

## Cigarette Smoking Patterns Among Racial and Ethnic Groups With Chronic Lung Diseases During the COVID-19 Pandemic



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**Introduction:** Chronic obstructive pulmonary disease and asthma are significant respiratory conditions that contribute to substantial morbidity and mortality globally. Chronic obstructive pulmonary disease remains the third most prevalent cause of death worldwide, with 90% of chronic obstructive pulmonary disease deaths attributed to combustible cigarette smoking. Asthma, although often less fatal, leads to considerable health burdens, particularly among marginalized populations who are at higher risk for both more severe chronic obstructive pulmonary disease and asthma outcomes. This study investigates the association between race/ethnicity and current cigarette smoking among adults diagnosed with chronic obstructive pulmonary disease and/or asthma in the U.S. before, during, and after the COVID-19 pandemic.

**Methods:** The authors analyzed data from 10,763 adults (aged  $\geq 40$  years) with a history of chronic obstructive pulmonary disease and/or asthma surveyed in the 2019, 2021, and 2023 National Health Interview Survey. The authors estimated predicted probabilities derived from multiple logistic regression and negative binomial regression models to examine changes in (1) the prevalence of current cigarette smoking in the target population, (2) the mean number of days of cigarette smoking in the past 30 days, and (3) the mean number of cigarettes smoked in the past 30 days across racial/ethnic subgroups and prepandemic, pandemic, and postpandemic periods.

**Results:** Current cigarette smoking was reported by about one fifth (20%) of U.S. adults diagnosed with chronic obstructive pulmonary disease and asthma. Among them, the mean number of days of cigarette smoking in the past 30 days was 27 days, and the mean number of cigarettes smoked in the past 30 days was 14. Hispanic individuals had the lowest prepandemic rates of current cigarette smoking (10.5%); however, it was the only racial/ethnic group showing a significant change during the pandemic, with rates increasing to 14.9% during the pandemic. Non-Hispanic White individuals, who showed the highest rates of current cigarette smoking (21.1%) during the pandemic, were the only racial/ethnic group showing a significant decline in the postpandemic period (19.8%). No significant changes were observed in the mean number of days or cigarettes smoked in the past 30 days, except for a marginally significant increase in cigarette consumption among non-Hispanic Black individuals.

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**Conclusions:** These analyses suggest that the pandemic had a differential impact on the rates of current smoking across racial/ethnic subgroups in adults with chronic obstructive pulmonary disease and/or asthma, with a detrimental effect in Hispanic individuals and an improvement among non-Hispanic White individuals. Given the dangers of smoking in chronic lung conditions, future research should investigate the factors behind these to develop targeted interventions.

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## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) remains a leading cause of global mortality, standing as the third leading cause of death worldwide,<sup>1</sup> with 138,825 deaths in the U.S. alone in 2021. This high mortality rate is predominantly driven by cigarette smoking, which is responsible for approximately 80%–90% of all COPD-related deaths.<sup>2,3</sup> Smoking causes irreversible lung damage, leading to progressive airway obstruction and exacerbations that dramatically increase the risk of hospitalization and premature death.<sup>4</sup> Although asthma is considerably less fatal, it still presents a substantial health burden, especially for marginalized populations during the coronavirus disease 2019 (COVID-19) pandemic.<sup>5,6</sup> These challenges are further compounded by socioeconomic and environmental factors, which disproportionately impact marginalized communities, worsening respiratory health and deepening existing health disparities.<sup>1,7</sup>

One critical factor contributing to the disparities in respiratory outcomes is cigarette smoking, which disproportionately affects individuals with lower SES and racial/ethnic minority groups. Among adults diagnosed with COPD, the prevalence of current cigarette smoking remains significantly higher than in the general population. National estimates suggest that although 14.1% of U.S. adults smoke, the rate climbs to 21.5% among older adults with COPD, and a notable 49.1% smoking rate is observed among middle-aged adults with COPD.<sup>8</sup> These statistics highlight the importance of understanding the smoking patterns within these vulnerable groups because smoking not only worsens respiratory conditions but also accelerates disease progression. Smoking rates particularly increased during the COVID-19 pandemic,<sup>9</sup> largely owing to general stress factors during this time; however, several studies have presented conflicting results regarding changes in smoking prevalence amid the COVID-19 pandemic in regard to race/ethnicity.<sup>10–15</sup> Higher rates were observed among men, individuals with lower income levels, and American Indians/Alaskan Natives, whereas Asians had the lowest prevalence; Hispanics notably experienced a substantial

decrease after Quarter 1 of 2020.<sup>16</sup> The need for targeted interventions aimed at reducing smoking rates among individuals with COPD and asthma is particularly urgent, given that the *Healthy People 2030* objective aims to reduce the national smoking prevalence to 6.1% by the end of the decade.<sup>17</sup>

