Cancer Risk Among Florida Firefighters

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Firefighter Cancer Initiative (FCI) Goals

- To monitor, understand and address the excess burden of cancer among firefighters
- 13 interlocking projects designed to move innovative research from “bench” to “trench”
Large variations in exposure across different types of fires and different groups of firefighters. RR’s consistently increased for:

- Non-Hodgkin’s lymphoma
- Prostate cancer
- Testicular cancer
Most recent meta-analysis of 32 studies published in 2006

Cancers “probably elevated” in firefighters are:

- **Multiple myeloma**
- **Non-Hodgkin’s lymphoma**
- **Prostate cancer**
- **Testicular cancer**
Since 2006 the # of possible firefighting associated cancers has grown

<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’s Lymphoma</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple Myeloma</td>
<td>X</td>
<td></td>
<td></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>
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<tr>
<td>Mesothelioma</td>
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<td></td>
<td>X</td>
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<tr>
<td>Melanoma</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Kidney</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Esophageal</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Skin</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
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 cancer (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)
Year 1 Linkage attempt
A deterministic match with FCDS data (1981-2013) using first name, last name, date of birth, gender, state, county, and city was attempted but returned only 53 tumor record matches.

Legislation prohibited release of social security number.
Year 2 Linkage attempt
28% of the firefighter certification records were not submitted to LexisNexis because of incomplete information.

In addition to name you need one of following:
- SS #
- Home phone #
- Home address

FIREFIGHTERS
Florida State Fire Marshall’s Office, 1972-2017
n=108,772

Records missing key linkage variables = 30,833
Obtained excellent return on submitted file

- Also obtained information on race, gender, and home address

77,939 Sent to Lexis Nexis for linkage:

98% return of SS #
58% return on missing DOB
(1,841 of 3,138)
FIREFIGHTERS
n=108,772
Records missing key linkage variables = 30,833

77,939 Sent to Lexis Nexis to be augmented with: SSN, DOB, & address
Total sample with linkable data = 77,123

CANCER CASES
Florida Cancer Database System
1981-2013
n = 3,201,900

LINKED VIA:
SSN, First & Last Name, DOB, Address

LINKED DATASET
n = 2,398 unique cases
n = 2,796 tumor records

EXCLUDED
708 patient links and 892 tumor record links Based on duplicate records
Year 3 Linkage: 1981-2014
Division to make study of firefighter employee occupational diseases. Studies of occupational diseases of firefighters or persons in other fire-related fields. — The division shall make a continuous study of is authorized to contract for studies, subject to the availability of funding, of firefighter employee occupational diseases of firefighters or persons in other fire-related fields and the ways and means for their the control and prevention of such occupational diseases, and shall adopt rules as necessary for such control and prevention. For this purpose, the division is authorized to cooperate with firefighter employers, firefighter employees and insurers and with the Department of Health. For such studies, as well as other studies of firefighter or persons in other fire-related fields, that are funded, in whole or in part, under an agreement, including contracts or grants, with the department, the division is authorized to release confidential information for such firefighter or persons in other fire-related fields, to parties who have entered agreements, with associated security measures, with the department when the study being conducted tracks diseases on an individual.
We submitted 30,786 firefighter records with social security number to augment records with date of birth, address history, sex and race.
FCDS used the new R package `fastLink` to complete a probabilistic record linkage
  • Computationally faster
  • Reproducible
  • Provides estimates of linkage quality (‘confusion tables’)

After exclusions 4,808 firefighters had at least one incident cancer
  • More than double the number of firefighters in linkage #2

http://imai.princeton.edu/research/files/linkage.pdf
Select Age-Adjusted Standardized Incidence Ratios (SIR) and 95% Confidence Intervals in a Cohort of **MALE** Florida Firefighters, 1981-2014

***PROVISIONAL***

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>N</th>
<th>SIR</th>
<th>95% CI</th>
<th>Linkage #2 comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testicular</td>
<td>125</td>
<td>0.95</td>
<td>0.79-1.12</td>
<td>Higher</td>
</tr>
<tr>
<td>Prostate</td>
<td>1402</td>
<td>2.50</td>
<td>2.36-2.63</td>
<td>Higher</td>
</tr>
<tr>
<td>Non-Hodgkin’s</td>
<td>206</td>
<td>1.46</td>
<td>1.26-1.65</td>
<td>Higher</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>59</td>
<td>2.06</td>
<td>1.54-2.59</td>
<td>Higher</td>
</tr>
</tbody>
</table>
Select Age-Adjusted Standardized Incidence Ratios (SIR) and 95% Confidence Intervals in a Cohort of MALE Florida Firefighters, 1981-2014

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<tr>
<th>Cancer Site</th>
<th>N</th>
<th>SIR</th>
<th>95% CI</th>
<th>Linkage #2 comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon</td>
<td>322</td>
<td>1.80</td>
<td>1.61-2.00</td>
<td>Higher</td>
</tr>
<tr>
<td>Brain</td>
<td>90</td>
<td>1.29</td>
<td>1.02-1.55</td>
<td>Higher</td>
</tr>
<tr>
<td>Melanoma</td>
<td>366</td>
<td>2.66</td>
<td>2.38-2.93</td>
<td>Higher</td>
</tr>
<tr>
<td>Kidney</td>
<td>185</td>
<td>2.26</td>
<td>1.93-2.59</td>
<td>NC</td>
</tr>
<tr>
<td>Esophageal</td>
<td>75</td>
<td>2.20</td>
<td>1.70-2.70</td>
<td>Higher</td>
</tr>
</tbody>
</table>

***PROVISIONAL***
Select Age-Adjusted Standardized Incidence Ratios (SIR) and 95% Confidence Intervals in a Cohort of FEMALE Florida Firefighters, 1981-2014 (Number of cancers=352)

***PROVISIONAL***

<table>
<thead>
<tr>
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<th>N</th>
<th>SIR</th>
<th>95% CI</th>
<th>Linkage #2 comparison</th>
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</thead>
<tbody>
<tr>
<td>Breast</td>
<td>108</td>
<td>1.58</td>
<td>1.28-1.87</td>
<td>Higher</td>
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<tr>
<td>Genital System</td>
<td>148</td>
<td>1.41</td>
<td>1.18-1.63</td>
<td>Higher</td>
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<tr>
<td>Endocrine</td>
<td>29</td>
<td>1.85</td>
<td>1.18-2.53</td>
<td>Similar</td>
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<tr>
<td>Kidney</td>
<td>11</td>
<td>3.04</td>
<td>1.24-4.83</td>
<td>NC</td>
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<tr>
<td>Skin</td>
<td>22</td>
<td>1.68</td>
<td>0.98-2.38</td>
<td>Higher</td>
</tr>
</tbody>
</table>
Findings summary

Results with our augmented file demonstrate that we were previously underestimating cancer risk in Florida firefighters.

Comparison of findings with our 2006 JOEM paper covering years 1981-1999 indicate that the number of firefighter-associated cancers and the magnitude of the SIR estimates have increased.

Findings for female firefighters, while still somewhat limited, show increased risk in select hormone-associated cancers.
Limitations/next steps

Working with our data for just two weeks so still verifying results
  • Evaluating multiple primary rules and person-years calculations

Did not account for firefighter mortality in our calculation of cancer rates
  • Underestimation of cancer risk in firefighters
  • Mortality linkage underway
Co-Authors

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Thank you!

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