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## Perceptions of Occupational Cancer Risk and Prevention among Dominican Republic Firefighters: A Qualitative Study

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### Abstract

**Objectives:** Characterize occupational cancer risk perceptions and attitudes towards cancer prevention practices among firefighters in the Dominican Republic.

**Methods:** Focus group discussions and key informant interviews were conducted in June 2019 among firefighters from three fire departments. Themes were inductively created using a qualitative descriptive approach.

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Authors' contributions:

AJCM, PLF, KMS, and NSS, conceived the study, participated in its design, coordination, performed statistical analyses, and co-drafted the manuscript. AJCM, PLF, KMS, LP, GR, NSS, MM, and EPT, collected field data, entered study data, assisted in data analysis, and interpretation of study results. AJCM, KMS, and PLF performed statistical analysis, interpreted study results and helped with the manuscript draft. All authors read, revised, and approved the final manuscript

**Institution and Ethics approval and informed consent:** The study research protocol was reviewed and approved by the University Institutional Review Board (#20180749) and the Dominican Republic Committee on Ethics (CEI-003).

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**Results:** Thirty-seven firefighters were interviewed with a group mean age of  $36.2 \pm 10.3$  years, of which 97.3% were male, and 37.1% worked at least 10 years. Six themes emerged: 1) availability of personal protective equipment (PPE); 2) constant toxic exposure during fire suppression; 3) occupational stress due to emergency response experiences; 4) lack of workplace health promotion activities and policies at the fire department level; 5) firefighters attribute Dominican Culture for not engaging in medical checkups; and 6) expensive medical copays limits healthcare access.

**Conclusion:** Dominican firefighters are willing to adopt cancer prevention practices, however organizational barriers (i.e., PPE availability, cultural barriers, health promotion practices) limit engagement.

### Keywords

cancer; fire service; fire fighter; first responders; Caribbean; Latino; cancer prevention

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Firefighters are regularly exposed to hazardous contaminants that could deteriorate their health.<sup>1-3</sup> The International Agency for Research on Cancer (IARC) classified employment as a firefighter as possibly carcinogenic to humans (Group 2B carcinogen).<sup>4</sup> Several epidemiologic studies have shown evidence on how firefighters are disproportionately affected by cancer.<sup>5-8</sup> Based on a pooled cohort study of three large fire departments in the United States, cancer incidence and mortality are increased in firefighters by 9% and 14%, respectively.<sup>5</sup> A recent meta-analysis on the association between firefighting and cancer revealed significantly higher incidence risk estimates for several cancer types, including cancer of the colon, rectum, and prostate.<sup>7</sup>

Internationally, reducing the cancer burden in the fire service has been at the forefront of firefighter safety.<sup>9,10</sup> Currently, some of the best-recommended practices for preventing cancer include using full protective equipment (including breathing apparatus), gross decontamination at the fire scene, engaging in an annual physical exam, and thoroughly documenting fire and chemical exposures on incident reports.<sup>10-14</sup> Moreover, it is essential to note that cancer prevention practices are affected by budgets, department-level organizational factors, and firefighter behavioral factors.<sup>15,16</sup>

Despite global advances in cancer health education, health screenings, and safety gear, firefighters from low-middle income countries (LMICs) such as the Dominican Republic (DR) face significant challenges in cancer prevention. It has been documented that DR fire departments purchase retired fire apparatuses and utilize donated equipment that has been taken out of service in the originating country, thus impacting the protective effect of the equipment.<sup>17-20</sup> Currently, there is no data on the use of cancer prevention strategies or how firefighters perceive cancer risk in the DR or nearby Caribbean countries.

Epidemiologic data shows that the most frequently occurring cancers in the DR, for men, include: prostate cancer (3.6%), lung cancer (8.7%), colorectal cancer (8.3%) and stomach cancer (4.7%); and for women, include breast cancer (34.5%), cervical cancer (10.7%), colorectal cancer (8.3%), and lung cancer (6.6%).<sup>21</sup> Given that firefighters have an increased risk of developing prostate or colorectal cancer and both of these cancer types are of high

incidence for Dominicans, it would be valuable to explore how DR firefighters conceptualize their occupational cancer risk and explore their attitudes and behaviors towards cancer prevention practices.