Racial and ethnic disparities compound the already significant burden of COPD and asthma in the U.S.<sup>8,18,19</sup> For instance, Black and Hispanic individuals experience higher rates of underdiagnosis and poorer management of their respiratory conditions than their White counterparts.<sup>18</sup> These disparities are driven by a host of socioeconomic, environmental, and healthcare access factors. Marginalized communities often experience higher rates of exposure to environmental pollutants, such as tobacco smoke and industrial emissions, and have less access to preventive healthcare services, which results in delayed diagnoses and fewer opportunities for early interventions, ultimately leading to worse outcomes.<sup>1</sup> The racial disparities in COPD are particularly evident in the progression/severity of the disease because a higher proportion of severe exacerbations have been found among Black individuals.<sup>20</sup> Moreover, recent studies have demonstrated that Black and Hispanic individuals may not derive the same protective effects from higher education and income levels that are typically associated with reduced risk of chronic lung diseases, such as COPD, among non-Hispanic White individuals.<sup>19,21</sup> These structural inequities exacerbate the progression of respiratory diseases, placing minority populations at a significant disadvantage.

The COVID-19 pandemic introduced new challenges that may have exacerbated these disparities in smoking behaviors, particularly among racial and ethnic minorities.<sup>10–13,16</sup> The pandemic has been a source of widespread stress and economic instability, factors that are known to increase smoking rates, especially in populations already vulnerable to high tobacco use.<sup>19,22,23</sup> Initial studies during the pandemic presented mixed findings regarding smoking trends in the general population, with some reporting a slight decline in smoking rates, whereas others suggested an increase due to stress, anxiety, and disruptions in smoking cessation services.<sup>11,24</sup> However, there is limited research

examining how these trends impacted individuals with chronic respiratory conditions, such as COPD and asthma, and even less is known about how these changes varied across racial and ethnic groups. Given that smoking is a leading contributor to COPD progression and exacerbates asthma symptoms, it is crucial to understand how the pandemic may have differentially affected smoking behaviors among individuals with these conditions. In addition, economic hardships, job losses, and increased stress may have significantly increased smoking rates in populations that already face significant health disparities, further widening the gap in respiratory health outcomes.

This analysis addresses these critical gaps in the literature by examining the association between race/ethnicity and current smoking behaviors among adults with COPD and/or asthma, focusing on changes observed during the COVID-19 pandemic. Using nationally representative data from the National Health Interview Survey (NHIS) collected in 2019, 2021, and 2023, the authors investigated whether the pandemic had a differential impact on smoking prevalence patterns across racial/ethnic subgroups. Specifically, the authors examined (1) changes in the prevalence of current cigarette smoking, (2) the mean number of days smoked in the past 30 days, and (3) the mean number of cigarettes smoked in the past 30 days, comparing those trends across prepandemic, pandemic, and postpandemic periods.

## METHODS

### Study Sample

This study examined data from the 2019, 2021, and 2023 NHIS, a nationally representative cross-sectional survey that gathers data on demographics and clinical information from approximately ~30,000 noninstitutionalized U.S. adults every year.<sup>25</sup> For this study, the authors analyzed complete data from 10,763 individuals aged  $\geq 40$  years who reported having *Ever been told by a doctor or other health professional that you had Chronic Obstructive Pulmonary Disease (COPD), emphysema, or chronic bronchitis or asthma* over the past 3 years. Of the 513 participants excluded, 331 did not provide information on the outcome variable of interest, and the rest had missing data for sociodemographic variables of interest. Data examining changes for each period were analyzed in year pairs to incorporate appropriate weight and design variables when data from multiple years are combined. A detailed description of the survey design and methodology is available elsewhere.<sup>26</sup> This study analyzes publicly available anonymized data and thus is exempt from IRB review.

### Measures

The primary exposures of interest were race/ethnicity and the pandemic period. Individuals were categorized as non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic other (including non-Hispanic American Indian/Alaskan Native and other single and multiple races) for race/ethnicity. The pandemic period was categorized as prepandemic, pandemic, and postpandemic periods on the basis of assessment of the 2019, 2021, and 2023 NHIS data, respectively.

The 3 outcome variables of interest included current combustible cigarette smoking status, the mean number of days of cigarettes in the past 30 days, and the mean number of cigarettes smoked in the past 30 days. Current cigarette smoking involved combustible cigarette smoking occurring either every day or some days. The mean number of days of cigarette smoking in the past 30 days was determined by asking individuals reporting smoking on some days *On how many of the past 30 days did you smoke a cigarette?* A value of 30 was assigned for everyday smokers. The mean number of cigarettes smoked a day in the past 30 days was estimated among individuals smoking cigarettes daily by asking them *On average, about how many cigarettes do you now smoke a day?* and among individuals reporting smoking some days by asking them *On average, when you smoked during the past 30 days, about how many cigarettes did you smoke a day?*

Sociodemographic factors, analyzed as covariates, included age, sex, marital status, rurality, education level, family poverty ratio, access to health care, a lifetime history of an anxiety disorder, and current E-cigarette vaping status. Age was treated as a continuous variable. Sex was categorized as a binary variable: male or female. Marital status was grouped into married/living with a partner and those not married or living with a partner. Rurality was classified as large fringe metropolitan/large central metropolitan, medium and small metropolitan, and nonmetropolitan areas.<sup>27</sup> Education level was categorized as high school graduate/GED equivalent or less, some college/associate degree, and college graduate or more. Family poverty ratio (determined by family household income divided by the poverty threshold) was categorized as low (0–1.99), middle (2.00–3.99), and high ( $\geq 4.00$ ).<sup>28</sup> Access to health care was based on whether participants had usual places to obtain care or any place they would go if they were sick. Lifetime history of anxiety and anxiety disorder was based on the binary question, *Have you ever been told by a doctor or other health professional that you had any type of anxiety disorder?* Current E-cigarette vaping status was determined on the basis of the question, *Do you now smoke e-cigarettes every day, some days or not at all?*, with

individuals reporting every day and some days coded as currently vaping.

