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Awareness of wildfire smoke among U.S. adults with and without asthma

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Abstract

Objective: To describe awareness of ambient wildfire smoke among U.S. adults with and without asthma.

Methods: We analyzed data from the summer wave of the 2021 *ConsumerStyles* survey, a nationally representative survey of 4085 U.S. adults. Respondents self-reported their asthma status and awareness of wildfire smoke where they lived in the past 12 months. We linked survey responses by zip code of residence with satellite-detected wildfire smoke plume data that estimated the daily maximum smoke plume density over the preceding year. We estimated associations between asthma status and awareness of wildfire smoke across categories of maximum smoke plume density and days with medium- or heavy-density smoke as prevalence ratios (PRs) with 95% confidence intervals (CIs) using predicted marginal probabilities from logistic regression models.

Results: Over 98% of the estimated population of U.S. adults lived in a zip code affected by ≥ 1 day of medium- or heavy-density wildfire smoke, which occurred on an average of 16 days in the past year. Awareness of wildfire smoke was reported by 19% of U.S. adults and was higher among

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Disclaimer

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adults with than without asthma (PR: 1.25; 95% CI: 1.01, 1.55), including in zip codes affected by heavy-density smoke (PR: 1.30, 95% CI: 1.04, 1.63) and with 22 or more days of medium- to heavy-density smoke (PR: 1.22, 95% CI: 1.01, 1.47).

Conclusions: Although awareness of wildfire smoke was higher among U.S. adults with than without asthma, low percentages of awareness overall indicate a need for health communication about wildfire smoke and its health risks.

Keywords

Air; communication; exposure; health; survey

Introduction

Associations between exposure to wildland fire smoke and exacerbations of respiratory health conditions, as indicated by increases in respiratory emergency department visits and hospital admissions, are well described (1–7). It is therefore important for individuals, including those with existing respiratory health conditions, to be aware of wildland fire smoke from prescribed fires and wildfires affecting their communities and potentially their health. Forecasts of geographic areas of the United States at increased risk of wildfires are publicly available (8). Information about the movement of smoke plumes potentially affecting U.S. communities is also available and used extensively during wildfire smoke episodes (9). Resources that scientists, public health professionals, emergency management officials, and health care providers can use to educate themselves and develop messages to communicate with populations at increased risk of wildfire smoke exposure about how to reduce their exposure to wildfire smoke are also widely available (1,2,10–12). In light of our understanding of the potential health impacts of exposure to wildfire smoke and the readily-available information about the occurrence and movement of wildfire smoke, it is not only important, but also practicable for individuals to be aware of wildfire smoke affecting their communities and potentially their health.

Previous epidemiologic research about air quality awareness suggests that being aware of air quality alerts and changing behaviors when one thought that the air quality was poor are both more common among adults with asthma than among adults without asthma (13,14). Despite decades of improvements in ambient air quality, especially in ambient particulate pollution concentrations (15,16), the majority of people in the United States have experienced increasing numbers of days of wildland fire smoke in recent years (17). While the observed increase in wildfire smoke has affected large geographic areas of the United States, the populations most affected have been in economically disadvantaged communities, where individuals might have limited resources not only to alert them to the presence of smoke, but also to reduce the health impacts of such exposures (17). To further improve our understanding of the extent to which individuals with asthma whose asthma symptoms might be increasingly exacerbated by the increasing numbers of days of smoke exposure we sought to assess awareness of wildfire smoke in the United States. Specifically, we analyzed responses to a survey conducted in 2021, a year that followed an exceptionally active year for wildfires (18), to describe self-reported awareness of wildfire smoke among U.S. adults with and without asthma.

