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Analysis of Health Risks and Conditions Associated with Smoke Inhalation in Wildfires

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Abstract

Introduction: Human health is increasingly threatened by environmental factors such as wildfires, which have risen globally and in Colombia. Wildfire smoke, rich in fine particulate matter, can trigger respiratory and systemic diseases, especially among vulnerable groups. In Girardot, Cundinamarca, limited awareness and prevention efforts highlight the need to assess the health risks of smoke exposure for targeted interventions. Objectives: This research specifically studies the impact of exposure to wildfire smoke on respiratory health in the population of the municipality of Girardot, Cundinamarca, between 2013 and 2023. The main objective is to determine the level of risk and health conditions associated with wildfire smoke exposure in the participating population. Methods: The methodology consisted of surveys administered to 104 participants, who were selected through random sampling. Participants provided sociodemographic information, information on their exposure to wildfire smoke, and information on the presence of respiratory symptoms. Data analysis employed descriptive and inferential statistical techniques, including chi-square and odds ratio (OR) tests with 95% confidence intervals. Microsoft Excel and R, version 4.4.1, were used for statistical data analysis. Results: The results reveal that nighttime exposure to wildfire smoke is associated with the onset of respiratory symptoms. Likewise, it was identified that workplace smoke exposure is also linked to the presence of respiratory symptoms. Conclusion: Therefore, the importance of adopting and implementing preventive, educational, and biosafety measures to mitigate and protect the health of the population in the event of future wildfires is highlighted. The negative effects of wildfire smoke inhalation on health are highlighted.

Keywords:
Environmental Exposure, Public Health, Respiratory Health, Wildfire Smoke

INTRODUCTION

Human health is affected by multiple factors that directly interact with a person's and community's environment. In recent years, there has been an increase in cases of wildfires not only in Colombia but around the world. The main causes of these conflagrations are climate change, pollution, and intense heat waves due to high temperaturas. The smoke releases form these fires contains substances and microparticles small enough to reach the lower respiratory tract, causing not only respiratory diseases but also systemic conditions such as cardiovascular diseases (Rizzo & Rizzo, 2025).

Therefore, the lack of awareness about the health alterations that can occur after inhaling smoke from wildfires may lead to future complications and even exacerbate the signs or symptoms of chronic diseases suffered by exposed individuals, such as hypertension, asthma, and chronic obstructive pulmonary disease (COPD) (Centers for Disease Control and Prevention, 2023).

According to the OECD (2020), air pollution is the main environmental risk to health worldwide and one of the leading causes of environmental degradation. UNEP (2021), as cited by Mejía in 2024, indicates that in the case of Latin America and the Caribbean, the main drivers of air pollution are "urban growth and economic development patterns that cause, among other problems, the increasing use of cars and motorcycles, as well as the longer distances traveled due to the progressive expansion of urban areas (Mejia, 2024).

The age groups at highest risk are the very young and the elderly, as well as individuals with pre-existing conditions and pregnant women (OECD, 2020), along with marginalized communities. According to the new guidelines issued by the Climate and Clean Air Coalition (CCAC), it is stated that "around 7 million people die each year from diseases and infections related to indoor and outdoor air pollution worldwide" It also mentions that 'in 2016, approximately 320,000 premature deaths were attributable to ambient air pollution in the region' (Climate and Clean Air Coalition (CCAC), 2021).

The European Environment Agency sets 45 μg/m³ as the strictest daily average limit for PM10 levels, and 15 μg/m³ for the annual average. However, the daily average was exceeded at 68% of the reported monitoring stations, and the annual average was exceeded in 77% of the reporting countries, except for Estonia and Iceland (Targa, Colina, Banyuls, Gonzalez-Ortiz & Soares, 2024).

In the Americas, according to the Public Health Situation Analysis of Wildfires in South America in 2024 conducted by the World Health Organization (WHO) and the Pan American Health Organization, it is established that in South America, the most critical months for wildfires coincide with the dry season, which varies depending on the geographical location and typically occurs between July and October. This time of year, is characterized by high temperatures that create environmental conditions conducive to the spread of fire (PAHO, 2024).

As stated in the Public Health Situation Analysis report (PAHO, 2025), "the pollutants generated by wildfires not only affect directly impacted areas but also nearby communities and even neighboring countries to which the wind carries the smoke." Consequently, the effects caused by pollutants from wildfires not only directly impact nearby populations but can also reach other regions and neighboring communities due to the dispersion of smoke by the wind.