### Statistical Analysis

Sociodemographic characteristics were examined across prepandemic, pandemic, and postpandemic periods. Weighted prevalence and mean estimates for the 3 outcomes of interest were calculated across racial/ethnic subgroups and periods. Adjusted prevalence and mean estimates<sup>29</sup> derived from adjusted logistic and negative binomial regression models were estimated for dichotomous and continuous outcomes, respectively. The models included an interaction term between race–ethnicity and period to determine the adjusted prevalence, means, and their corresponding SE estimates across the 12 groups formed. Independent models were conducted to compare prepandemic and pandemic periods and pandemic and postpandemic periods. Negative binomial regression models were selected on the basis of the log-transformed overdispersion test. Multivariate models were adjusted for all covariates. Differences across periods in the outcomes of interest are calculated for each racial/ethnic group. A Wald test was used to determine whether there was a significant difference ( $p < 0.5$  in this study) between the compared periods for each racial/ethnic group and to determine whether the size of the period gap differs across racial/ethnic subgroups (i.e., the test of interaction). Statistical analyses, accounting for the NHIS probability sampling design to ensure national representativeness, were performed using Stata 17.<sup>30</sup>

## RESULTS

Table 1 provides an overview of the sociodemographic characteristics of U.S. adults diagnosed with asthma and COPD across 3 time points: before pandemic (2019), during the pandemic (2021), and after pandemic (2023). The analysis included 10,763 participants, with 3,626 surveyed before the pandemic; 3,507 during the pandemic; and 3,630 after the pandemic. Racial distribution among individuals with asthma and/or COPD showed that non-Hispanic White individuals consistently made up 72%–73% of the sample, whereas non-Hispanic Black individuals (10%–11%) and Hispanic individuals (10%) also remained consistent over the different pandemic periods (Table 1). The non-Hispanic other group slightly decreased from 5.80% before pandemic to 5.48% after pandemic. Males comprised about 41%–42% of the sample throughout the study. Rurality showed minor shifts from before the pandemic to after the pandemic with an increase in participants from large central metropolitan areas (25.77%–27.47%) and a decrease in

nonmetropolitan residents (19.45%–17.77%). Educational attainment among individuals with asthma and/or COPD increased, with college graduates or higher increasing from 23.38% before pandemic to 29.65% after pandemic, whereas those with a high school education or less declined. The proportion of participants in the highest-income category ( $\geq 4.00$ ) rose from 33.19% to 36.69%. Healthcare access remained high (95%–96%) throughout. E-cigarette use stayed stable with a slight postpandemic increase (17.73% vs 16.99%). Lifetime anxiety symptoms increased from 25.84% before pandemic to 28.62% after pandemic, whereas current cigarette smoking declined from 20.92% during the pandemic to 18.51% after pandemic.

Table 2 summarizes the patterns of current cigarette smoking among U.S. adults with asthma and/or COPD across racial/ethnic groups over the 3 study periods. Before pandemic, non-Hispanic White individuals and non-Hispanic Black individuals had the highest prevalence of smoking (21.5% and 23.0%, respectively), whereas Hispanic individuals had the lowest (12.9%). Among non-Hispanic White individuals, smoking prevalence decreased from 22.03% before pandemic to 19.82% after pandemic. The mean smoking days for non-Hispanic White individuals increased during the pandemic (28.32 days) but slightly decreased after pandemic (28.19 days), with cigarette consumption remaining stable. Non-Hispanic Black individuals showed a decline in smoking prevalence from 22.45% before pandemic to 20.07% after pandemic. The mean number of cigarettes smoked per day decreased from 11.61 cigarettes per day during the pandemic to 9.24 cigarettes per day after pandemic. However, this represents an overall increase from the prepandemic average of 8.11 cigarettes per day, indicating that despite the decline after pandemic, smoking levels remained elevated compared with prepandemic levels. Hispanic individuals saw an increase in smoking prevalence before the pandemic to during the pandemic (10.50%–14.94%), which then declined to 11.70% after pandemic. However, contrary to the decline in smoking prevalence, their cigarette consumption increased after the pandemic, rising from 14.41 cigarettes per day during the pandemic to 14.71 cigarettes per day after the pandemic despite a decrease in the number of smoking days. The non-Hispanic other group experienced a significant reduction in smoking prevalence from 22.49% before pandemic to 11.16% after pandemic. However, despite this reduction in prevalence, their smoking behavior showed an upward trend after pandemic. The mean number of smoking days increased from 27.61 days before the pandemic to 28.95 days after the pandemic, and their cigarette consumption rose from 13.04 cigarettes per day before the



**Table 1.** Sociodemographic Characteristics of U.S. Adults With Asthma and/or Chronic Obstructive Pulmonary Disease Before, During, and After the COVID-19 Pandemic: Results of the 2019, 2021, and 2023 National Health Interview Survey (N=10,763).

