

CLINICAL REVIEWS

Firefighters and Cancer: Bridging Gaps in Prevention, Policy, and Research

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Firefighters face elevated cancer risks due to chronic occupational exposure to carcinogens, yet early detection and preventive care remain inconsistent. Evidence demonstrates a higher incidence of multiple malignancies, including prostate, colorectal, melanoma, and hematologic cancers, with emerging concerns regarding breast and cervical cancer among female firefighters. Despite the availability of established screening modalities, many firefighters do not receive risk-appropriate, guideline-concordant care because U.S. Preventive Services Task Force recommendations do not fully align with occupational risk-based screening advocated by the International Association of Fire Fighters. As a result, primary care clinicians may be unaware of expanded screening needs for this high-risk population. Structural barriers, including limited insurance coverage, variable presumptive cancer protections, and inconsistent decontamination practices, further hinder timely prevention and early detection. Bridging occupational risk with primary care-based prevention offers an essential opportunity to improve early diagnosis, reduce cancer-related morbidity and mortality, and better serve this high-risk yet underserved patient population.

Introduction

Cancer remains one of the leading causes of death worldwide and poses an especially significant threat to firefighters, who experience higher cancer morbidity and mortality due to repeated occupational exposure to hazardous materials. Global cancer incidence is projected to rise substantially, with new cancer cases reaching 35.3 million annually by 2050, and cancer-related deaths to exceed 18.2 million.¹ In the United States, firefighters face a 9% higher incidence of cancer and a 14% higher cancer-related mortality rate compared to the general population.² These elevated rates highlighted that firefighters experience a distinct cancer risk profile compared with the general population. Although numerous studies have documented these risks, significant gaps remain in screening, early detection, preventive care, and access to comprehensive insurance coverage. Addressing these gaps is an urgent public health priority.

Occupational Exposures and Incomplete Prevention

Firefighters face a constellation of occupational hazards that place them at disproportionate risk for multiple cancers. Although progress has been made in characterizing exposure pathways, significant gaps persist in protective measures, decontamination practices, and early detection of exposure. For example, inconsistent adherence to gear-cleaning protocols and variation in post-fire gross decontamination routines exist across departments.³⁻⁵ Chronic inhalation of combustion byproducts and dermal absorption of contaminants contribute to elevated rates of several malignancies, as demonstrated by the NIOSH cohort study and subsequent analyses.^{6,7} Notably, firefighters experience: twice the risk of testicular cancer ($RR \approx 2.02$), mesothelioma ($RR \approx 2.0$), elevated risks of multiple myeloma ($RR \approx 1.53$), non-Hodgkin lymphoma ($RR \approx 1.51$), skin cancer ($RR \approx 1.39$), malignant melanoma ($RR \approx 1.31$), brain cancer ($RR \approx 1.31$), prostate cancer ($RR \approx 1.28$), colon cancer ($RR \approx 1.21$), and leukemia ($RR \approx 1.14$) compared with the general population.^{6,7} Importantly, several of these, including colorectal, skin, prostate, and some hematologic cancers, have established evidence-based screening modalities, underscoring the need to integrate occupational risk into screening conversations. Protective gear alone cannot fully eliminate carcinogenic exposure,^{8,9} so comprehensive occupational health strategies must integrate improved PPE and decontamination protocols with systematic screening, preventive education, and organizational cultures that normalize early detection behaviors.

Exposure-Associated Cancers

Firefighters are exposed to a mixture of combustion byproducts and synthetic chemicals during fire suppression, overhaul, and maintenance activities. These exposures occur primarily through inhalation of smoke and particulates, or through dermal absorption from contaminated gear and fire station environments. The International Agency for Research on Cancer (IARC) recently classified occupational exposure as a firefighter as carcinogenic to humans (Group 1), with strong evidence linking it to cancers of the lung, bladder, colon, and mesothelioma.^{4,10} Key agents of concern include polycyclic aromatic hydrocarbons (PAHs), benzene, formaldehyde, and diesel exhaust. Moreover, per- and polyfluoroalkyl substances (PFAS), used in turnout gear and firefighting foams, are persistent environmental contaminants that bioaccumulate in human tissue and have been linked to kidney, testicular, and thyroid cancers.³ Repeated contamination of PPE, inadequate decontamination protocols, and poor ventilation additionally compound chronic exposure, creating a distinct risk profile in this population.

Sex-Specific Risks Among Female Firefighters

Understanding occupational exposures through a sex-specific lens is critical, as female firefighters face unique physiological and policy-related vulnerabilities that amplify cancer risks.¹¹ Female firefighters remain critically underrepresented in firefighting research because many meta-analyses exclude them due to small sample sizes, which limit statistical power.^{11,12} Although they constitute a small proportion of the workforce, emerging evidence points to elevated risks for breast, cervical, thyroid, and reproductive cancers, often at younger ages and in more aggressive forms compared with the general population. For example, while breast cancer in the general population typically presents at a median age of 62 years, the mean age of diagnosis among female firefighters in the Kunz study cohort was only 39 years,¹¹ over two decades earlier. Additionally, previous epidemiologic studies have identified an elevated incidence of cervical cancer among female firefighters relative to expected population rates.⁷ Together, these findings suggest both earlier occurrence and higher-than-expected incidence of reproductive cancers in female firefighters, underscoring the need for targeted surveillance, research, and presumptive protections.