According to the study conducted by Xu R, Yu P, Abramson MJ, Johnston FH, Samet JM, Bell ML, et al. (2020), cited by PAHO (2025, p. 5), 'wildfire smoke is a mixture of air pollutants, with particulate matter (PM) being the most dangerous to public health. Fine particulate matter can penetrate deep into the lungs and cause serious damage. Exposure to PM2.5 during wildfires has been associated with a higher risk of asthma attacks, hospitalizations, and increased use of medication for respiratory issues. In the long term, it has also been linked to premature deaths in the general population, in addition to worsening and causing diseases in the lungs, heart, brain/nervous system, skin, digestive tract, kidneys, eyes, nose, and liver. It has also been shown to contribute to memory loss and cognitive decline (Xu et al. 2020)

According to Directive 2008/50/EC of the European Parliament and of the Council (2008), cited by Almenar Muñoz (2017, p. 2), "in order to protect human health and the environment in general, it is particularly important to combat pollutant emissions at the source and to identify and implement the most effective emission reduction measures at the local, national, and community levels." Therefore, to ensure the protection of human health and the environment, both public and private institutions are required to adopt a comprehensive approach to mitigate and combat pollutant emissions through the implementation of preventive and educational measures at the local, regional, national, and international levels.

Recently, a tool has been developed namely, the Comprehensive Analysis of Vulnerability and Risk due to Climate Change in Colombia which was carried out within the framework of the Third National Communication to the United Nations Framework Convention on Climate Change. This study reveals that 'Colombia has increased its share of global emissions from 0.37% to 0.42% in recent years.' According to the World Resources Institute of the World Bank (WRI), Colombia ranks 40th globally in greenhouse gas (GHG) emissions and fifth among the 32 countries that make up Latin America and the Caribbean (Gobernación de Cundinamarca, 2024).

This climate risk analysis in the department of Cundinamarca indicates that the department ranks 17th in terms of vulnerability, including 15 municipalities and the city of Bogotá D.C. "In this

particular case, the most affected municipalities are Bogotá, Cota, and Girardot. Four major areas requiring special attention have also been identified: water resource management, biodiversity conservation, food security, and public health" (Gobernación de Cundinamarca, 2024).

Since these areas represent significant levels of risk, it is essential to address them as a priority in order to prevent severe impacts on the ecosystem and mitigate the effects of climate change in the Cundinamarca region; in recent years, Cundinamarca has lost nearly 5,000 hectares of primary and secondary forest due to fire (Gobernación de Cundinamarca, 2024).

In this regard, environmental impacts such as forest loss, the decline of wildlife, and the disappearance of water sources also affect the health of the population. Therefore, it is important to consider vulnerable patients with pre-existing heart conditions or a genetic predisposition to cardiovascular diseases, individuals from lower socioeconomic backgrounds, ethnic and racial minorities, pregnant women, youth under the age of 18, and elderly people over the age of 65, as they experience a higher risk of adverse cardiovascular events after exposure to wildfire smoke compared to the general population (Williams & Perreault, 2024).

Respiratory morbidity associated with exposure to wildfire smoke includes asthma, chronic obstructive pulmonary disease (COPD), bronchitis, and pneumonia. Epidemiological data linking wildfire smoke exposure to cardiovascular mortality and morbidity are mixed and inconclusive. Therefore, this study aimed to determine the level of risk and the health conditions associated with exposure to wildfire smoke in the rural areas belonging to District Two of the city of Girardot, between the years 2013 and 2023.

The justification for this research was based on the need to address the issue of air pollution caused by wildfires and its impact on human health. Therefore, this study will provide local authorities, institutions, and the community at large with valuable knowledge that will assist in making informed decisions and in implementing effective public policies to address the challenges faced by people exposed to air pollution caused by wildfires and its direct impact on human health.

METHOD

1. Design

The present study is descriptive and cross-sectional in nature, with a quantitative approach. According to Sampieri et al., this type of design aims to detail the most relevant properties, characteristics, and profiles of individuals, groups, communities, or other phenomena under analysis, allowing for the creation of a map of situations and events as they occur in reality (Sampieri, Fernandez & Baptista, 2014).

Variables such as age, sex, municipality of residence, personal medical history, and diagnosis were analyzed. The information was obtained from case records found during the evaluated period in public health databases at the departmental and municipal levels in Girardot. The databases were cleaned, validated, and processed using the statistical software Excel and R. The analysis was conducted using descriptive statistics, and the results were presented in tables and dynamic charts.