There is a strong need for international firefighter research to explore adopted cancer prevention practices for this occupational group disproportionately exposed to known carcinogenic agents. This study aims to fill a critical knowledge gap by characterizing and documenting cancer perceptions by firefighters in the DR. As a formative first step, we used qualitative methods to explore and describe occupational cancer risk perceptions and attitudes towards cancer prevention practices among Dominican firefighters.

## **MATERIALS AND METHODS**

### **Study Design**

We used qualitative methods to document DR firefighters work-related cancer risk perceptions and characterize attitudes and behaviors toward cancer prevention practices.<sup>22,23</sup> AJCM, PLF, and KMS conducted focus group discussions (June 2019) with firefighters across three different fire brigades located in the capital of the DR. Focus group discussions were used as they are effective in eliciting experiences, opinions, and feelings of a purposely selected group, and the data gathered can be generalized.<sup>24</sup> AJCM, PLF, and KMS also conducted semi-structured key informant interviews (June 2019), which were used to explore the perspectives on the topics of interest specifically by fire service leadership.<sup>24</sup> Participating fire brigades were selected based on call volume and geographical location. The study research protocol was reviewed and approved by the University Institutional Review Board (#20180749) and the Dominican Republic Committee on Ethics (CEI-003).

### **Participant Recruitment and Eligibility Criteria**

We used purposeful sampling to recruit participants from the following fire brigades: (1) the Santo Domingo—National District Fire Department, (2) Santo Domingo—East Fire Department, and (3) the Santiago Central Fire Department.<sup>25</sup> Recruitment was conducted at fire stations designated by fire service leadership. Our medical research partner from the National District Fire Department was essential in coordinating in-person informational sessions at different fire stations, during which we fully explained the study's rationale and procedures involved, and afterwards, invited firefighters to participate. Initial participant eligibility criteria for both key informant interviews and focus group discussions included: adults 18 years of age who could speak and write in Spanish and were employed under one of the fire brigades participating in the study. Further eligibility was required for the key informant interviews, such that participants were selected based on work characteristics (i.e., tenure, rank and role in the fire department). Additional effort was made to recruit a diverse group of participants across firefighter tenure, rank and role. Participants were offered a monetary incentive of 25 USD cash and a shirt for their time and participation.

### **Participant Consent and Data Collection**

All eligible participants gave verbal consent in Spanish prior to engaging in any research activity. Focus group sessions included five to nine firefighters and lasted between 60 to 70

minutes. Group sessions and interviews were conducted at private training rooms located at participating fire stations. Key informant interviews included one participant and lasted between 20 to 40 minutes. Prior to initiating the discussions, participants from the focus groups and key informant interviews were administered a one-time, paper-based, language sensitive, 17-item sociodemographic, and work characteristics questionnaire using validated measures.<sup>26</sup> Once participants were done answering the questionnaire, the discussion session or interview began. Discussion sessions and interviews were led by an experienced Spanish speaking moderator (AJCM). The moderator used a standardized semi-structured interview script containing four domains on perceptions of occupational cancer risk and behaviors on utilized cancer prevention practices. Each domain consisted of four to six open ended questions; interview guide for interviews and focus groups is included as supplemental material in this manuscript [Appendix A]. Field notes were taken during focus groups and interviews to complement data analysis (PLF and KMS). All focus groups and interview sessions were audio-recorded utilizing audio recording software on two encrypted electronic devices (i.e., tablets).

