Occupational Cancer Surveillance in the Age of Restricted Identifier Access:

A Linkage of Florida Cancer Data System (FCDS) Data with Firefighter Certification Records

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Background

Cancer Incidence in Florida Professional Firefighters, 1981 to 1999

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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*)

Firefighters are routinely exposed to various carcinogens during firefighting and overhaul (ie, time period for searching and extinguishing hidden fires after the main fire is brought under control).[1] Carcinogens such as benzene and polycyclic aromatic hydrocarbons (PAHs) have been frequently detected in fire smoke.[2] Epidemiologic studies have demonstrated an increased risk for several cancers that can be plausibly linked to carcinogens encountered by firefighters in the course of their work.[3,4] There is evidence of excess mortality from leukemia, non-Hodgkin lymphoma, multiple myeloma, and cancers of the brain and bladder. Weaker but still plausible evidence has linked firefighting to increased mortality risks from melanoma and cancer of the rectum, colon, stomach, prostate, and lung.[4–11] Because most previous studies of firefighters and cancer were based on mortality data, the full extent of their cancer risk, in particular the risk of being diagnosed with cancer, is not yet known. This retrospective co-

- Firefighters are routinely exposed to a range of carcinogens via respiratory and dermal contact
- State of Florida funding has been obtained to monitor risk and study ways to lower these exposures

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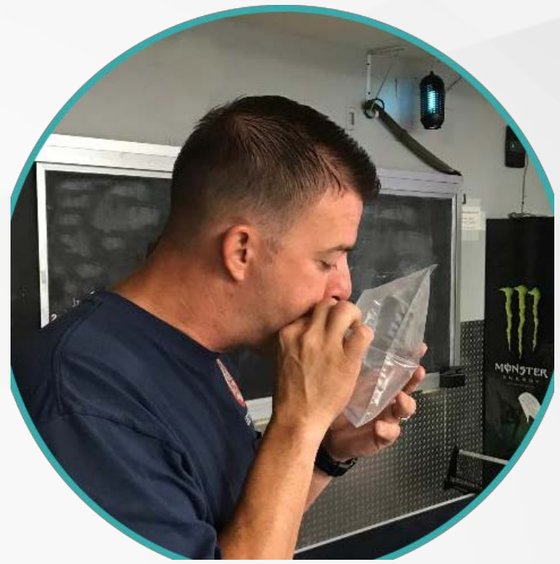
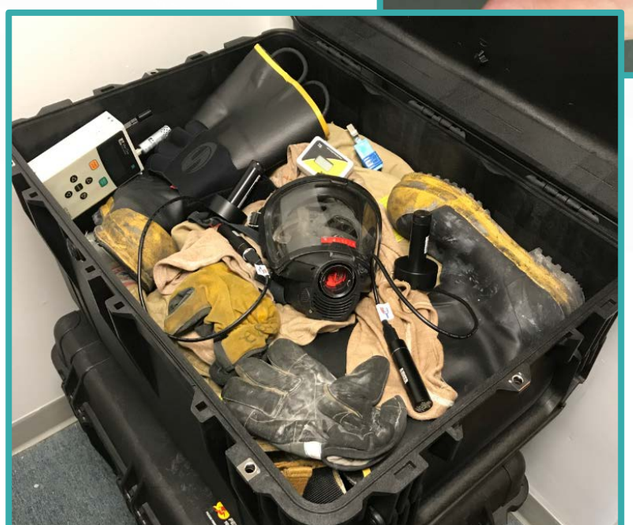
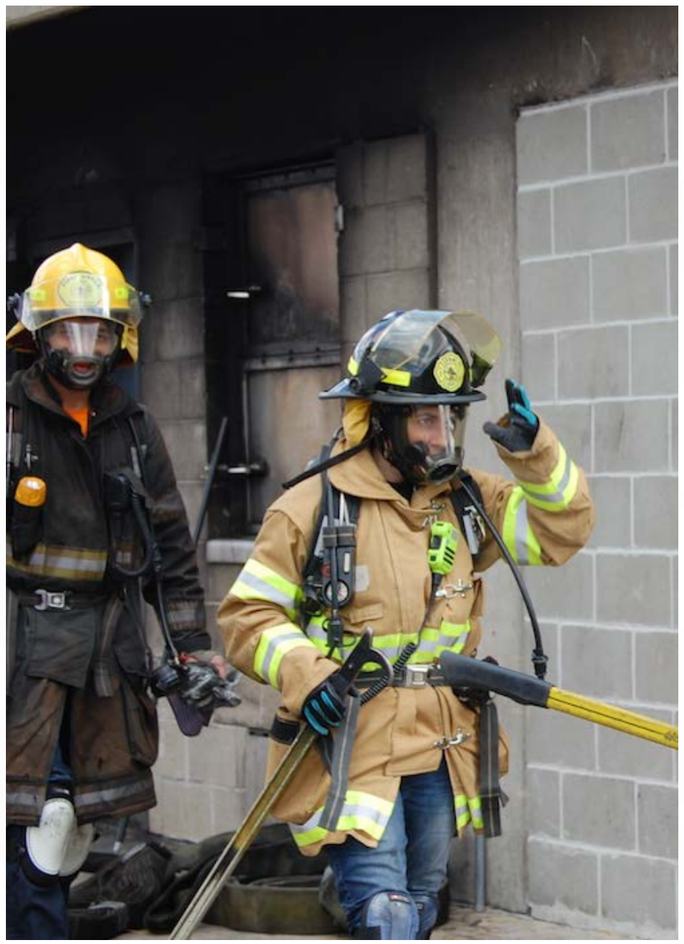
Firefighter Cancer Initiative (FCI) Goals