2. Population and Sample

The research consists of individuals over 18 years of age living in the various micro-territories that make up District Number 2 of the city of Girardot, in areas where at least one wildfire has occurred and who, therefore, have been exposed to wildfire smoke during the years 2013 to 2023. These are residents of the micro-territories belonging to District 2 of the city of Girardot, Cundinamarca, during the period 2013 – 2023.

Table 1. Number of families of Micro Territory, Girardot (2013 – 2023)

Micro Territory	Number of Family	Sample
Vereda San Lorenzo	82	104
Vereda Acapulco	48	
Vereda Agua Blanca	7	
Vereda Potrerillo	43	
Vereda el Progreso	28	

Note: Own elaboration

For this study, random sampling was used, focusing on the residents of the micro-territories that make up District Number 2 of the municipality of Girardot: Acapulco, San Lorenzo, Agua Blanca, Potrerillo, and El Buche. Specifically, the study was conducted with the participation of 104 residents from these hamlets (veredas).

The selection of study participants was based on specific inclusion and exclusion criteria. In this particular case, the inclusion criteria were: permanent residence in the micro-territories of San Lorenzo, Agua Blanca, Potrerillo, and Acapulco of District Number Two in the city of Girardot during the last ten years (2013–2023), being over 18 years of age, and a voluntary willingness to participate in the study by providing informed consent. On the other hand, the exclusion criteria were: temporary residence in the area, inability to autonomously respond to the survey due to cognitive or physical disabilities, refusal to provide informed consent, and minors without parental or guardian consent to participate.

3. Study Variables

In this research, certain variables were defined to assess the relationship between exposure to wildfire smoke and its effects on human health.

The dependent variable was associated with the presence of health effects due to the inhalation of wildfire smoke. It was measured through the frequency of respiratory symptoms, the number of respiratory disease cases, the number of medical consultations for respiratory problems, and the health-related quality of life index. The independent variable was exposure to wildfire smoke, measured in terms of duration and frequency of exposure. Moderator variables included demographic characteristics (age, sex, marital status, educational level, occupation, and place of residence) and the participants' pre-existing health conditions (chronic diseases prior to wildfire smoke inhalation). Finally, control variables included the use of personal protective equipment and access to healthcare services.

To collect the necessary information, a specific instrument was designed addressing two fundamental aspects: first, the characterization of the target population, and second, the level of exposure and health conditions associated with the inhalation of wildfire smoke.

4. Data Collection and Analysis

The data collection instrument consists of 25 questions, divided into two main phases:

The first phase focused on the characterization of the target population: this section gathered information on the sociodemographic characteristics of the population, with the aim of obtaining a comprehensive overview of the individuals involved.

The second phase focused on the level of risk and health conditions: this section made it possible to assess the level of exposure and the health conditions associated with the inhalation of wildfire smoke, identifying potential risks and consequences for human health.

As for the questions, they were organized into three categories:

1. *Personal and sociodemographic data:* information related to date of birth, identification document, sex, place of birth, phone number, age, marital status, level of education, occupation, and place of residence.
2. *Risk analysis related to wildfire smoke inhalation:* questions regarding smoke exposure, use of biosecurity devices, distance between the home and wildfire locations, and measures taken at home to prevent smoke inhalation.
3. *Health conditions associated with wildfire smoke inhalation:* questions related to signs and symptoms experienced after smoke inhalation, need for medical assistance, diagnosis of pulmonary or other systemic diseases, and use of medications to improve breathing.

Regarding the process carried out for data collection and analysis, it was conducted in five phases:

