
<td>2. Exposure App Development</td>
<td>10. PBDE &amp; Thyroid Function</td>
<td>14. Train the Trainer</td>
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<tr>
<td>3. Exposure App User Experience</td>
<td></td>
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<tr>
<td>5. Environmental Sampling Program</td>
<td>12. Tumor Bank</td>
<td></td>
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<td>6. FCDS Linkage</td>
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<td>7. Annual Cancer Survey and</td>
<td></td>
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<tr>
<td>Biobanking</td>
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<tr>
<td>8. Cancer Screening/Testing</td>
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Prevention

Cancer Screening

Guardrails

AERIAL

Personal Exposure Reporting Application

Create a Report

Incident Information

Incident Number: 

Incident Type: Fire

Incident Date: mm/dd/yyyy

Alarm Time: 

Incident Zip Code: 

Were you asleep at alarm time? 

How long were you at the incident? 

Unit Number: 
Annual Cancer Survey

**Purpose:** Understand cancer risks specific to Florida Firefighters
Create a database of the risks and behaviors of all Florida Firefighters

- **Comprehensive Baseline Questionnaire:**
  - Medical History
  - Cancer History
  - Cancer Risk Behaviors
  - Cancer Screening Behaviors
  - Occupational History
  - Environmental Exposures

- All Florida firefighters are invited to participate
Annual Cancer Survey

- 3,152 completed surveys
- 504 completed Year 2 follow-up surveys
- Mean age = 40.4 years (±9.1 years)
- 90.0% male
- 39.4% were Hispanic
- Average tenure = 14 years (±8.6) as a firefighter
Annual Cancer Survey Findings

- Elevated prevalence of melanoma (0.7%) compared to the Florida adult melanoma prevalence (0.011%)
- Younger age of diagnosis (42 years) compared to general US population (64 years)
Sun-protective practices among a non-probabilistic sample of Florida firefighters by history of skin cancer type

Annual Cancer Survey Link

To complete the Annual Cancer Survey visit:

www.tinyURL.com/ACSfirefighter
AERIAL Survey and Retiree Focus Groups

- 162 completed surveys
- Mean age = 60 years
- 90.7% male
- Average tenure = 30 years as a firefighter

- Focus groups themes:
  - Occupational exposures
  - Cancer as an inevitable outcome
  - Challenges of cross contamination
  - Improvements in policy surveillance for increased protection
To complete the AERIAL Survey visit:

www.tinyURL.com/AERIALfirefighters
Colorectal Cancer Screening Project

• Recruitment of South Florida firefighters through workplace email and promotion during station visits.

• Screened for eligibility through the Annual Cancer Survey
  - Active firefighter
  - 40-65 years old
  - Not up to date with CRC screening.

• Firefighters were mailed a FIT kit and screening results were reported via phone.

• Firefighters who screened positive were referred for colonoscopy at a tertiary care center.
Colorectal Cancer Screening

Firefighters Screened (n=1611)

Ineligible (n = 1086)
- Age <40 or >65 (n=635)
- FIT in the last year (n=154)
- Colonoscopy in last 10 years (n=132)
- Other (n=165)

Eligible* (n=525)
- Kit sent (n=496)
- Kits returned (n=310)
- FIT Positive (n=6)
Detection, Diagnosis, and Treatment
Tumor Bank

**Purpose:** Develop and implement a novel firefighter-focused tumor bank to characterize and examine the microenvironment of tumor morphology and work-related exposures specific to firefighters.

1. **Firefighter Diagnosed with Cancer**
   - **Contacts Tumor Bank Team:**
     - Research Coordinator
     - Email/Phone
     - Florida Firefighters Cancer Support Network
     - Recruitment Events
   - **Screened for Eligibility by Results**
   - **Obtain Consent and Health Authorization Release Form via REDCap**
   - **Administer Tumor Bank Survey**
   - **Research Team Requests Sample from Corresponding Pathology Lab**
   - **Research Team Receives Sample**
   - **Send Tumor Sample to Biospecimen Core Facility**
Prevalence of Identified Tumor Samples Among Participating South Florida Firefighters (n=35+)

- Bone: 1
- Breast: 1
- Esophagus: 2
- Leukemia: 2
- Lymphoma: 1
- Prostate: 4
- Skin (unsure): 3
- Thyroid: 3
Personal Reported Incident Types

Year - 2017

**Showing:**
- Personal
- Year - 2017

### Fire Incident Types

- **40 Incidents**
- **37 Incidents**
- **11 Incidents**
- **2 Incidents**

### Top 3 Symptoms for Fire Incidents

<table>
<thead>
<tr>
<th>Rank</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Skin Irritation / Rash</td>
</tr>
<tr>
<td>2</td>
<td>Skin Burn</td>
</tr>
<tr>
<td>3</td>
<td>Muscle Cramps</td>
</tr>
</tbody>
</table>
Personal Exposure Reporter Application

Department Onboarding:

- Contact FCI with request to get your department started.
  - Email: firefighterstudy@miami.edu

- Complete FCI form with information required:
  - Department logo
  - Incident number format
  - Station list
  - Headquarter address

- Once confirmation of onboarding is received, start using the app!
  - Tutorial available at www.sylvester.org/firefighters
  - App website: http://per.miami.edu
Train the Trainer

- Goal: Provide firefighters the knowledge and tools necessary to implement cancer risk reduction training and practices at their departments and stations.

