



Firefighters & Brain Cancer

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DetecTogether

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GENERAL EPIDEMIOLOGY: BRAIN CANCER

The American Cancer Society (ACS)¹ estimates approximately 24,530 new cases of brain or spinal cord cancer will be diagnosed and 18,600 deaths will occur in the United States in 2021. Overall, the likelihood of a person developing brain cancer is less than 1%¹. Survival rates for brain cancer vary depending on the type of tumor and age of the individual. In general, 5 year relative survival rates are higher for younger individuals than older, and range from 22% to 92%².

INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC)

In June 2022, IARC convened an international meeting of scientists to re-evaluate firefighting as an exposure related to cancer. They determined the literature supports reclassifying **firefighting to a Group 1 carcinogen (carcinogenic to humans) based on “sufficient” evidence**³. This is the **highest** classification of exposure only assigned when there is scientific certainty.

Their statement indicated:

There was also “strong” mechanistic evidence that occupational exposure as a firefighter shows the following key characteristics of carcinogens in exposed humans: “is genotoxic”, “induces epigenetic alterations”, “induces oxidative stress”, “induces chronic inflammation”, and “modulates receptor-mediated effects”.

It should be noted that IARC criteria and classifications are focused on *scientific levels of certainty* which are more stringent than those focused on the “weight of the evidence”⁴ which is often used in cases of workers compensation.

GENERAL RISK FACTORS FOR BRAIN CANCER

There are a number of brain tumor types, and while each may have specific risk factors, several risk factors may be common across type. Additionally, while there are factors that may increase risk of brain tumors, many brain tumors may not have an obvious cause or be linked to known risk factors³.

- **Radiation Exposure.** The best-known risk factor for brain tumors is radiation exposure, often a result of treatment of some other condition³. These types of tumors may occur in people who received radiation treatment as a child for leukemia, with tumors developing from 10 to 15 years after treatment. In an effort to reduce the number of radiation-induced tumors, radiation therapy is only administered after careful consideration of risks and benefits³.
- **Family History.** Although not common, a rare number of cases of brain tumors are a result of family history. In these situations, family members who have specific disorders increase the likelihood of offspring developing tumors. These disorders include neurofibromatosis type 1 and type 2, tuberous sclerosis, Li-Fraumeni syndrome, and Turcot syndrome³.
- **Weakened Immune Systems.** Individuals with weakened immune systems have an increased risk of developing primary CNS lymphomas of the brain or spinal cord. While having a weakened immune system may be congenital, it may also be a result of treatments of other cancers or diseases such as acquired immunodeficiency syndrome (AIDS)³.

RISK FACTORS RELEVANT TO FIREFIGHTERS

Firefighters are exposed to a broad range of chemicals, both in the firehouse and during emergency response. There are two specific exposures that should be considered when evaluating the relationship between firefighter exposures and brain cancer.

Polychlorinated biphenyls (PCBs; Group 1 Carcinogen⁴). PCBs are man-made organic chemicals commonly used as coolants, lubricants in transformers, capacitors, and other electrical equipment. While the chemicals have been banned since the late 1970s due to evidence that they are a probable human carcinogen, they remain in products manufactured prior to the ban and have been found in the fire environment as a product of combustion⁵. Exposure to PCBs has been linked to an elevated risk of brain cancer^{6,7}.

Radiation Frequency (RF) Exposure. The topic of RF exposures has become increasingly important for firefighters as cell phone towers are often built on the same property as firehouses. The IARC monograph series classified RF as possibly carcinogenic in their 2011 review of the literature. It has, however, been posited in the literature that RF plays a significant role in cancer development among firefighters⁸ and is a topic the International Association of Fire Fighters (IAFF)⁹ is aggressively pursuing through research.

RISK OF BRAIN CANCER AMONG FIREFIGHTERS

A number of methodologically sound studies have studied the relationship between brain cancer and firefighting and have found increased risks.

Tsai et al¹⁶ conducted a case-control study of cancer risk among firefighters in California from 1988-2007 using the California Cancer Registry (CCR). The study included 3,996 male firefighters with cancer and 48,725 non-firefighter controls. **The authors found that firefighters overall experienced a statistically significant and greater risk for brain cancer** (OR = 1.54, 95% CI = 1.19-2.00) even after adjusting for age of diagnosis, race, and year of diagnosis. When the analysis was restricted just to White firefighters, the magnitude of the OR was similar (OR = 1.41, 95% CI = 1.07-1.87). When the analysis examined firefighters of other race or ethnicity, the magnitude of the OR tripled (OR = 3.58, 95% CI = 1.65-7.74). **These results suggest that firefighters have at least 40% greater odds of developing brain cancer than non-firefighter controls.**

Lee et al¹⁷ examined over 100,000 career Florida firefighters over a 34-year period, identifying 3,760 male and 168 female primary cancer incidence using the Florida State Fire Marshall's Office and Florida Cancer Data System. After adjusting for age and year of cancer diagnosis, the authors found although male firefighters had a slightly non-significant elevated risk of brain cancer (aOR = 1.03, 95% CI = 0.82 – 1.31), while **female firefighters had a significantly elevated risk of brain cancer** (aOR = 2.54, 95% CI = 1.19 – 5.42).

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