### Data Analysis

Quantitative data collected from the one-page demographic questionnaire was analyzed using SPSS Version 26, IBM Corp. We calculated descriptive statistics for continuous variables, expressed as means with its standard deviation, and for categorical variables, expressed as frequency and percent of the sample. Audio files were fully transcribed in Spanish and translated to English. We conducted a thematic analysis of focus group discussions and interviews using an inductive approach.<sup>27</sup> This approach allowed us to condense extensive raw data and establish links between our research objectives and the findings derived from the raw data.<sup>27</sup> Focus group and interview transcripts were coded openly and independently by two different team members (PLF and LP) using Dedoose Version 8.0.35. Preliminary codes were discussed until a final coding scheme was agreed on. Final codes were used to recode transcripts and identify themes across the five focus group sessions and five key informant interviews. Thematic saturation was determined by exploring and analyzing, similarities and differences across and within key informant interviews and focus group discussions.

## RESULTS

We conducted five focus group discussion sessions (n=32), and 5 key informant interviews (n=5) across the different fire services. Among the 37 firefighters who completed the demographic questionnaire prior to the start of the discussion, 97.3% identified as male, 37.8% were in the 30–39 years-old age group (mean =36.2, SD =10.3 years), 48.6% attended less than high school, and 51.3% were never married [Table 1].

### Qualitative Findings

In the Dominican Republic, firefighters are divided into two main subgroups: Volunteer firefighters and Permanent firefighters. Volunteer firefighters attend a six month to one-year fire academy while permanent firefighters are not required to undergo training prior to starting their career as a permanent (i.e., paid) firefighter and learn about firefighting on

a day by day basis. All study participants identified as permanent (i.e., paid) firefighters. The firefighters interviewed agreed their job in the fire service increases their risk of developing cancer, “*Several colleagues have already suffered from cancer. Some of them are young and you can think it’s due, because of work, what they have been through here...*” (G1, P3). Perceived factors that could increase occupational cancer risk and impact engagement of cancer prevention practices were summarized within two main categories: 1) factors impacting occupational cancer risk, and 2) factors impacting engagement in cancer prevention practices. Main categories were organized across six overarching themes [Table 2]. Supporting quotes are identified by focus group number (e.g., Focus Group 1 = G1) and participant number (e.g., participant 3 = P3) or key informant interview number (e.g., Key Informant Interview 1 = K1) and participant title (e.g., sergeant). Additional supportive quotes [Appendix B and C] appear in parentheses including a number nomenclature according to the theme they are supporting (e.g., quotation 1.1 supports theme I in the respective category being discussed).

### Factors Impacting Occupational Cancer Risk

Within factors impacting occupational cancer risk, three major themes emerged: (1) Availability of Personal Protective Equipment, (2) Constant Toxic Exposure during Fire Suppression, and (3) Occupational Stress due to Emergency Response Experiences. Appendix B includes additional supportive quotes for the themes mentioned.

**Theme I: Availability of Personal Protective Equipment**—Personal protective equipment (PPE) for firefighters include items such as turnout gear, hoods, gloves, and breathing equipment (e.g. mask and oxygen tanks). Across fire departments, it was common to hear firefighters discuss availability of PPE as they do not have access to at least one full set of personal protective equipment (1.2; 1.3; 1.4); “*The gear here are very scarce. Here, that’s like looking for treasure under the earth...*” (KI, Sergeant). Given the lack of available protective equipment, firefighters are required to share PPE amongst themselves, which often results in firefighters using dirty turnout gear from the past work shift: “*I can assure you that one hundred percent of us here, including the senior officers, none of us [decontaminate our gear]. You just arrive, and if the uniform is dirty you say, “Pass me the brush and put it in the sun. At best. That’s it”* (G3, P9).

Dominican firefighters also worry about inconsistent availability of PPE during emergency response as it might mean going into the fire scene unprotected (1.5; 1.6), “*Sometimes we enter [the fire scene] without the necessary equipment and that can provoke cancer.*” Firefighters mentioned how respiratory equipment while responding to fires is scarce (1.1; 1.6); one particular participant said, “*the greatest risk that we have is the high contamination from carbon monoxide that we inhale through the fires. Even though many times we have breathing gear, they’re not as constant, they don’t last on [referring to having enough oxygen]”* (G1, P2).