Methods

Study population

We analyzed data from the summer wave of the 2021 ConsumerStyles survey, hereafter referred to as SummerStyles. SummerStyles, is a cross-sectional survey commissioned by Porter Novelli Public Services (Washington, DC) during June 2–21, 2021. Respondents were a random sample of adults registered with Ipsos' KnowledgePanel,[®] an online panel of approximately 60,000 non-institutionalized adults in the United States. Sampling of potential respondents was probability-based to be representative of the U.S. adult population. In 2021, SummerStyles was conducted among adults who responded to the spring wave of the ConsumerStyles survey during March 23–April 13, 2021. The spring wave of the survey was sent to 10,919 adults and completed by 6455 adults (spring wave response rate: 59.1%). The SummerStyles survey was completed by 4085 of 5741 spring wave respondents (SummerStyles response rate: 71.2%). The population of 4085 SummerStyles respondents is our final study population.

Measures

Each 2021 SummerStyles respondent answered the following question: *During the past 12 months, was there any time you thought, or you were informed, that there was wildfire smoke in the air where you live?* Respondents replied with *yes*, *no*, or *don't know*, or they declined to answer. As in previous analysis of ConsumerStyles data (13,14,19,20), we categorized *don't know* and missing responses as *no*. Responses are interpreted as indicating the respondents' *awareness of wildfire smoke*. For each respondent, SummerStyles data include demographic information, including age, educational attainment, race/ethnicity, sex, and U.S. Census region. Respondents self-reported currently having or having had asthma in the past year by answering the question: *During the past year, have you had (or do you currently have) any of these health conditions?* The question was followed by a list of health conditions, including asthma.

To estimate ambient exposure to wildfire smoke, we used satellite-detected wildfire smoke plume data from the U.S. National Oceanic and Atmospheric Administration (NOAA) Hazard Mapping System (21). Hazard Mapping System data are estimates of smoke plume density that are based on expert image analysts' visual classifications of smoke plumes recorded by near real-time polar and geostationary satellite observations (21). Smoke plume densities are qualitatively categorized as light, medium, and heavy based on the apparent opacity of the smoke plumes in the satellite imagery (21). Technical details about the satellite equipment and the classification of smoke density are available in the Hazard Mapping System documentation (21).

Statistical analysis

For the present analysis, we used Hazard Mapping System data for each day between June 2, 2020 and June 1, 2021, inclusive, a time period corresponding to the year before the SummerStyles surveys were completed. For each day during that period, we assigned to each U.S. zip code the maximum density plume observed in the zip code. For each zip code,

we then calculated the total numbers of days of light-, medium-, and heavy-density smoke and linked these totals with each respondent's data by zip code of residence.

The SummerStyles survey was designed and conducted to be representative of the U.S. adult population. To accomplish this representativeness the data are proportionally weighted the data to match U.S. Current Population Survey proportions of nine factors: age, educational attainment, household income, household size, metropolitan status, parental status of children 12–17 years old, race/ethnicity, sex, and U.S. Census region.

We conducted descriptive analyses to generate weighted prevalences of self-reported awareness of wildfire smoke and potential exposure to wildfire smoke across categories of the maximum density smoke plume (none or light, medium, and heavy) and with days of medium- and heavy-smoke plume density (0, 1–7, 8–14, 15–21, and 22–83 days). All descriptive analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, North Carolina). Associations between asthma status and self-reported awareness of wildfire smoke were estimated as prevalence ratios (PRs) with 95% confidence intervals (CIs) using predicted marginal probabilities from logistic regression models in SAS-callable SUDAAN (RTI International, Research Triangle Park, North Carolina). The regression models were adjusted for age (18–29, 30–44, 45–59, and 60–94 years), educational attainment (less than high school, high school, some college, bachelor's degree or higher), race/ethnicity (White, non-Hispanic; Black, non-Hispanic; 2+ races, non-Hispanic; other, non-Hispanic; Hispanic), sex (female, male), and U.S. Census region (Midwest, Northeast, South, West). PRs are interpreted as, for example, the prevalence of wildfire smoke awareness among adults with asthma compared to the prevalence of wildfire smoke awareness among adults without asthma. The study protocol for the present analysis was reviewed and determined to be exempt from full institutional review board review at the Centers for Disease Control and Prevention.