1. *Dissemination and outreach:* The first step was to inform the presidents of the Community Action Boards (JAC) of the targeted hamlets, who in turn informed the residents about the study.
2. *Informed consent:* Informed consent was obtained from each participant, ensuring their understanding of the study's objectives, the voluntary nature of participation, and the ethical and professional handling of the information.
3. *Survey administration:* Surveys were conducted through visits to each household in the micro-territories using the ArcGIS Survey 123 digital platform. The surveys were administered by student researchers under the supervision of the academic advisor.
4. *Data collection and storage:* Once collected, the data were securely stored in the ArcGIS Survey 123 database and later downloaded into an Excel spreadsheet for statistical analysis.
5. *Data analysis:* Microsoft Excel and the statistical data analysis software R (version 4.4.1) were used for data analysis. The validity and reliability of the measurement instrument were evaluated using Cronbach's Alpha, which yielded a value of 0.87, indicating good internal consistency. The statistical analysis was conducted based on the following criteria:
    a. Quantitative variables were analyzed using measures of central tendency (mean) and dispersion (standard deviation).
    b. Quantitative variables were tested for normality using the Shapiro-Wilk test.
    c. Qualitative variables were analyzed using frequencies and percentages.
    d. Possible differences between groups were assessed using the student's t-test for quantitative variables.
    e. To evaluate the association between qualitative variables, contingency tables were generated and analyzed using the Chi-square test and Odds Ratio (OR) with their 95% confidence intervals.

5. Research Ethics

The study was conducted in accordance with international guidelines from the Declaration of Helsinki and the Nuremberg Code. It also complied with national regulations established in Resolution 008430 of 1993 by the Ministry of Health of Colombia. It was classified as a risk-free study, as no intervention was carried out that could alter the biological, physical, mental, or social characteristics of the participants. Confidentiality and privacy of the data were guaranteed, and informed consent was obtained from each participant

RESULT

The results are presented in four key categories. First, the sociodemographic characterization of the participants revealed a homogeneous distribution in terms of sex, age, and educational level. Second, the level of risk, associated

with exposure to smoke from forest fires, showed a relationship with proximity to the fire zone and the use of biosecurity measures. Third, the analysis of health conditions indicated a positive association between smoke exposure and the presence of respiratory and skin symptoms among participants. Lastly, the study identified significant associations between the variables, highlighting the connection between smoke exposure, biosecurity practices, and proximity to the fire.

1. Sociodemographic Characterization

An analysis of 104 surveys was conducted. The mean age was 53.5 years (SD = 17.9), with the youngest participant being 19 years old and the oldest 94. Among the study group, men represented 44.4% (44/104) with a mean age of 47.7 years (SD = 21), while women accounted for 47.1% (49/104) with a mean age of 55.5 years (SD = 18). A statistically significant difference was found between the ages of men and women (t = 2.04; p = 0.04, t-student test).

It was also identified that 50% of families had three or fewer members. Similarly, 75% of families had three or fewer adults, and 75% had one or fewer elderly individuals and one or fewer children under the age of 15. The smallest household consisted of one person, while the largest had eight members. This indicates that the participating households are mainly composed of adult members.

Table 2. Description of the number of people who make up the families of adults exposed to smoke from forest fires

Family formation	Average	SD	0%	25%	50%	75%	100%
Adults in the family	2,6	1,5	0	2	2	3	8
Adults over 60	0,7	0,8	0	0	1	1	3
Men in the family	1,8	1,3	0	1	1	2	7
Women in the family	1,5	0,9	0	1	1	2	5
Children under 15	0,5	0,8	0	0	0	1	3
Family members	3,2	1,6	1	2	3	4	8

Note: Own Elaboration

It was reviewed whether there are individuals with chronic illnesses within the family, finding that 57.7% (60/104) reported no chronic illnesses, while 42.3% (44/104) stated that there are people in the household with chronic illnesses.

2. Level of Risk

Table 3. Contingency table of exposure to wildfire smoke based on participation in fire brigades and the use of biosecurity measures (face masks or goggles) among adults in the municipality of Girardot, Colombia

Participation in brigades	Did not use biosafety	Used biosafety
No	84	10
Yes	7	3

Nota: Author's elaboration

On the other hand, a hypothesis was generated suggesting that those with greater knowledge about the risks of inhaling wildfire smoke might be more likely to take preventive measures at home, such as closing doors and windows during a wildfire event (Table 3). It was found that there is indeed an association (X^2= 10.2, df=1; p = 0.01), meaning that individuals who are aware of the health effects caused by exposure to harmful particles such as ozone and nitrogen dioxide are more likely to keep doors and windows closed at home when there are active wildfires nearby. However, the obtained Odds Ratio (OR) was not conclusive, as the confidence intervals include one (OR = 1.6, 95% CI = 0.8 – 2.9).