**Theme II: Constant Toxic Exposure during Fire Suppression**—Participants discussed how toxic exposures during firefighting activities might also affect their health and in the long-term cause chronic diseases such as cancer (2.1; 2.2; 2.3; 2.4; 2.5; 2.6), one

participant mentioned, *“I can get cancer because of the smoke and all of the chemicals there are. I can perceive them because I’m at the location, I’m at the emergency scene and I can ingest some of that toxic [material]. Lungs don’t want anything that’s toxic. So, I can get cancer...”* (KI, Sergeant).

Other toxic exposures identified were excessive inhalation of smoke (2.10; 2.11) and carbon monoxide at the fire scene (2.8), *“We are practically one hundred percent exposed to [developing] lung cancer, due to the smoke inhalation we encounter, which is practically daily”* (G4, P5). Firefighters also mentioned overexposure to heat (2.7) and radiation (2.9, 2.12) during emergency response, which they discussed in the long term could impact their health.

### **Theme III: Occupational Stress due to Emergency Response Experiences—**

Another factor participants contextualized as impacting their cancer risk was increased stress levels due to traumatic experiences lived during fire suppression (3.1; 3.4). Some of the experiences shared included dealing with lives lost at the fire scene, often of young children, losing coworkers, and being exposed to dangerous materials (3.2; 3.3). Firefighters stated increased stress levels could compromise their health and in the long term, they could suffer from cancer, *“With time, I think this job can cause you an illness [referring to cancer] because of the stress”* (G1, P3) (3.5). As the discussion evolved, firefighters expressed they would like to see programs offered by their fire departments that focused on dealing with stress and mental health, *“...It would be good to establish a program for us maybe through an institution that does a [stress and mental health] evaluation, [it can be] monthly or every trimester for each of its members”* (G3, P6).

## **Factors Impacting Firefighter’s Engagement in Cancer Prevention Practices**

Within the category of factors impacting engagement in cancer prevention practices, three themes were identified: (1) lack of health promotion activities and policies at the fire department level; (2) firefighters attribute Dominican culture for not engaging in medical checkups; and (3) expensive medical copays inhibit access to healthcare. Appendix C includes additional supportive quotes for the themes mentioned.

### **Theme I: Lack of Health Promotion Activities and Policies at the Fire Department Level—**

Dominican firefighters are required to complete a physical exam upon their entry to the fire service but are not required to get an annual physical exam. Given that by engaging in an annual physical exam, firefighters could catch a disease such as cancer at an early stage, firefighters suggested creating policies that required annual physical exams (1.1; 1.2; 1.3; 1.4). One participant mentioned, *“I suggest that an evaluation is made and that a general checkup be made of each member of the station, that’s how we begin to respect this disease [referring to Cancer]”* (G3, P7). Participants also shared a department level policy mandating an annual physical exam should be covered by their fire department given that the majority of firefighters do not have enough resources to cover physical exams (1.6).

Firefighters also stated health promotion activities related to cancer within their fire departments needed to change (1.5). The majority expressed if they received education

on the topic, they would be able to better protect themselves from cancer. One participant shared, *“We need educational talks about what produces it [referring to cancer], so that the firefighter becomes familiar with it...how can I prevent it...and once I hear that educational talk, I can apply it to myself. If I want you to learn to count to a thousand, I must teach you what those numbers are”* (G3, P6).

### **Theme II: Firefighters attribute Dominican culture for not engaging in medical checkups**

—Even though Dominican firefighters know routine medical checkups and engaging in prevention activities can result in early detection and improve cancer prognosis, they blamed their *“Dominican Culture”* for not engaging in such actions (2.1; 2.3; 2.4; 2.5; 2.6). It was common to hear during interviews, *“We do not go to the doctors to get checked up”* (G2, P1). When asked to comment more on what they referred to as the *“Dominican men culture”*, one firefighter responded, *“Dominican men normally have the culture of believing that if he’s not dying, there’s no reason to go to the doctor, only when it’s really bad. Because if it’s a small pain, he takes a pill. If he has a headache or a stomachache or had a foot fracture, and due to the swelling he can’t take it anymore, then he goes to the doctor...and that’s the Dominican men culture normally. I mean, they don’t have the initiative to check how’s their physical state periodically...it’s not part of their culture”* (G5, P6).

