

# E-Cigarette, Conventional Cigarette, and Depression: Role of Race/Ethnicity in the Health Information National Trends Survey (HINTS) 2022

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## Article Info

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## Abstract

**Background:** While previous research has established the role of depression as a correlate of tobacco use, limited research has been conducted on potential racial variations in these associations.

**Aims:** This study had two objectives: (1) to investigate the associations between depression and smoking conventional and vaping e-cigarettes, and (2) to explore the role of race in modifying these associations.

**Methods:** Data from the Health Information National Trends Survey (HINTS-2022) survey, which is a national probability sample of US adults, were analyzed. Variables of interest included lifetime and current smoking status, e-cigarette use, depression (PHQ-4), socioeconomic status (SES), and demographic characteristics. Binary logistic regression models were applied to assess the associations between depression as the independent variable and current and ever smoking conventional cigarettes and vaping e-cigarettes as dependent variables, adjusting for covariates (age, gender, education, marital status, and employment). We tested potential interactions between race/ethnicity (non-Hispanic Whites, non-Hispanic Blacks, Hispanic Whites and any other/mixed race/ethnicity) and depression on our outcomes.

**Results:** The study findings indicated significant associations between depression and use of conventional cigarettes and e-cigarettes. Although individuals who were experiencing depression were more likely to use conventional cigarettes ( $p < 0.05$ ) and e-cigarettes ( $p < 0.05$ ) compared to those non-depressed, the positive associations between depression and lifetime and current smoking were stronger for Black than White individuals.

**Conclusions:** This study suggests that depression may have a more salient role in smoking cigarettes and e-cigarette use for Black than White adults. It is unclear if Black adults are more likely to smoke if they are depressed, or if Black adults who smoke cigarettes are more likely to be depressed because of higher stigma and lower access to mental health care services.

## Background

The role of high depressive symptoms and depression as risk factors of substance use is well established<sup>1</sup>. Numerous studies have shown that individuals with depression are also more likely to use a wide range of substances<sup>2</sup>. The bidirectional link between substance use and depression suggests that substance use may also operate as a risk factor for depression<sup>3</sup>. However, very little research has explored racial differences in the links between depression and high

depressive symptoms and smoking<sup>4</sup> and vaping electronic cigarettes (e-cigs)<sup>5</sup>.

Between and within racial group heterogeneities may exist regarding the comorbidity between smoking and depression<sup>6</sup>. People from diverse demographic backgrounds may exhibit distinct motivations for substance use or presentation of depression<sup>7</sup>. Black and White individuals may also differ in smoking behaviors<sup>8</sup>, depression<sup>9</sup>, and how they cope with stress<sup>10</sup>, as well as likelihood of seeking care if they are depressed<sup>11</sup>. For example, some research suggests that Black and White individuals may differ in the connection between depression and smoking cigarettes or vaping e-cigs<sup>12</sup>.

While the overall connection between depression and smoking<sup>6</sup> and vaping are known, few studies have explored Black-White differences in this regard. Furthermore, while cigarette smoking is declining<sup>13</sup>, e-cigs popularity is increasing<sup>14,15</sup>, thus there is a need to investigate not only conventional cigarettes but also e-cig use, as correlates of depressive symptoms<sup>16</sup>. Given the unique and different characteristics of users of e-cigs compared to conventional cigarettes<sup>17,18</sup>, some results may apply to conventional nicotine delivery systems but not to other alternatives<sup>19</sup>.

## Aim

Built on our past work on the bidirectional links between depression and substance use in Black individuals<sup>20</sup>, we conducted this study to fill the gap in the literature. Our study had two aims: (1) to test the association between depression and smoking conventional cigarettes and vaping e-cigs and (2) to explore group differences in these associations. Given higher chronicity of depression in Black communities<sup>21,22</sup>, in part because of low health care use<sup>23</sup> and high stigma<sup>24</sup>, we hope to gain a deeper understanding of how racial group membership impacts the need of diverse racial groups with and without depression for cessation programs for smoking conventional cigarettes or vaping e-cigs. The findings of this study may have significant implications for tailoring interventions and prevention strategies that simultaneously address smoking/vaping and depressive needs of diverse populations.

## Methods

This cross-sectional study utilized data from the Health Information National Trends Survey (HINTS – 2022<sup>25</sup>). HINTS is a nationally representative survey conducted in the United States designed to assess various aspects of health communication, cancer knowledge, health care use, smoking behavior, e-cig use, and depressive symptoms<sup>25</sup>. The survey is administered through computer-assisted telephone interviews, ensuring a standardized data collection process<sup>25</sup>.

The study included a representative probability sample of US adults obtained from the HINTS survey. The sample consisted of both men and women, covering a diverse range of demographic characteristics. The participants were selected through a multistage sampling design, incorporating both landline and mobile phone numbers to ensure adequate representation across the population<sup>25</sup>. Our analytical sample was composed of all HINTS participants in the year 2022, regardless of their race/ethnicity and smoking status.