Results

Characteristics of the 4085 U.S. adults included in this analysis are shown in Table 1. Overall, 303 adults, corresponding to 7.4% (95% CI: 6.4, 8.4) of the weighted population estimate of U.S. adults, reported having asthma currently or in the past year. When we linked survey responses with estimates of smoke plume density, we found that respondents experienced an average of 37.6 days (95% CI: 37.2, 38.0) of light-density smoke, 8.9 days (95% CI: 8.7, 9.1) of medium-density smoke, and 7.1 days (95% CI: 6.7, 7.4) of heavy-density smoke in the past year. Combining medium- and heavy-density smoke days yielded an average of 16.0 days (95% CI: 15.5, 16.5) of medium- or heavy-density smoke in the past year (range: 0–83 days). In total, 19.1% (95% CI: 17.8, 20.5) of the weighted population estimate of U.S. adults reported being aware of wildfire smoke where they lived during the past 12 months. Days of medium- or heavy-density smoke in the past year and awareness of wildfire smoke were both highest in the western U.S. Census region. For example, adults in the western U.S. Census region experienced an average of 32.8 days of medium- or heavy-density smoke, compared to 18.4 days in the midwestern region and fewer than 10 days in the northeastern and southern regions. Similarly, the weighted percentage of adults aware of wildfire smoke where they lived in the past 12 months was 56.9% in the western

U.S. Census region and less than 9% in each of the remaining regions. The percentage of the weighted population estimate of U.S. adults aware of wildfire smoke was modestly higher among adults with asthma (24.3%; 95% CI: 18.7, 29.9) than among adults without asthma (18.7%; 95% CI: 17.3, 20.2).

When we examined the maximum-density smoke plume detected in zip codes in which respondents lived and days of medium- or heavy-density smoke plumes, we found that 98.7% of the weighted population estimate of U.S. adults lived in a zip code affected by one or more days of medium- or heavy-density smoke (Table 2) and that this percentage varied little by U.S. Census region: Midwest: 99.9%, Northeast: 99.5%, South: 98.3%, West: 97.9%. For 43.9% of the weighted population estimate, the medium- or heavy-density smoke plumes occurred on 15 or more days in the past year (Table 2), though this percentage varied considerably by region: Midwest: 74.3%, Northeast: 0.1%, South: 13.3%, West: 97.7%. Overall, the percentage of the weighted population estimate of U.S. adults aware of wildfire smoke where they live was highest in zip codes with heavy-density smoke plumes (20.2%; 95% CI: 18.6, 21.7) (Table 2) and this percentage was driven by awareness reported in the western U.S. Census region (Midwest: 6.5%, Northeast: 5.7%, South: 5.1%, West: 57.7%). The percentage of adults aware of wildfire smoke where they live was also highest among those with 22 or more days of medium- to high-density smoke (49.4%; 95% CI: 45.9, 52.9) (Table 2) and, similarly, this percentage was driven by awareness reported in the western U.S. Census region (Midwest: 18.2%, Northeast: 0.0%, South: 8.8%, West: 59.8%).

Overall, adjusted associations between asthma status and awareness of wildfire smoke indicate that awareness of wildfire smoke was 25% higher among adults with asthma than among adults without asthma (PR: 1.25; 95% CI: 1.01, 1.55) (Table 3). When we assessed associations across categories of the two metrics of potential exposure to wildfire smoke, we found increased adjusted associations among adults in zip codes affected by heavy-density smoke plumes (PR: 1.30; 95% CI: 1.04, 1.63) and with 22 or more days of medium- to high-density smoke (PR: 1.22; 95% CI: 1.01, 1.47).

Discussion

To investigate awareness of wildfire smoke among U.S. adults, we compared percentages of adults with and without asthma reporting awareness of wildfire smoke in the air where they live. We estimated that over 98% of U.S. adults lived in an area affected by medium- or heavy-density smoke plumes in the year preceding the survey, while just 19% reported being aware of the wildfire smoke. Awareness was 25% higher among adults with than without asthma, 30% higher among adults with than without asthma in areas with heavy-density smoke plumes, and 22% higher among adults with than without asthma in areas affected by three or more weeks of medium- to heavy-density smoke plumes. Taken together, these findings indicate higher awareness of wildfire smoke among U.S. adults with than without asthma, especially in geographic areas with the most intense or longest duration exposures. The observation that fewer than a third of U.S. adults with asthma were aware of wildfire smoke in the areas where they live also reveals opportunities for improvements in health communication about the presence of wildfire smoke for a population at increased risk of exacerbations of their asthma symptoms.