Characteristic	Before the pandemic (n=3,626)	During the pandemic (n=3,507)	After the pandemic (n=3,630)
Age year, mean $\pm$ SE	60.95 $\pm$ 0.26	61.01 $\pm$ 0.26	61.02 $\pm$ 0.25
Race, % (95% CI)			
NH White	73.41 (71.30, 75.43)	73.05 (70.75, 75.23)	72.47 (70.26, 74.58)
NH Black	10.48 (9.16, 11.97)	11.10 (9.74, 12.62)	11.38 (9.90, 13.05)
Hispanic	10.31 (8.83, 12.0)	10.12 (8.70, 11.75)	10.66 (9.17, 12.36)
Other	5.80 (4.87, 6.90)	5.73 (4.61, 7.10)	5.48 (4.60, 6.52)
Male sex, % (95% CI)	41.89 (39.98, 43.82)	40.55 (38.72, 42.40)	41.66 (39.73, 43.62)
Rurality, %, 95% CI)			
Large central metropolitan	25.77 (23.25, 28.46)	26.33 (23.75, 29.09)	27.47 (24.94, 30.16)
Medium metropolitan	23.01 (20.37, 25.87)	22.87 (20.40, 25.54)	22.97 (20.44, 25.71)
Small metropolitan	31.78 (28.55, 35.19)	32.19 (29.03, 35.53)	31.78 (28.65, 35.09)
Nonmetropolitan	19.45 (17.34, 21.75)	18.61 (16.80, 20.55)	17.77 (15.98, 19.72)
Education level, % (95% CI)			
High school or less	43.08 (41.04, 45.14)	39.93 (37.97, 41.92)	39.19 (37.23, 41.17)
Some college or associate degree	33.54 (31.64, 35.50)	29.86 (28.05, 31.73)	31.16 (29.50, 32.87)
College graduate or more	23.38 (21.79, 25.05)	30.21 (28.37, 32.12)	29.65 (27.89, 31.48)
Family Poverty Ratio, % (95% CI)			
0–1.99 (low)	36.25 (34.14, 38.42)	32.01 (30.00, 34.08)	34.17 (32.14, 36.27)
2.00–3.99 (middle)	30.56 (28.84, 32.34)	30.27 (28.51, 32.09)	29.14 (27.46, 30.87)
$\geq$ 4.00 (high)	33.19 (31.20, 35.23)	37.73 (35.72, 39.78)	36.69 (34.56, 38.87)
Married/living with a partner, % (95% CI)	58.83 (56.97, 60.66)	58.45 (56.54, 60.34)	56.94 (55.02, 58.84)
Healthcare access, % (95% CI)	95.71 (94.75, 96.50)	96.50 (95.66, 97.19)	95.91 (95.00, 96.65)
Current E-cigarette vaping, % (95% CI)	16.99 (15.49, 18.59)	16.74 (15.25, 18.34)	17.73 (16.25, 19.31)
Lifetime anxiety symptoms, % (95% CI)	25.84 (24.08, 27.68)	26.32 (24.65, 28.05)	28.62 (26.81, 30.50)
Current cigarette smoking, % *95% CI)	20.92 (19.31, 22.62)	20.92 (19.31, 22.62)	18.51 (16.88, 20.25)
Days of cigarette smoking in the past 30 days, mean $\pm$ SE	27.32 $\pm$ 0.32	27.75 $\pm$ 0.28	27.41 $\pm$ 0.33
Cigarettes smoked in the past 30 days, mean $\pm$ SE	13.72 $\pm$ 0.40	14.73 $\pm$ 0.45	14.70 $\pm$ 0.48

Note: Estimates correspond to weighted column percentages and survey means.  
NH, non-Hispanic.

pandemic to 14.17 cigarettes per day after the pandemic, indicating increased smoking intensity despite lower overall smoking prevalence.

Figures 1–3 illustrate the adjusted prevalence and mean estimates from logistic and negative binomial regression models and presents the test examining within and between differences across racial/ethnic groups. During the pandemic, Hispanic individuals saw a significant increase in smoking prevalence (mean difference=7.1%, SE=0.3,  $p=0.018$ ), whereas non-Hispanic Black individuals saw a nonsignificant decline of 2.9% (SE=0.3,  $p=0.404$ ) (Figure 1). Non-Hispanic White

individuals remained stable (mean difference=0.3%, SE=0.1,  $p=0.802$ ). After pandemic, non-Hispanic White individuals experienced a significant reduction in smoking prevalence (mean difference= –2.5%, SE=1.2,  $p=0.045$ ). Comparisons of within differences between racial/ethnic groups (contrast test) suggest that the changes observed among Hispanics were significantly different from the changes observed in the other racial/ethnic groups ( $p<0.05$ ).

