

Findings from a Study of **Cancer** among **U.S. Fire Fighters**



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In 2010, the National Institute for Occupational Safety and Health (NIOSH) began a multi-year study of nearly 30,000 fire fighters from the Chicago, Philadelphia, and San Francisco Fire Departments to better understand the potential link between fire fighting and cancer. The study was a joint effort led by researchers at NIOSH in collaboration with researchers at the National Cancer Institute and the University of California at Davis Department of Public Health Sciences, and supported in part by the U.S Fire Administration. This study was completed in late 2015.

What we found

The fire fighters we studied showed higher rates of certain types of cancer than the general U.S. population.

Based on U.S. cancer rates:

- Fire fighters in our study had a greater number of cancer diagnoses and cancer-related deaths.
 - These were mostly digestive, oral, respiratory, and urinary cancers.
- There were about twice as many fire fighters with malignant mesothelioma, a rare type of cancer caused by exposure to asbestos.
 - Exposure to asbestos while fire fighting is the most likely explanation for this.
- There were more cases of certain cancers among younger fire fighters.
 - For example, fire fighters in our study who were under 65 years of age had more bladder and prostate cancers than expected.

When comparing fire fighters in our study to each other:

- The chance of lung cancer diagnosis or death increased with amount of time spent at fires.
- The chance of leukemia death increased with the number of fire runs.

What this means

For fire service

This study provides further evidence that fire fighters are at increased risk of certain types of cancer as a result of occupational exposure. Raised awareness and exposure prevention efforts are cost-effective means to reduce occupational cancer risk. Thus, the fire service should increase efforts to educate members about safe work practices. This includes proper training, proper use of protective clothing, and proper use of approved respiratory protection during all phases of fire fighting.

For fire fighters

If you are a fire fighter and you are healthy right now this study does not mean that you will get cancer. We don't know, simply from this study, whether or not you will get cancer. Instead, our study found that fire fighters, on average, have a higher risk of certain types of cancer compared to the general population.

If you are a fire fighter and have cancer this study does not mean that your service caused your cancer. This study cannot determine if an individual's specific cancer is service-related. In addition to exposures that you may have encountered as a fire fighter there are other factors that may influence whether or not you developed a particular cancer, and this study was not able to address many of these factors.

If you are an active or retired fire fighter and are worried about your health, share this information with your doctor. It is important that your doctor is kept aware of possible job-related health concerns.

How the study was done

Our study had four steps:

Step 1. We assembled the study population

We assembled the study population from records of the fire departments in Chicago, Philadelphia, and San Francisco. We included 29,993 fire fighters with at least one day of active duty between 1950 and 2009.

Step 2. We gathered cancer and death information through 2009

- From national and state death certificate data, we determined how many former fire fighters had died, and from what causes.
- From state cancer registry data, we identified fire fighters who were diagnosed with cancer.

Based on previous studies of fire fighters, the cancers of primary concern were

- cancers of the
 - lung
 - brain
 - stomach
 - esophagus
 - intestines
 - rectum
 - kidney
 - bladder
 - prostate
 - testes
- leukemia
- multiple myeloma
- non-Hodgkin lymphoma

Step 3. We assessed each fire fighter's potential job exposures

For 19,309 male fire fighters who were first hired in 1950 or later and who were employed for at least one year, we assessed potential job exposure based on existing records. The measures we used were:

- Exposed-days: the number of days each fire fighter worked in a job or at a location with the potential for exposure for each fire fighter from all three fire departments.
- Fire-runs: the total number of fire-runs made by each fire fighter from the Chicago and Philadelphia Fire Departments
- Fire-hours: the total time spent at fires by each fire fighter from the Chicago Fire Department

We only assessed fire-runs and fire-hours for fire departments with data on annual fire-runs and/or amount of time apparatus were deployed into the field.

Step 4. We compared disease outcomes by various groups

We compared death rates and cancer diagnoses in the following groups:

- Fire fighters compared to U.S. and state populations
- Fire fighters with more exposed-days compared to those with fewer
- Chicago and Philadelphia fire fighters who made more fire-runs compared to those who made fewer
- Chicago fire fighters who spent more time at fires compared to those who spent less

Study Limitations

Although the study is large, our ability to detect links between fire fighting and cancer is still limited, especially for rare cancers. Limitations include:

- Few women and minorities were in the study which limits the ability to see links between fire fighting and cancer in these groups.
- Measurements of actual exposures were not available.
- Information on exposures to cancer-causing agents outside of fire fighting was not available.
- Information on lifestyle choices that are linked to cancer (such as diet, exercise, smoking habits, and alcohol use) was not available.

For more information

- NIOSH Fire Fighter Cancer Study Website
<http://www.cdc.gov/niosh/firefighters/ffcancerstudy>
- Press Release: NIOSH Study of Firefighters Finds Increased Rates of Cancer
<http://www.cdc.gov/niosh/updates/upd-10-17-13.html>
- NIOSH Science Blog: Is There a Link Between Firefighting and Cancer? – Epidemiology in Action
<http://blogs.cdc.gov/niosh-science-blog/2014/12/17/cancer-ff/>

- Frequently Asked Questions (FAQs)
<http://www.cdc.gov/niosh/firefighters/pdfs/FAQ-NIOSHFFCancerStudy.pdf>
- Publications (available per BMJ guidelines)
 - Mortality and cancer incidence in a pooled cohort of US firefighters from San Francisco, Chicago and Philadelphia (1950– 2009)
http://www.cdc.gov/niosh/firefighters/pdfs/OEM_FF_Ca_Study_10-2013.pdf
 - Exposure–response relationships for select cancer and non-cancer health outcomes in a cohort of US firefighters from San Francisco, Chicago and Philadelphia (1950–2009)
[http://www.cdc.gov/niosh/firefighters/pdfs/Daniels-et-al-\(2015\).pdf](http://www.cdc.gov/niosh/firefighters/pdfs/Daniels-et-al-(2015).pdf)
 - Creation of a retrospective job-exposure matrix using surrogate measures of exposure for a cohort of US career firefighters from San Francisco, Chicago and Philadelphia
http://www.cdc.gov/niosh/firefighters/pdf/dahm_et_al_2015.pdf

Cancer screening and prevention

- Lung cancer
<http://www.cdc.gov/cancer/lung/>
- Oral cancer
http://www.cdc.gov/oralhealth/oral_cancer/
- Colorectal (colon) cancer
<http://www.cdc.gov/cancer/colorectal/>
- Malignant mesothelioma
<http://ephtracking.cdc.gov/showCancerMesotheliomaEnv.action>

If you have questions about this study, or to request printed copies of electronic materials available on the NIOSH website, please send an email to GHartle@cdc.gov, or call the NIOSH Industrywide Studies Branch at (513) 458-7118.