Another firefighter said, *“I don’t understand the reason as to why I need to go get my health checked by a doctor...you lose more by doing so. Because if I don’t feel anything is wrong with, why do I need to visit a doctor”* (G2, P2). Additionally, one of our key informants mentioned (2.7), *“Firefighters, many times, think that they [only] need to go to the doctor if they have pain. If I don’t have pain, well, I don’t go to the doctor...”* (KI, medical doctor).

### **Theme III: Expensive Medical Copays inhibit access to Healthcare**

—Healthcare utilization behaviors were heavily influenced by expensive medical copay payments. Dominican firefighters’ employers deduct a monthly medical insurance fee from their salaries, meaning all firefighters interviewed have access to a type of health coverage plan (3.1). Even though firefighters have access to a medical plan, participants emphasized that expensive copays inhibit them from visiting doctors for routine care (3.2; 3.5; 3.6; 3.7; 3.8). Firefighters conveyed their salary compensation is simply not enough to be able to afford copays. One participant shared, *“Firefighters on a national level, have very low salaries and that limits it a lot of times. If in a month you have 2,000.00 (Dominican pesos) to spare, you have to take 1,000.00 (Dominican pesos) for a medical check-up and then you may not have enough for food, or something”* (G5, P6).

## **DISCUSSION**

This study aimed to assess and understand Dominican Republic’s firefighters’ perceptions of work-related cancer risks and cancer prevention practices. Qualitative analysis of the focus group discussions and interview data indicated that DR firefighters are aware and concerned about their increased occupational cancer risk. However, various factors are affecting their engagement in cancer prevention activities.

Findings suggest firefighters lack personal protective equipment and breathing gear during emergency response, both of which are essential during fire suppression activities. The Lavender Ribbon Report by the International Association of Fire Chiefs states, as one of their 11 best-recommended actions to mitigate cancer, “full protective equipment (PPE) must be worn throughout the entire incident, including SCBA (breathing apparatus) during salvage and overhaul”.<sup>10</sup> A study by Fent et al. explained that even when wearing the highest level of respiratory protection there is still a chance of exposure to carcinogens. The Dominican Republic fire service leadership must assess this need because, in the long-term, it could be detrimental to their firefighters. Firefighters also identified how stress impacts their health and could lead to developing cancer. This finding is similar to Schaefer et. Al. as firefighters reported stress is a contributing risk factor for their long-term health and well-being.<sup>28</sup> As suggested by Dominican Firefighters, leadership should look into promoting activities were firefighters can learn how to manage stress post-emergency response and other factors contributing to their cancer risk.

Despite firefighters claiming it is part of their “*Dominican culture*” not to engage in routine medical visits, they expressed a positive attitude towards engaging in an annual physical exam. Firefighters indicated not having enough funds to pay for medical checkups copays and suggested DR fire departments create a policy offering all firefighters a fully funded annual physical screening exam so that they could better monitor their overall health. This finding was similar to Jahnke et al., in which firefighters participating in focus group discussions across the United States expressed a need for consistent medical screenings for early detection.<sup>29</sup> Furthermore, firefighters expressed a positive attitude towards participating in educational presentations on their occupational cancer risk and understanding the different ways they could mitigate their risk. Cancer prevention needs to be a priority within fire service leadership and policies promoting health and cancer prevention should be created at the department level.