Across all periods, non-Hispanic White individuals reported the highest mean number of cigarettes smoked per day, although no statistically significant changes

**Table 2.** Patterns of Current Cigarette Smoking Across Racial/Ethnic Groups of U.S. Adults With Asthma and Chronic Obstructive Pulmonary Disease Before, During, and After the COVID-19 Pandemic

Race	Current cigarette smoking, % (95% CI)			Days of cigarette smoking in the past 30 days, mean $\pm$ SE			Cigarettes smoked in the past 30 days, mean $\pm$ SE		
	2019 <sup>a</sup>	2021	2023 <sup>a</sup>	2019	2021	2023	2019	2021	2023
NH White	22.03 (20.16, 24.03)	21.07 (19.29, 22.97)	19.82 (17.83, 21.97)	27.77 $\pm$ 0.31	28.32 $\pm$ 0.27	28.19 $\pm$ 0.30	14.93 $\pm$ 0.46	15.86 $\pm$ 0.50	15.95 $\pm$ 0.56
NH Black	22.45 (17.87, 27.82)	20.18 (15.73, 25.50)	20.07 (15.44, 25.67)	25.01 $\pm$ 1.05	26.07 $\pm$ 1.10	24.09 $\pm$ 1.35	8.68 $\pm$ 0.74	11.61 $\pm$ 1.28	9.24 $\pm$ 1.01
Hispanic	10.50 (7.42, 14.65)	14.94 (11.13, 19.76)	11.70 (8.08, 16.65)	25.19 $\pm$ 2.00	24.29 $\pm$ 1.56	23.83 $\pm$ 1.76	10.71 $\pm$ 1.80	9.03 $\pm$ 1.41	10.41 $\pm$ 1.59
Other	22.49 (16.25, 30.25)	14.53 (8.91, 21.61)	11.16 (7.02, 17.28)	27.61 $\pm$ 1.09	27.81 $\pm$ 1.05	28.95 $\pm$ 1.04	10.43 $\pm$ 1.24	11.42 $\pm$ 1.46	14.17 $\pm$ 2.00

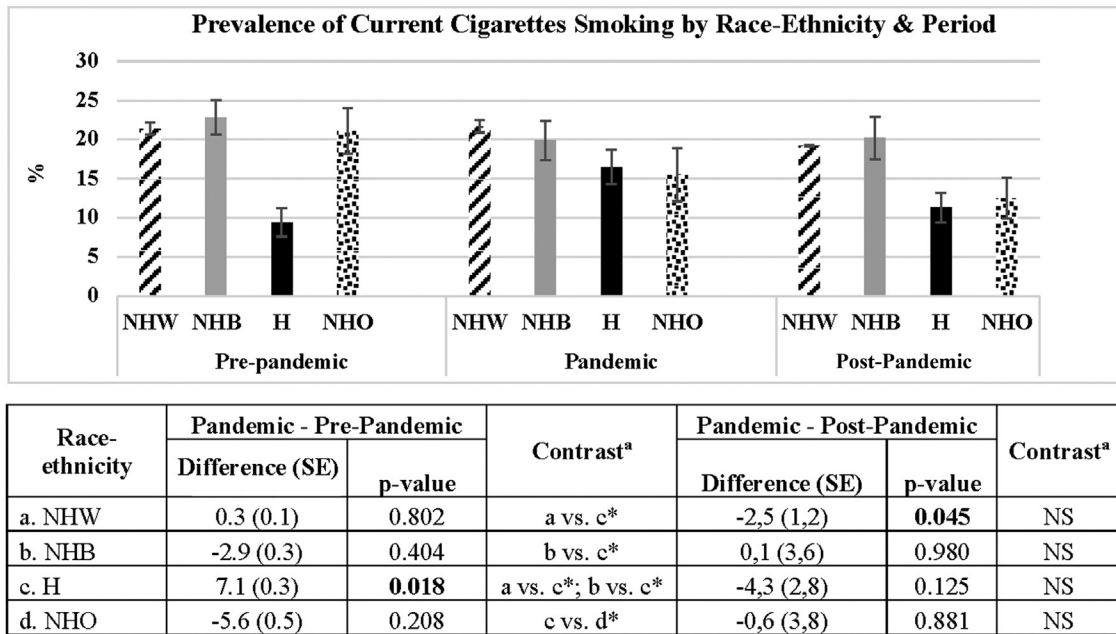
<sup>a</sup> $p < 0.01$ ; Pearson chi-square was conducted.  
NH, non-Hispanic.

were observed between racial/ethnic groups (Figure 2). During the pandemic, non-Hispanic White individuals showed a nonsignificant increase in daily cigarette consumption (mean difference=0.8, SE=0.4,  $p=0.204$ ). On the other hand, non-Hispanic Black individuals saw a marginally significant increase (mean difference=0.9, SE=1.5,  $p=0.052$ ). Hispanic individuals and the non-Hispanic other group showed nonsignificant changes, with mean differences of  $-1.5$  (SE=2.6,  $p=0.508$ ) and  $0.4$  (SE=1.5,  $p=0.564$ ), respectively. After pandemic, non-Hispanic White individuals saw no significant change (mean difference=0.1, SE=0.7,  $p=0.805$ ), whereas non-Hispanic Black individuals had a nonsignificant decrease (mean difference=  $-2.4$ , SE=1.6,  $p=0.143$ ). No significant contrasts were found between racial/ethnic groups across periods (all  $ps > 0.05$ ).