The year preceding the 2021 SummerStyles survey corresponded to the period of June 2, 2020–June 1, 2021. During this time, residents of the western United States witnessed a series of major wildfires, including the August Complex fires, which burned over one million acres in northern California between August 16 and November 11, 2020 (23). An analysis by the U.S. National Aeronautics and Space Administration indicates that smoke from the August Complex fires reached approximately four kilometers in elevation on August 31, 2020 (24), increasing the potential for smoke to be transported long distances from the fires and to affect regional, and even continental, air quality (25). Indeed, although the 2020 August Complex fires were record-breaking fires, individuals in the western United States during the June 2, 2020–June 1, 2021 time period experienced numerous record-breaking fires, including the SCU Lightning Complex, LNU Lightning Complex, and Creek fires in California and the Cameron Peak and East Troublesome fires in Colorado (26,27). Given the remarkable year for large wildfires in the western United States, the higher percentage of adults in the western region than in the remaining regions who reported being aware of wildfire smoke is unsurprising. Perhaps the more surprising finding is that less than 9% of adults in remaining regions reported being aware of wildfire smoke in the past year, since at least 98% of adults in each region resided in zip codes with any medium- or heavy-density smoke plumes.

The data, and thus our findings, should be interpreted considering several potential limitations. First, forest and land management officials, air quality experts, public health officials, and others often distinguish between prescribed fires and wildfires. *Prescribed fires* originate from planned ignitions in accordance with applicable laws, policies, and regulations to meet specific objectives (28), including land management objectives. In contrast, *wildfires* are non-structure fires originating from unplanned ignitions, such as lightning, volcanoes, unauthorized and accidentally human-caused fires, and those originating from prescribed fires that are subsequently declared wildfires (28). Together, prescribed fires and wildfires are referred to as *wildland fires*, as they are both non-structure fires that occur in vegetation or natural fuels (28). We cannot be sure whether adults reporting awareness of wildfire smoke were aware of whether the smoke originated from a prescribed fire or a wildfire. We conducted our analysis and interpret our findings based on the assumption that responses indicate awareness of smoke from fires of either type. This assumption might have resulted in misclassification of awareness, especially in geographic areas impacted more intensely or frequently by smoke from prescribed fires than from wildfires. In fact, we also cannot be sure that *don't know* ($n = 180$, 4.4%) and missing ($n = 14$, 0.3%) responses to the survey question about awareness of wildfire smoke do not reflect uncertainty about whether the question also included awareness of smoke from prescribed fires. Collecting additional information about whether respondents were aware of smoke from prescribed fires might have reduced misclassification affecting these data.

Second, our ability to draw conclusions about awareness of wildfire smoke among U.S. adults in areas affected by only light-density smoke in the past year was limited by the small number of respondents categorized as such. Of the 56 respondents in areas with no smoke or only light-density smoke detected in the past year, 29 were in areas with only light-density smoke, of whom 7 reported awareness of wildfire smoke. These small numbers limited our ability to analyze and draw conclusions about awareness of light-density wildfire smoke

among adults by asthma status. Third, although the survey question asked respondents whether they were aware of wildfire smoke where they lived in the past year, it is possible that respondents could have answered the question based on awareness of smoke outside of their residential zip code or longer than one year ago. Such responses could have resulted in misclassification of exposure, which might have disproportionately affected areas with little or infrequent wildfire smoke. Additional information about the density, location, and timing of the wildfire smoke reported by adults in these areas would improve our ability to draw conclusions about awareness of light-density smoke. Lastly, respondents self-reported their asthma status and we have no information with which to validate their responses. Information with which to validate their responses, along with additional information about asthma severity or symptom frequency, would provide valuable information about awareness of wildfire smoke among individuals with asthma ranging from mild to severe.