- To monitor, understand and address the excess burden of cancer among firefighters
- 13 interlocking projects designed to move innovative research from “bench” to “trench”





Background



- Year one efforts were hampered by a state regulation preventing release of social security number (including partial SS)

- 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

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Methods

- In year two granted permission to link certification file to Lexis-Nexis to obtain SS # (& other missing information)

LexisNexis®

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Methods

- 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

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Results

- 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)

Results

- However cost for look-up is large, especially if you are seeking social security #

- Cost based on batch look-up, not on returned records

Variable	Cost per look-up	# submitted records	Cost
Social security number	0.32	77939	24,940.48
Home Address	0.07	77939	5,455.73
Race and Gender	0.06	77939	4,676.34
Date of Birth	0.05	3138	156.90
		Total charge:	**$35,229.45**

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FIREFIGHTERS
Florida State Fire Marshall's Office,
1972-2017
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

EXCLUDED
708 patient links
and
892 tumor record links
Based on duplicate records

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

Linkage details

- Stata (v. 14.2) was used for pre-processing/clerical review
- A probabilistic linkage using R (v. 3.3) was undertaken using:
  - SSN
  - Address (A)
  - DOB (D)
  - Gender (G)
  - Name (N)
- Five data passes were run with blocking on (1) SSN, (2) A-D-G-N, (3) A-D-G, (4) A-D-N, and (5) D-N-G.

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Results

High Priority Male Cancers Comparison of Initial and New Linkage Results			
	1981-1999	**1981-2013**	**% Increase**
	# cases	**# cases**	
All Cancers	970	2206	227%
Cancer Type			
Colon	78	122	56%
Rectum	23	62	**269%**
Lung and Bronchus	128	140	9%
Melanoma	99	290	**292%**
Prostate	209	604	**288%**
Testes **60% ↑**	54	108	200%
Urinary Bladder **29% ↑**	73	95	30%
Kidney/Renal	27	94	**348%**
Thyroid **77% ↑**	20	87	**500%**
Hodgkin	11	31	281%
Non-Hodgkin's	15	99	**660%**
Myeloma	--	21	

- Increase in cases will allow for assessment of all high priority cancers
- Increased burden for select cancers

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Results

High Priority Female Cancers Comparison of Initial and New Linkage Results				
		1981-1999	**1981-2013**	**% Increase**
		# cases	**# cases**	
All Cancers		52	192	369%
Cancer Type				
Melanoma	**300% ↑**	5	26	**520%**
Thyroid	**397% ↑**	6	25	**417%**
Cervix Uteri	**524% ↑**	15	11	

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Results

High Priority Female Cancers Comparison of Initial and New Linkage Results				
		1981-1999	**1981-2013**	**% Increase**
		# cases	**# cases**	
All Cancers		52	192	369%
Cancer Type				
Melanoma	**300% ↑**	5	26	**520%**
Thyroid	**397% ↑**	6	25	**417%**
Cervix Uteri	**524% ↑**	15	11	

- **Decline in linked cervical cases suggests we are missing many of the earlier female firefighter cancer cases!**

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Future Direction 2017-18

- Recent statute modification now allows for release of SS #; may help ‘recover’ cases among the 30,000 records we could not link
  - Will enable us to include vital missing female cases and will further strengthen case counts for males
- Relink with the cancer registry and undertake linkage with mortality file

633.516 ~~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.

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Summary and Recommendations

- Use of LexisNexis to augment records for registry linkages is viable if you have access to name and at least 1 of 3 of the following:
  - Social security #
  - Home phone #
  - Home address
- Costly, especially if you are seeking social security number
- Working with key stakeholders to change regulations restricting researcher data access to critical linkage identifiers is time consuming but worthwhile

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Thank You

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