Non-Hispanic White individual and non-Hispanic Black individual participants reported smoking on more days than Hispanic and non-Hispanic other group participants across all periods (Figure 3). During the pandemic, non-Hispanic White individuals saw a nonsignificant increase in smoking days (mean difference=0.5, SE=0.4,  $p=0.221$ ), whereas non-Hispanic Black individuals had a slight increase (mean difference=0.9, SE=1.5,  $p=0.556$ ). Hispanic individuals and the non-Hispanic other group saw nonsignificant changes of  $-1.4$  days (SE=2.6,  $p=0.575$ ) and  $0.4$  days (SE=1.5,  $p=0.799$ ), respectively. After pandemic, non-Hispanic White individuals showed no change in smoking days (mean difference=  $-0.1$ , SE=0.4,  $p=0.915$ ), and non-Hispanic Black individuals reported a nonsignificant decrease of 1.9 days (SE=1.8,  $p=0.272$ ). No significant contrasts were observed between groups during any period.

## DISCUSSION

This study demonstrates both novel and significant shifts in smoking behavior among individuals with COPD and/or asthma across different racial/ethnic groups during the COVID-19 pandemic, particularly highlighting the contrasting trends observed among Hispanic individuals and non-Hispanic White individuals. After adjusting for multiple potential confounders, the authors found that the rate of current cigarette smoking increased among Hispanic individuals between the pre-pandemic and pandemic periods, whereas it decreased among non-Hispanic White individuals from the pandemic to the postpandemic period. In addition, there was a marginally significant increase in the quantity of cigarettes used among non-Hispanic Black individuals. These results add to the literature on racial/ethnic disparities in smoking among individuals with COPD and



**Figure 1.** Adjusted prevalence of current cigarette smoking across racial/ethnic subgroups and pre-pandemic, pandemic, and post-pandemic period.

Notes: Adjusted prevalence and mean estimates were derived from adjusted logistic and negative binomial regression models, adjusting for sociodemographic and health-related factors (age, race/ethnicity, biological sex, poverty level, marital status, access to healthcare status, urbanicity, lifetime history of an anxiety disorder, and current E-cigarette use) and year of the survey and including an interaction term for race/ethnicity and period. All estimates are adjusted for the NHIS's complex sampling design. \* $p < 0.05$ .

<sup>a</sup>The contrasts column reports which period differences are significantly different across racial/ethnic groups.

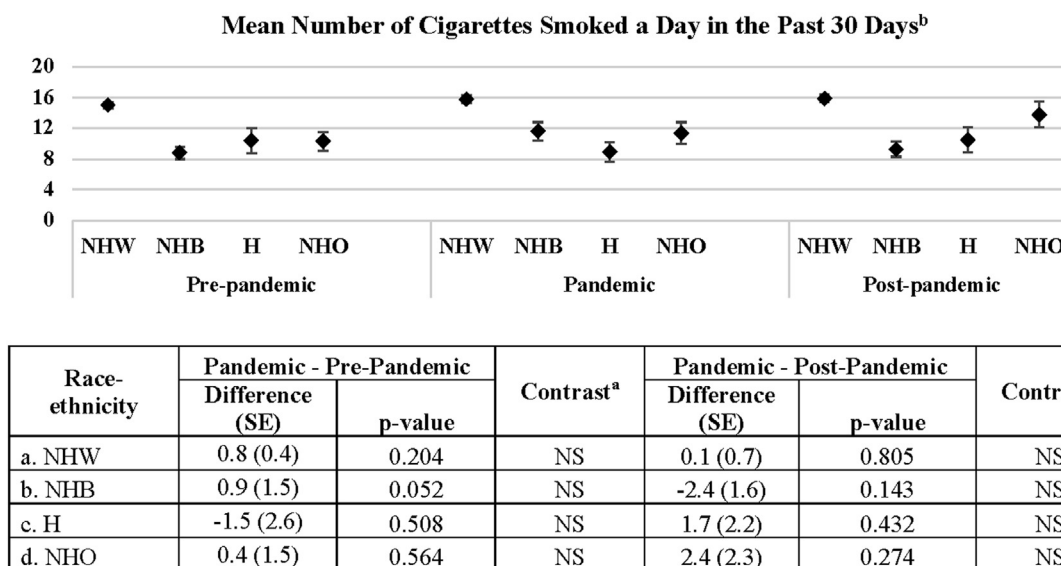
H, Hispanic; NHB, non-Hispanic Black; NHIS, National Health Interview Survey; NHO, non-Hispanic other; NHW, non-Hispanic White.

asthma by documenting changes over a critical period, the COVID-19 pandemic, which have not been previously investigated, and by providing estimates that can be assessed against future NHIS analyses.