3. Relationship with Health Conditions

Ten questions were asked to assess the relationship between forest fire smoke inhalation and health conditions. It was found that the majority of respondents (79.8%) had not experienced respiratory problems. However, 93.3% reported having skin symptoms such as itching, pruritus, irritation, or others after exposure to forest fire smoke. Only 5.8% had sought medical attention, and 4.8% had been hospitalized due to respiratory symptoms. Additionally, 10.6% reported having chronic illnesses, stating that they did not have these conditions prior to being exposed to forest fire smoke (see Table 4).

Table 4. Frequency and percentage of the relationship between forest fire smoke inhalation and health conditions in adults in the municipality of Girardot, Colombia

Questions	YES	NO	N/A
1. Did you experience any respiratory symptoms after inhaling smoke from forest fires between the years 2013 and 2023, such as coughing, difficulty breathing, or sore throat?	21 (20,2%)	83 (79,8%)	0
2. Does exposure to forest fire smoke cause any skin symptoms such as itching, pruritus, irritation, or others?	97 (93,3%)	7 (6,7%)	0
3. Did you go to the emergency service after experiencing these symptoms?	6 (5,8%)	98 (94,2%)	0
4. Have you been hospitalized due to illnesses related to exposure to forest fire smoke between the years 2013 and 2023?	5 (4,8%)	99 (95,2%)	0
5. Have you been hospitalized for respiratory illnesses in the last ten years (2013 to 2023)?	5 (4,8%)	92 (88,5%)	7 (6,7%)
6. Do you have any chronic illness for more than ten years that tends to worsen symptoms when exposed to forest fire smoke?	8 (7,7%)	96 (92,3%)	0
7. Have you been diagnosed with any chronic illness in the last ten years, such as high blood pressure or COPD (Chronic Obstructive Pulmonary Disease?	11 (10,6%)	93 (89,4%)	0
8. Are you still currently experiencing the signs and symptoms that appeared when you were exposed to forest fire smoke?	6 (5,8%)	98 (94,2%)	0
9. Before inhaling forest fire smoke, did you suffer from any chronic respiratory disease such as asthma, fibrosis, or COPD?	0	104 (100%)	0
10. Do you use any medications to help you breathe better when exposed to forest fire smoke, such as inhalers?	6 (5,8%)	98 (94,2%)	0

Note: Own elaboration

Table 5. Contingency table on respiratory symptoms and emergency room visits due to exposure to forest fire smoke in adults from the municipality of Girardot, Colombia

Symptoms	No Emergency Service	Emergency Service
No respiratory symptoms	81	2
Have respiratory symptoms	17	4

Note: Own elaboration

The hypothesis of an association between the presence of respiratory symptoms and hospitalization due to illnesses related to exposure to forest fire smoke was tested. It was found that two of the four intersections of the reviewed variables had observed frequencies less than five (Table 5), making the Chi-square test unreliable. The Odds Ratio (OR) showed that people with respiratory symptoms are 19.3 times more likely to have been hospitalized compared to those who did not show respiratory symptoms. The confidence interval is wide, indicating high variability in the estimate, but it confirms a strong association (OR = 19.3; 95% CI = 2.0 – 183.6).

Table 6. Contingency table on respiratory symptoms and having been hospitalized in the last ten years (2013 to 2023) due to exposure to forest fire smoke in adults in the municipality of Girardot, Colombia

Symptoms	Not hospitalized	Hospitalized
No respiratory symptoms	74	2
Have respiratory symptoms	18	3

Note: Own elaboration

It was identified whether there was an association between the presence of respiratory symptoms and the diagnosis of a chronic disease in the last 10 years. Observed frequencies lower than five were obtained in two of the four intersections of the variables reviewed (Table 6), so the Chi-square test would not be reliable. The OR indicated that people with respiratory symptoms are 4.7 times more likely to have a chronic disease compared to those without respiratory symptoms. However, the confidence intervals do not allow for a conclusion of statistical significance, as the lower bound of the interval is very close to one (OR = 4.7; 95% CI = 1.1 – 20.5).