### Strengths and Limitations

This qualitative research study is not without limitations. There is a possibility of selection bias. The fire stations participating in the focus group discussions were not randomly selected but rather selected by the fire service leadership from the participating fire brigades. Despite this possible bias, our key informants were comprised of a diverse group of fire department members across firefighter tenure, rank and role, giving space for a more intimate conversation and a variety of responses. Another limitation of our research is our study sample. Only one female firefighter participated in the research project; therefore, we could be missing the female firefighter perspective on the topics addressed. Only three fire departments were included in the study limiting the study’s generalizability. Despite our limitations, this study contributes significantly to the international occupational cancer prevention literature. It is the first research project, to our knowledge, assessing firefighters’ perception of cancer risk and prevention practices in a Low to Middle Income Country in the Caribbean.



## Implications and Future Directions

Findings provide data on what barriers firefighters face when engaging in cancer prevention activities, which can dictate how fire service leadership prioritizes educational activities within their department to target those behaviors. The gathered information could generate unique and targeted interventions to reduce the risk of cancer among the fire service and provide a healthier lifestyle for firefighters. Therefore, future research should focus on creating roadmaps in establishing cancer promotion programs unique to firefighters in the Caribbean. Lastly, the dissemination of the study findings will open communication about cancer prevention strategies with other fire departments throughout the Caribbean.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1.**

Socio-Demographic and Work Characteristics of Firefighters participating in Key Informant Interviews and Focus Group Discussions (n = 37), Dominican Republic, June 2019

| Characteristics                            | Total Sample n=37 <sup>†</sup> |
|--|--------------------------------|
| <b>Age</b>                                 |                                |
| 18–29 years old                            | 10 (27.0)                      |
| 30–39 years old                            | 14 (37.8)                      |
| 40–49 years old                            | 9 (24.3)                       |
| 50–59 years old                            | 3 (8.1)                        |
| 60 years old and older                     | 1 (2.7)                        |
| <b>Gender</b>                              |                                |
| Male                                       | 36 (97.3)                      |
| Female                                     | 1 (2.7)                        |
| <b>Ethnicity</b>                           |                                |
| Hispanic                                   | 37 (100.0)                     |
| Non-Hispanic                               | 0 (0.0)                        |
| <b>Educational Attainment</b>              |                                |
| Never Attended School                      | 1 (2.7)                        |
| Less than High School                      | 18 (48.6)                      |
| High School                                | 11 (29.7)                      |
| Greater than High School                   | 7 (18.9)                       |
| <b>Marital Status</b>                      |                                |
| Married                                    | 12 (32.4)                      |
| Divorced, Widowed or Separated             | 6 (16.2)                       |
| Never Married / Member of Unmarried couple | 19 (51.3)                      |
| <b>Years in the Fire Service</b>           |                                |
| 0–5 years                                  | 10 (27.0)                      |
| 6–10 years                                 | 4 (10.8)                       |
| 11–15 years                                | 6 (16.2)                       |
| 16–20 years                                | 8 (21.6)                       |
| 20 years or more                           | 9 (24.3)                       |
| <b>Mean ± SD</b>                           |                                |
| <b>Weekly Hours Worked</b>                 | 76.62 ± 35.05                  |
| <b>Annual Income (in USD)</b>              | 3,259.77 ± 5,876.66            |

<sup>†</sup>Differences in sub-total population sample due to item non-response or missing. SD = standard deviation

**Table 2.**

Summary of Key Themes, Dominican Firefighters Perceptions on Occupational Cancer Risks and Cancer Prevention Practices, Dominican Republic, June 2019.

| Categories   | Themes   |
|--|--|
| <b>Factors impacting occupational cancer risk</b>                  | Availability of Personal Protective Equipment                                  |
|  | Constant Toxic Exposure during Fire Suppression                                |
|  | Occupational Stress due to Emergency Response Experiences                      |
| <b>Factors impacting engagement in cancer prevention practices</b> | Lack of health promotion activities and policies at the fire department level  |
|  | Firefighter's attribute Dominican culture for not engaging in medical checkups |
|  | Expensive medical copays inhibit access to healthcare                          |

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