The increase in smoking prevalence among Hispanic individuals during the pandemic may be influenced by a range of factors. The authors hypothesized on the basis of previous literature<sup>13,14</sup> that increased occupational exposure, financial constraints, and heightened stress levels during the pandemic likely played a significant role. For instance, a study conducted in California, where 39.6% of the population is Hispanic, found that individuals who smoked cigarettes during the postlockdown era had increased their cigarette consumption rates compared with those who smoked before the lockdown.<sup>14</sup> In addition, changes in the social environment, such as reduced social support or increased isolation, might have further contributed to this increase.<sup>31</sup> On the other hand, the decrease among non-Hispanic White individuals might reflect successful smoking cessation efforts or reduced smoking initiation, potentially driven by increased awareness of health risks associated with COVID-19.<sup>32</sup> The negative health effects of the virus may have acted as a catalyst for smoking cessation in this group.

Non-Hispanic Black individuals showed a marginally significant increase in the number of cigarettes consumed during the pandemic. This increase may be attributed to similar stressors faced by Hispanic individuals, such as financial strain, heightened stress, and disruptions in daily routines.<sup>33,34</sup> For instance, one study showed that non-Hispanic Black individuals have increased cigarette smoking in addition to increased stress and anxiety during the pandemic and qualify for screening for lung diseases, such as lung cancer.<sup>34</sup> In addition, non-Hispanic Black communities may have faced unique challenges, including disparities in access to health care and resources for smoking cessation,<sup>35</sup> which could have exacerbated smoking behaviors during this period. Current research suggests that non-Hispanic Black individuals with COPD have fewer pack years of smoking but are more likely to experience respiratory impairment and hospitalization for exacerbations than their non-Hispanic White counterparts.<sup>36</sup> Factors influencing smoking cessation vary between racial groups, with non-Hispanic White individuals often influenced by individual characteristics and non-Hispanic Black individuals more strongly influenced by social support.<sup>37</sup>

Recent studies suggest that reductions in COPD and asthma exacerbations since the pandemic are more closely



**Figure 2.** Adjusted mean estimate of the number of cigarettes smoked a day in the past 30 days across racial/ethnic subgroups and prepandemic, pandemic, and postpandemic periods.

Notes: Adjusted prevalence and mean estimates were derived from adjusted logistic and negative binomial regression models, adjusting for sociodemographic and health-related factors (age, race/ethnicity, biological sex, poverty level, marital status, access to healthcare status, urbanicity, lifetime history of an anxiety disorder, and current E-cigarette use) and year of the survey and including an interaction term for race/ethnicity and period. All estimates are adjusted for the NHIS's complex sampling design. \* $p < 0.05$ .

<sup>a</sup>The contrasts column reports which period differences are significantly different across racial/ethnic groups.

<sup>b</sup>Mean estimates among individuals who reported current cigarette smoking.

H, Hispanic; NHB, non-Hispanic Black; NHIS, National Health Interview Survey; NHO, non-Hispanic other; NHW, non-Hispanic White.

linked to social isolation and the use of face masks rather than any protective effect from inhaled corticosteroids. Interestingly, one study found that this protective effect was evident in a large cohort of patients with asthma, except among non-Hispanic Black individuals. This discrepancy highlights the challenges faced by more vulnerable communities, where social distancing can be difficult due to job conditions or living situations. The COVID-19 pandemic has thus underscored the disparities in health outcomes for racial and ethnic minority communities, prompting a deeper examination of how these disparities affect patients with COPD from these groups. Addressing factors beyond smoking that contribute to racial disparities in COPD and asthma outcomes is crucial for effective management and prevention strategies, such as tackling environmental injustice.<sup>38</sup>

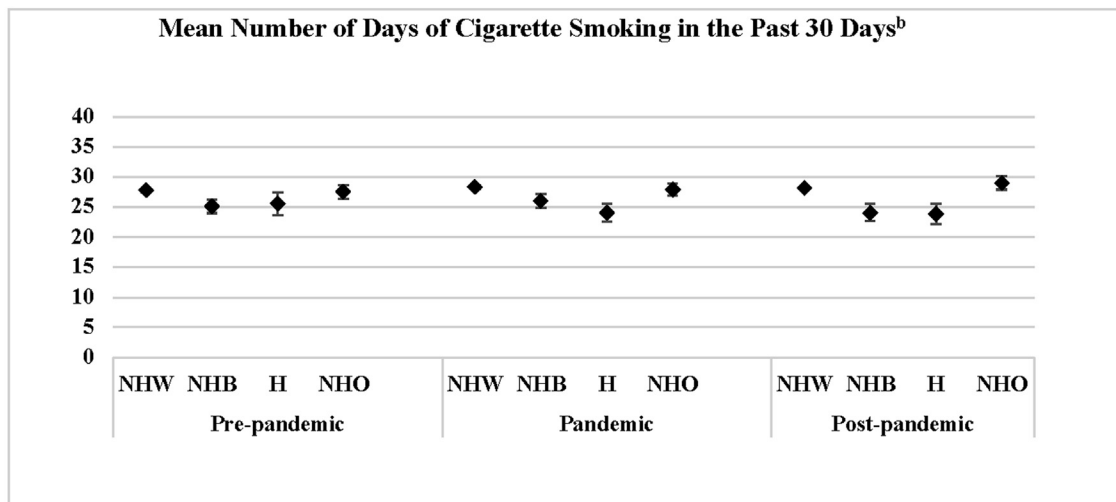
This study adds to the existing literature on racial/ethnic disparities in smoking behavior among individuals with COPD and asthma by documenting changes during the COVID-19 pandemic, a critical period that has not been thoroughly examined in this context. These findings are concerning because they suggest that the pandemic may have exacerbated inequities, particularly affecting Hispanic individuals and potentially non-Hispanic Black individuals by increasing smoking rates,