Table 7. Contingency table on respiratory symptoms and continued presence of signs or symptoms after exposure to forest fire smoke in adults in the municipality of Girardot, Colombia

Symptoms	Do not use medication	Use medication
No respiratory symptoms	81	2
Have respiratory symptoms	17	4

Note: Own elaboration

Finally, the possible association between respiratory symptoms and the use of medication to improve breathing after exposure to wildfire smoke was analyzed. Observed frequencies were less than five in two of the four intersections of the variables reviewed (Table 7), so the Chi-square test would not be reliable. The OR indicated that individuals with respiratory symptoms are 9.5 times more likely to use medication to improve breathing compared to those without respiratory symptoms. The confidence intervals do not include one, indicating statistical significance (OR = 9.5; 95% CI = 1.6 – 56.3

DISCUSSION

This study found that exposure to smoke from forest fires significantly impacts the respiratory, cardiovascular, dermatological and psychological health of affected populations, particularly in vulnerable regions such as Latin America. These results align with international literature showing that inhaling fine particulate matter (PM2.5) from fire smoke increases acute respiratory symptoms and exacerbates chronic diseases, leading to hospitalisations for asthma and chronic obstructive pulmonary disease (Reisen et al., 2015; Gould et al., 2024).

In addition to respiratory effects, several studies indicate an increased cardiovascular risk, including arrhythmia, myocardial infarction, and decompensation in patients with heart failure. This is due to the systemic impact of fine particles on endothelial function and inflammation (Rizzo & Rizzo, 2025; Youssouf et al., 2014). These findings are consistent with our results, which demonstrate a differential impact on populations with chronic comorbidities.

Another relevant aspect identified is dermatological and ophthalmological involvement. Recent evidence has described an increase in medical consultations for atopic dermatitis, pruritus, and irritative lesions on the skin and mucous membranes following exposure to fire smoke, which is consistent with the findings of our study (Fadadu et al., 2021; Parga et al., 2025). This finding is particularly relevant in rural and working communities that are exposed to smoke for prolonged periods.

Conversely, the literature highlights the neurological and mental health effects associated with smoke from fires. For example, Calderón-Garcidueñas et al. (2021) demonstrated the role of chronic exposure to air pollutants in cognitive impairment and the increased risk of neurodegenerative diseases. Meanwhile, Bonilla et al. (2023) identified an increase in anxiety, depression and post-traumatic stress disorder (PTSD) in affected populations. Our results complement this evidence by revealing community perceptions of psychological distress following exposure to high-magnitude events.

In terms of inequality, the literature indicates that indigenous and rural communities, such as those studied, face a higher risk due to limited institutional response capacity and barriers to healthcare access (Berberian et al., 2022; Oliveira et al., 2023). This underlines the importance of epidemiological surveillance strategies and response plans that are adapted to local conditions.

Finally, this study emphasises the importance of integrating public health and environmental risk management perspectives into national policies, in line with international recommendations on climate change adaptation and health (Yu et al., 2022). Future research should focus on longitudinal analyses and the development of predictive tools that allow for the anticipation of health impacts based on the intensity and frequency of forest fires.

CONCLUSION

The sociodemographic results indicated a final sample of 104 people who met the inclusion criteria. The mean age of participants was 53.5 years, with a normal age distribution. The age difference between men and women was statistically significant. Regarding education, the majority of participants reported having a vocational education (46.2%). In terms of occupation, the predominant role was homemaker (34.6%), followed by farmers and peasants (14.4%).

The study also revealed that the majority of participants reside in rural areas (88.4%). No significant association was found between gender and type of residence. Household composition reflected families predominantly made up of adults, with a median of three members per family.

Overall, the analysis allowed for a detailed characterization of the sample, identifying sociodemographic patterns and establishing relevant statistical relationships between the variables studied.

The analysis of contingency tables and chi-square tests performed in this study revealed significant associations between wildfire smoke exposure and the presence of respiratory symptoms in the Girardot population. The results indicate that nighttime exposure to wildfire smoke while sleeping is significantly associated with the onset of respiratory symptoms. Likewise, workplace smoke exposure is also associated with the presence of these symptoms.

However, participation in fire brigades does not appear to be associated with the use of biosecurity devices, and awareness of the risks of wildfire smoke does not necessarily lead to the adoption of preventive measures such as closing doors and windows. Furthermore, although the use of biosecurity devices is associated with a lower incidence of respiratory symptoms, this association is inconclusive due to the observed frequency of fewer than five.

These findings underscore the need to strengthen community strategies for promoting and preventing respiratory illnesses, as well as to improve education about the risks of wildfire smoke and the importance of adopting biosafety measures. Implementing educational resources and holding community meetings can be effective tools for increasing awareness and resilience in the face of future wildfire events.

Finally, the research highlights the importance of adopting preventive and educational measures to mitigate the negative effects of wildfire smoke inhalation on human health, promoting a healthier and safer environment for the population of Girardot.

Conflict of Interest

The authors declare no conflicts of interest.

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