Preexisting asthma is just one of the well-described health conditions that increase an individual's risk of experiencing symptoms or exacerbations of their health conditions during or following exposure to wildfire smoke (1,2,29). People with other respiratory diseases, including chronic obstructive pulmonary disease, people with cardiovascular disease, children, older adults, pregnant women, and people with increased exposure to wildfire smoke, such as outdoor workers, are all at increased risk of adverse health effects due to wildfire smoke exposure (1,2,10,29). Our study focused on wildfire smoke awareness among adults with and without asthma and cannot be used to draw conclusions about wildfire smoke awareness among children with or without asthma or among their parents, guardians, or other caretakers. Similarly, our findings cannot be used to draw conclusions about wildfire smoke awareness among persons with or without other conditions that affect their risk of experiencing health effects due to wildfire smoke exposure. Nonetheless, our finding that 19% of adults self-reported being aware of wildfire smoke in the past year, while >98% of adults lived in a zip code affected by one or more days of medium-or heavy-density smoke in the past year, indicates a need for increased awareness of wildfire smoke among all adults, regardless of health or risk status.

Resources informing individuals about the presence of wildfire smoke in their U.S. communities largely overlap the resources that provide information about air quality, including particulate pollution and ozone. For example, the U.S. Air Quality Index (AQI), a color-coded categorization of air quality is available at www.AirNow.gov, via the AirNow app, by email, and on AQI widgets added to websites, computer desktops, and mobile device screens. Each AQI category has associated activity guidelines identifying who needs to be concerned about the air quality at each index level and what actions individuals can take to reduce their air pollution exposure. AirNow.gov and the AirNow app both show the locations of air quality monitors color-coded to AQI categories; however, air quality monitors are notably absent in some areas, especially rural areas, of the United States. Privately-operated air monitoring networks (e.g. PurpleAir, Inc., Draper, Utah) and air quality forecasts (e.g. BreezoMeter by Google, Mountain View, California) provide alternatives to the U.S. Air Quality Index that can be especially useful in areas without U.S. air quality monitoring network monitors. AirNow.gov and the AirNow app both include options to display fire and smoke maps (e.g. <https://fire.airnow.gov/>) showing satellite-detected fires and smoke plumes. Information about the presence of fires and smoke

plumes, like information about air pollution from non-fire sources, can be used to alert individuals of poor air quality that can affect their health so that they can take actions to avoid or reduce exposure to air pollution and protect their health. Actions recommended to reduce exposure to wildfire smoke often include limiting time spent outdoors, staying indoors in a space with air filtered by a portable air cleaner or high-efficiency air filter, and wearing an N95 respirator if you must go outside when air quality is poor (10,30).

Previous analysis of survey data collected by Porter Novelli Public Services, Inc. during 2016–2018 indicates that changes in behavior when one perceives or is alerted about poor ambient air quality are relatively uncommon; for example, only 9% of adults reported spending less time outdoors and just 3% reported doing less strenuous activity (14). The percentages increased with increasing days of poor air quality and were slightly higher among adults with asthma than among adults without asthma. Additional information about the barriers people face to taking actions that reduce their exposure to air pollution, and subsequent efforts to address those barriers, might facilitate changes in behaviors that reduce air pollution exposures, including among individuals most at risk.

Conclusion

In 2021, percentages of U.S. adults reporting awareness of wildfire smoke were higher among adults with asthma than without asthma. However, overall, fewer than a third of U.S. adults with asthma were aware of wildfire smoke in the areas where they live, indicating opportunities for increasing awareness about the presence of wildfire smoke, the health effects of wildfire smoke exposure among adults with asthma, and appropriate self-protective actions. We anticipate that these findings will be useful to environmental health professionals, epidemiologists, public health communicators, and others interested in protecting U.S. adults from wildfire smoke.

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Table 1. Characteristics of 2021 SummerStyles respondents, days of medium- or heavy-density smoke, and self-reported awareness of wildfire smoke.