- Partnering with the Michael S. Gordon Center for Research in Medical Education

- Incorporates:
  - Focus group feedback
  - Research findings
  - Tools developed by FCI investigators and local firefighters
  - Hands on demonstration of decontamination procedures

- Pilot to be completed May 2018
Health Communication and Education Campaign
Organizational-Level Factors that Influence Cancer Screening Activities within the Fire Service

<table>
<thead>
<tr>
<th>Policies, programs, and practices</th>
<th>All Fire Departments N (%) †</th>
<th>Cancer Screening Available N (%) †</th>
<th>Cancer Screening not-available N (%) †</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSH Program present</td>
<td>106 (86.9)</td>
<td>52 (92.9)</td>
<td>54 (81.8)</td>
<td>0.052</td>
</tr>
<tr>
<td>OSH Program updated regularly</td>
<td>68 (60.2)</td>
<td>38 (74.5)</td>
<td>30 (48.4)</td>
<td>0.005</td>
</tr>
<tr>
<td>Written OSH Program Policy Statement</td>
<td>80 (73.4)</td>
<td>39 (81.3)</td>
<td>41 (67.2)</td>
<td>0.049</td>
</tr>
<tr>
<td>Management sets safety goals at worksite</td>
<td>66 (56.9)</td>
<td>30 (56.6)</td>
<td>36 (57.1)</td>
<td>0.953</td>
</tr>
<tr>
<td>Managers held accountable for OSH</td>
<td>78 (70.3)</td>
<td>39 (76.5)</td>
<td>39 (65.0)</td>
<td>0.188</td>
</tr>
<tr>
<td>Employees can report safety hazards/problems</td>
<td>117 (95.9)</td>
<td>53 (96.4)</td>
<td>64 (95.5)</td>
<td>0.816</td>
</tr>
<tr>
<td>Feedback to employees reporting hazards/problems</td>
<td>77 (75.5)</td>
<td>37 (82.2)</td>
<td>40 (70.2)</td>
<td>0.160</td>
</tr>
<tr>
<td>Supervisors/Managers provided OSH training</td>
<td>45 (42.5)</td>
<td>22 (43.1)</td>
<td>23 (41.8)</td>
<td>0.891</td>
</tr>
</tbody>
</table>

† Differences in sub-total population sample due to item non-response or missing.
## EPIGENETICS CASE-CONTROL STUDY

*High / Low Florida Firefighter Exposures*

<table>
<thead>
<tr>
<th>Probe ID</th>
<th>Chr #</th>
<th>Estimate</th>
<th>p-value</th>
<th>Gene Name &amp; Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>cg08412885</td>
<td>6p21.33</td>
<td>0.347</td>
<td>0.017</td>
<td><strong>LY6G5C:</strong> Tumor suppression and inflammatory response</td>
</tr>
<tr>
<td>cg27435646</td>
<td>7q21.3</td>
<td>0.105</td>
<td>0.005</td>
<td><strong>PEG10:</strong> Overexpression associated with hepatocellular carcinoma and B-cell lymphocytic leukemia</td>
</tr>
<tr>
<td>cg16184495</td>
<td>19p13.12</td>
<td>0.197</td>
<td>0.000</td>
<td><strong>EPHX3:</strong> Protein coding gene for hydrolase activity. Associated with prostate cancer</td>
</tr>
<tr>
<td>cg22705386</td>
<td>7q32.2</td>
<td>0.191</td>
<td>0.047</td>
<td><strong>MEST:</strong> Encodes alpha/beta hydrolase superfamily. Associated with the following cancers Kidney, Uterine, Breast, Lung Wilms Tumor, Cervical cancer and Eewing’s sarcoma</td>
</tr>
<tr>
<td>cg06212135</td>
<td>7q32.2</td>
<td>0.163</td>
<td>0.013</td>
<td><strong>MESTIT1:</strong> Encodes for antisense RNA. Associated with lung adenocarcinomas, colon cancer, and breast cancer</td>
</tr>
<tr>
<td>cg24089209</td>
<td>14q32.2</td>
<td>0.782</td>
<td>0.059</td>
<td><strong>MEG3:</strong> Inhibits tumor cell proliferation</td>
</tr>
<tr>
<td>cg00964321</td>
<td>16p13.11</td>
<td>0.122</td>
<td>0.047</td>
<td><strong>PDXDC1:</strong> Gene for pyridoxal phosphate binding and carboxy-lyase activity. Associated with colorectal cancer cells.</td>
</tr>
</tbody>
</table>

†Estimates of controls (n=37 low exposure) compared to cases (n=39 high exposures), adjusted for age, ethnicity, smoking status cancer status and cell type.
PAH Detection from Wristbands

**Heat Map of PAH quantity**

PAH Detection in Fire Stations in South Florida

- **Napthalene**
- **1-methylnapthalene**
- **2-methylnapthalene**
- **Acenaphthylene**
- **Acenaphene**
- **Fluorene**
- **Anthracene**
- **Phenantherene**
- **Pyrene**
- **Fluoranthene**
- **Chryseene**
- **Benzo(a)anthracene**
- **Benzo(a)pyrene**
- **Benzo(k)fluoranthene**
- **Benzo(b)fluoranthene**
- **Benzo(g,h,i)perylene**
- **Indeno(1,2,3-cd)pyrene**
- **Dibenz(a,h)anthracene**

**OSHA guidelines**

<table>
<thead>
<tr>
<th>Permissible exposure limit (PEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAHs 35.4 ppb</td>
</tr>
<tr>
<td>PAHs in water 0.2 ppb (EPA)</td>
</tr>
</tbody>
</table>

**STOP**

Chemicals identified in samples can pose a health threat and were found at levels much higher than OSHA permitted levels of exposure.

PAH Quantity detected using treated silicone wristbands placed throughout a fire station for 24hrs. For comparison, the maximum EPA permitted level of PAHs in drinking water is 0.2 ppb; these samples exceed this limit 40-fold or more.
Survivorship: Partnering for a Healthier Future
Thank You

Questions?

For any additional questions:
firefighterstudy@med.miami.edu