Barriers to Screening and Early Detection

Firefighters' elevated cancer burden highlights the urgency of improving access to screening. Several cancers with significantly increased incidence in this population, including colorectal ($RR \approx 1.21$), prostate ($RR \approx 1.28$), melanoma ($RR \approx 1.31$), and certain hematologic malignancies ($RR \approx 1.14-1.51$), are detectable through established evidence-based screening modalities.⁷ Despite these elevated risks, many firefighters do not receive timely or guideline-concordant screening, often due to cost, limited occupational health infrastructure, and limited awareness among both firefighters and their primary care providers.¹³⁻¹⁵ Implementing screening programs within fire departments faces challenges, including cost, limited occupational health infrastructure, inconsistent insurance coverage, and cultural stigma surrounding preventive care.^{13,14} Because USPSTF recommendations guide insurance coverage, screenings that fall outside those guidelines are often not reimbursed, thus creating barriers even when occupational organizations advise earlier or more frequent testing.

Notably, the International Association of Fire Fighters (IAFF) recommends screening practices that exceed U.S. Preventive Services Task Force (USPSTF) guidelines to address firefighters' elevated cancer risk. The IAFF generally advocates for earlier initiation and higher screening frequency across multiple cancers. For instance, recommendations include annual rather than biennial breast cancer screening after age 50, as well as testicular self-exams and

clinical skin checks, where the USPSTF finds insufficient evidence.^{15,16} A detailed comparison of these recommendations is provided in Table 1 (see Supplementary Materials).

Given these discrepancies, primary care providers may be unaware of the expanded IAFF recommendations. Providing firefighters with an occupational health screening summary or referral letter to share with their providers may improve adherence and ensure that high-risk individuals receive appropriately tailored preventive care.

Policy and Legislative Imperatives

Presumptive laws, statutes recognizing certain cancers as occupationally related to firefighters, vary widely across jurisdictions and often exclude cancers not firmly established in epidemiologic studies.⁴ Given emerging evidence of elevated breast and cervical cancer incidence among female firefighters, the exclusion of these conditions from many presumptive laws leaves women without essential occupational protections and benefits. The consequences of these exclusions are profound. Firefighters may be denied paid leave, medical coverage, or survivor benefits, and often face lengthy, costly legal battles. High-profile cases, such as that of Steven Shipp, a Washington, D.C., firefighter who died before his cancer could be recognized as work-related, underscore the urgency of reform.^{17,18} Policymakers must expand the scope of presumptive laws, streamline claims processes, and ensure timely access to benefits.

Research Gaps and Future Directions

Despite decades of epidemiologic study, critical research gaps persist in understanding cancer risk among firefighters. Data on racial and ethnic disparities, sex-specific exposures, and long-term health outcomes remain limited. Hispanic and Black firefighters may experience disproportionately higher rates of certain cancers, yet are underrepresented in national registries and cohort studies.⁷ Future research must prioritize diverse recruitment, biomarker discovery, and longitudinal surveillance to guide evidence-based screening and policy development. Building comprehensive, diverse firefighter cancer registries and exposure biomarker databases will be essential to closing these knowledge gaps.

Conclusion: A Call to Action

Firefighters face substantial, well-documented cancer risks that demand urgent and comprehensive action. Preventive strategies should go beyond protective gear to include decontamination, improved firehouse safety infrastructure, and regular cancer screenings. Policy reforms must expand and harmonize presumptive laws to ensure equitable protections for all

firefighters, particularly women at risk for sex-specific cancers. Research priorities should focus on longitudinal studies, biomarker development for early detection, and inclusion of diverse firefighter populations.

In parallel, strengthening clinician education represents a critical and underutilized opportunity to improve early detection and prevention. Primary care physicians, particularly those trained in family medicine and internal medicine, play a central role in delivering cancer screening and risk-based counseling. Integrating International Association of Fire Fighters (IAFF) recommendations for earlier and more frequent cancer screening into medical curricula and residency training may enhance clinicians' ability to recognize firefighters as a high-risk population and initiate timely preventive care. Experiential educational models, such as short elective rotations in which medical students and residents engage directly with firefighters to identify gaps in care and develop screening plans in collaboration with existing primary care providers, may further strengthen occupational health competency and care coordination.

Addressing occupational cancer among firefighters is both a public health and societal responsibility and an imperative to protect those who risk their lives to safeguard others.

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SUPPLEMENTARY MATERIALS

Table 1.

Download: <https://tfmrj.scholasticahq.com/article/158265-firefighters-and-cancer-bridging-gaps-in-prevention-policy-and-research/attachment/332645.docx>