Characteristics	All respondents		With asthma		Medium- or heavy-density smoke		Aware of wildfire smoke	
	No. ^a	Weighted % (95% CI) ^b	No. ^a	Weighted % (95% CI) ^c	Weighted mean no. days (95% CI)	No. ^d	Weighted % (95% CI) ^e	
All respondents	4085	100.	303	7.4 (6.4, 8.4)	16.0 (15.5, 16.5)	850	19.1 (17.8, 20.5)	
Age, in years								
18–29	380	19.9 (18.0, 21.7)	25	7.1 (4.2, 9.9)	16.4 (15.0, 17.8)	55	14.5 (10.6, 18.3)	
30–44	1002	25.4 (23.8, 27.0)	71	6.6 (4.8, 8.4)	16.5 (15.4, 17.6)	215	20.1 (17.2, 22.9)	
45–59	1170	25.0 (23.5, 26.5)	98	8.6 (6.8, 10.5)	15.7 (14.9, 16.6)	223	18.9 (16.3, 21.4)	
60–94	1533	29.7 (28.2, 31.2)	109	7.3 (5.8, 8.7)	15.5 (14.7, 16.2)	357	21.7 (19.5, 23.9)	
Asthma ^d								
No	3782	92.6 (91.6, 93.6)	-	-	15.9 (15.4, 16.4)	770	18.7 (17.3, 20.2)	
Yes	303	7.4 (6.4, 8.4)	303	100.	16.9 (15.0, 18.8)	80	24.3 (18.7, 29.9)	
Educational attainment								
Less than high school	209	11.0 (9.5, 12.5)	17	8.1 (4.0, 12.2)	16.1 (13.9, 18.4)	31	13.8 (8.8, 18.8)	
High school	1015	27.3 (25.7, 29.0)	73	7.7 (5.6, 9.7)	15.1 (14.2, 16.0)	167	15.9 (13.3, 18.5)	
Some college	1244	30.1 (28.4, 31.7)	103	8.0 (6.3, 9.7)	16.5 (15.6, 17.4)	296	22.1 (19.4, 24.7)	
Bachelor's degree or higher	1617	31.6 (30.0, 33.2)	110	6.3 (5.0, 7.6)	16.2 (15.4, 17.0)	356	21.0 (18.8, 23.2)	
Race/ethnicity								
White, non-Hispanic	3028	63.2 (61.3, 65.1)	230	8.0 (6.8, 9.2)	15.5 (15.0, 16.0)	604	18.1 (16.6, 19.6)	
Black, non-Hispanic	311	11.7 (10.3, 13.0)	30	9.2 (5.5, 12.9)	11.1 (10.0, 12.2)	34	8.6 (5.5, 11.7)	
2+ races, non-Hispanic	130	1.8 (1.5, 2.2)	13	9.7 (4.1, 15.3)	18.3 (16.0, 20.6)	44	28.4 (19.7, 37.1)	
Other, non-Hispanic	204	6.9 (5.9, 8.0)	10	4.8 (1.8, 7.8)	20.4 (18.2, 22.7)	52	27.6 (20.6, 34.6)	
Hispanic	412	16.3 (14.7, 17.9)	20	4.5 (2.3, 6.8)	19.1 (17.3, 20.9)	116	26.2 (21.4, 31.0)	
Sex								
Female	1988	51.6 (49.8, 53.4)	187	9.5 (8.0, 11.1)	16.1 (15.4, 16.8)	400	18.7 (16.7, 20.7)	
Male	2097	48.4 (46.6, 50.2)	116	5.1 (4.1, 6.2)	15.8 (15.1, 16.5)	450	19.6 (17.7, 21.6)	
U.S. Census region ^e								
Midwest	898	20.7 (19.3, 22.2)	71	8.2 (6.0, 10.4)	18.4 (17.9, 18.8)	72	6.5 (4.8, 8.2)	
Northeast	764	17.4 (16.0, 18.7)	54	7.4 (5.2, 9.6)	8.7 (8.6, 8.8)	41	5.8 (3.7, 7.9)	
South	1468	38.0 (36.2, 39.8)	95	6.6 (5.0, 8.2)	7.4 (7.1, 7.8)	145	8.4 (6.8, 9.9)	

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Characteristics	All respondents		With asthma		Medium- or heavy-density smoke		Aware of wildfire smoke	
	No. ^a	Weighted % (95% CI) ^b	No. ^a	Weighted % (95% CI) ^c	Weighted mean no. days (95% CI)	No. ^a	Weighted % (95% CI) ^c	
West	955	23.9 (22.3, 25.5)	83	7.9 (6.0, 9.7)	32.8 (31.7, 34.0)	592	56.9 (53.0, 60.7)	

^aUnweighted number of respondents.