which could worsen the progression of COPD, asthma, and other smoking-related conditions, including cancer and cardiovascular disease.<sup>39–41</sup> Although changes in smoking prevalence were observed, this study did not find significant changes in the frequency and quantity of smoking among those who continued to smoke, except for the marginal increase in cigarette consumption among non-Hispanic Black individuals. This is particularly troubling given that individuals with COPD and asthma were at increased risk of severe COVID-19 outcomes.<sup>42</sup> The pandemic represented a critical opportunity to promote smoking cessation, yet the stability in smoking patterns suggests that these efforts may not have been sufficiently impactful.<sup>43–46</sup> Notably, these differences are persistent after the COVID-19 pandemic, which severely affected under-resourced populations. Future research should investigate whether the increase in smoking among Hispanic and non-Hispanic Black individuals was more pronounced among those already smoking or among new smokers and assess the long-term health impacts of these trends.

### Limitations

This study, although providing valuable insights, is not without limitations. First, reliance on self-reported data





Race-ethnicity	Pandemic - Pre-Pandemic		Contrast <sup>a</sup>	Pandemic - Post-Pandemic		Contrast <sup>a</sup>
	Difference (SE)	p-value		Difference (SE)	p-value	
a. NHW	0.5 (0.4)	0.221	NS	-0.1 (0.4)	0.915	NS
b. NHB	0.9 (1.5)	0.556	NS	-1.9 (1.8)	0.272	NS
c. H	-1.4 (2.6)	0.575	NS	-0.2 (2.3)	0.923	NS
d. NHO	0.4 (1.5)	0.799	NS	1.1 (1.5)	0.377	NS

**Figure 3.** Adjusted mean estimate of the number of days of cigarette smoking in the past 30 days across racial/ethnic subgroups and prepandemic, pandemic, and postpandemic periods.

Notes: Adjusted prevalence and mean estimates were derived from adjusted logistic and negative binomial regression models, adjusting for sociodemographic and health-related factors (age, race/ethnicity, biological sex, poverty level, marital status, access to healthcare status, urbanicity, lifetime history of an anxiety disorder, and current E-cigarette use) and year of the survey and including an interaction term for race/ethnicity and period. All estimates are adjusted for the NHIS's complex sampling design. \* $p < 0.05$ .

<sup>a</sup>The contrasts column reports which period differences are significantly different across racial/ethnic groups.

<sup>b</sup>Mean estimates among individuals who reported current cigarette smoking.

H, Hispanic; NHB, non-Hispanic Black; NHIS, National Health Interview Survey; NHO, non-Hispanic other; NHW, non-Hispanic White.

may introduce reporting bias, potentially affecting the accuracy of smoking status information. In addition, the shift to primarily telephone-based survey administration in 2021 caused a drop in response rates,<sup>47</sup> which might limit comparisons. Furthermore, being cross-sectional, this study cannot establish causation or temporality, and there may be misclassification bias regarding smoking doses. Noncurrent smokers included former smokers or those who had smoked at least 100 cigarettes in their lifetime but had quit smoking at least 31 days before the interview. In addition, COPD is often underdiagnosed among Black individuals; therefore, there may be an underrepresentation of Black individuals with COPD in this analysis. Unfortunately, the NHIS does not include information about the time lag between the survey and the last smoking episode for former smokers, limiting the possibility of examining whether changes are related to the number of days or years in cessation. Despite these limitations, this study benefits from thorough

consideration of various confounders and the use of a large, nationally representative database. In addition, the stratification by race and ethnicity enables a nuanced examination of how smoking behaviors among individuals with COPD and/or asthma have been differentially impacted across various racial and ethnic groups throughout the COVID-19 pandemic. This allows for a deeper understanding of the pandemic's impacts on smoking patterns within specific subpopulations.

## CONCLUSIONS

The analysis of this national survey data highlights racial/ethnic significant differences in current smoking rates among patients with COPD and/or asthma during the COVID-19 pandemic. Specifically, Hispanic individuals experienced an increase in current smoking prevalence, whereas non-Hispanic Black individuals showed a rise in cigarette consumption. In contrast, non-Hispanic

White individuals exhibited a decrease in smoking prevalence. Efforts to reduce smoking among patients with COPD and asthma should focus on improving access to both behavioral and pharmacologic interventions and addressing social determinants of health. Future research should explore the effects of equitable healthcare access and the implementation of evidence-based cessation policies on mitigating racial and ethnic disparities in asthma and COPD.

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