^bWeighted column %, with 95% confidence interval (CI).

^cWeighted row %, with 95% CI.

^dCurrently or in the past year.

^eDefined by the U.S. Census Bureau (22): *Midwest*: Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, North Dakota, Nebraska, Ohio, South Dakota, Wisconsin; *Northwest*: Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont; *South*: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia, Washington DC; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, Wyoming.

Satellite-detected measures of potential exposure to wildfire smoke in the past 12 months and self-reported awareness of wildfire smoke among adults in the United States, 2021.

Table 2.

All respondents			Aware of wildfire smoke	
	No. ^a	Weighted % (95% CI) ^b	No. ^a	Weighted % (95% CI) ^c
Maximum density smoke plume				
None or light	56	1.3 (0.9, 1.6)	9	17.1 (5.5, 28.8)
Medium	576	14.5 (13.2, 15.8)	86	13.3 (10.2, 16.3)
Heavy	3453	84.2 (82.9, 85.6)	755	20.2 (18.6, 21.7)
Days of medium- or heavy-density smoke plume				
0	56	1.3 (0.9, 1.6)	9	17.1 (5.5, 28.8)
1–7	967	24.4 (22.8, 26)	104	8.8 (6.9, 10.7)
8–14	1266	30.5 (28.8, 32.2)	62	5.1 (3.6, 6.7)
15–21	660	16.1 (14.8, 17.4)	74	9.4 (7.0, 11.8)
22–83	1136	27.8 (26.1, 29.4)	601	49.4 (45.9, 52.9)

^aUnweighted number of respondents.

^bColumn percentage of the weighted population estimate, with 95% confidence interval (CI).

^cRow percentage, with 95% CI.

Table 3.

Percentages of adults with asthma and without asthma who reported being aware of wildfire smoke where they lived in the past year and associations between asthma status and wildfire smoke awareness, across categories of maximum smoke plume density and days of medium- or heavy-density smoke plume.

	With asthma ^a		Without asthma ^a	
	Weighted % (95% CI) ^b	aware of wildfire smoke	Weighted % (95% CI) ^b	aware of wildfire smoke
Total	24.3 (18.7, 29.9)		18.7 (17.3, 20.2)	1.25 (1.01, 1.55)
Maximum density smoke plume				
None or light	– ^e		15.6 (3.2, 28.0)	– ^e
Medium	9.3 (1.5, 17.1)		13.5 (10.3, 16.8)	0.80 (0.34, 1.90)
Heavy	26.6 (20.3, 33.0)		19.7 (18.1, 21.3)	1.30 (1.04, 1.63)
Days of medium- or heavy-density smoke plume				
0	– ^e		15.6 (3.2, 28.0)	– ^e
1–7	5.4 (0.9, 9.8)		9.1 (7.1, 11.1)	0.66 (0.29, 1.48)
8–14	9.2 (0.0, 19.6)		4.8 (3.3, 6.3)	1.92 (0.64, 5.73)
15–21	10.6 (0.2, 20.9)		9.3 (6.8, 11.8)	1.65 (0.83, 3.26)
22–83	59.7 (48.5, 71.0)		48.5 (44.8, 52.2)	1.22 (1.01, 1.47)

^aCurrently or in the past year.

^bRow percentage, with 95% Confidence Interval (CI).

^cPrevalence ratio (PR), with 95% CI.

^dAdjusted for age, educational attainment, race/ethnicity, sex, and U.S. Census region.

^eNot estimated due to the small number of respondents with asthma in the category of none or light-density smoke plume.