The variables of interest in this study included race/ethnicity, smoking status, e-cig use, depressive symptoms, demographic, and socioeconomic status (SES) characteristics. race/ethnicity were self-identified and as follow: Non-Hispanic White (reference group), Hispanic White, Non-Hispanic Black, and other/mixed/multiple race. Other/mixed/multiple included any group which was not White or Black. Smoking status was assessed using self-reported measures, distinguishing between current smokers and non-smokers. Separate questions were asked about conventional cigarettes and e-cigs. E-cig use was evaluated by identifying individuals who reported current or ever use of e-cigs<sup>26</sup>. Depressive symptoms were measured using the Patient Health Questionnaire-4 (PHQ-4)<sup>27</sup>, a validated screening tool that assesses symptoms of depression. A threshold of 3 or more was considered mild-to-moderate, and a score of 7 or above was considered severe depression<sup>28</sup>. Race/ethnicity was the moderator. Age, gender, and SES indicators (i.e., education, marital status, and employment) were included as covariates in the analysis.

Statistical Package for the Social Sciences (SPSS) software was utilized for data analysis<sup>29</sup>. Univariate, bivariate, and multivariable models were employed to examine racial differences in the variables of interest. For multivariable modeling, binary logistic regression models were employed to assess the associations between depressive symptoms and smoking conventional cigarettes or e-cigs. We ran binary logistic regression models overall without and with interactions terms between depression and race. The models were adjusted for covariates, including age, educational attainment, marital status, and employment. Smoking/vaping and depression were the outcome and predictor variables, respectively. Odds Ratio, 95% CI, and p-values were reported. Statistical significance was set at  $p < 0.05$ .

## Results

Table 1 summarizes the data by demographic factors, socioeconomic factors, and ever and current use of e-cigs and conventional cigarettes. 6154 participants entered our analysis. Participants ranged in age from 18 to 99, with a mean (SD) age of 55.60 (17.4).

**Table 1:** Summary of demographic and socioeconomic data

	Mean	SD
Age (Years)	55.60	17.44
	N	%
Gender		
Female	3535	56.5
Male	2307	36.9
Missing	410	6.6
Full Employed		
No	3062	49.0
Yes	2778	44.4
Missing	412	6.6
Married		
No	3213	51.4
Yes	2624	42.0
Missing	415	6.6
Education		
Less than High School Diploma	387	6.2
High School Diploma	1068	17.1
Some College	1672	26.7
College Graduate and More	2721	43.5
Missing	404	6.5
Hispanic		
No	5251	84.0
Yes	1001	16.0
Other/Mixed Race		
No	5093	81.5
Yes	1159	18.5
Black		
No	5363	85.8
Yes	889	14.2

**Table 2:** Summary of tobacco use data

	White		Black		Other/Mixed	
	n	%	n	%	N	%
e-Cig Use Current						
No	5721	91.5	868	97.6	4853	90.5
Yes	191	3.1	17	1.9	174	3.2
Missing	340	5.4	4	.4	336	6.3
e-Cig Use Ever						
No	5076	81.2	799	89.9	4277	79.8
Yes	836	13.4	86	9.7	750	14.0
Missing	340	5.4	4	.4	336	6.3
Current Use of Cigarette						
No	5212	83.4	749	84.3	4463	83.2
Yes	642	10.3	126	14.2	516	9.6
Missing	398	6.4	14	1.6	384	7.2
Ever Use of Cigarette						
No	3759	60.1	585	65.8	3174	59.2
Yes	2095	33.5	290	32.6	1805	33.7
Missing	398	6.4	14	1.6	384	7.2

Table 2 summarizes tobacco use data overall and by race. As shown in this table, ever and current use of e-cigs and conventional cigarettes were comparable across racial groups.

Table 3 shows the summary of the logistic regressions for the associations between depression and ever and current use of e-cigs and conventional cigarettes. While depression was associated with higher odds of ever and current use of conventional cigarettes, the association between depression and smoking was dependent on race/ethnicity (stronger for non-Hispanic Black than non-Hispanic White adults). Regarding the magnitude of the difference in the effect sizes for Blacks vs Whites, for ever-smoking, on average, this effect was 1.637, and for Whites, this effect was 1.519, and for Blacks, this effect was 1.78 larger than Whites. This magnitude of difference was more for current cigarette use (2.275 higher for Blacks than Whites, 2.048 on average, and 1.659 for Whites).

Table 4 shows the summary of the logistic regressions for the associations between depression and ever and current use of e-cigs. While depression was associated with higher odds of ever and current use of e-cigs, these associations did not depend on race.

## Discussion

The findings of this study revealed that depression is associated with smoking conventional cigarettes and e-cig use. We also found moderating effects of race—specifically, there is a stronger association between smoking and depression for Black adults compared to White adults.

The results of our first finding is consistent with previous research that has suggested a link between smoking/vaping and depression<sup>6</sup>. There are, however, very few studies on group differences in the association between smoking and depressive symptoms. One study reported a stronger link between depression and smoking among women compared to men<sup>6</sup>. We are unaware of any past work on racial variation in the comorbidity between depression and tobacco use in forms of smoking or vaping.

The stronger association between depression and smoking in Blacks than Whites may be because depression is more chronic in Black communities. There are several reasons for higher chronicity, severity, and consequences of depression for Black individuals compared to White individuals<sup>21,22</sup>. First, systemic racism and social inequality can significantly impact the mental health of Black communities. Structural and institutional racism, which limit access to quality healthcare including but not limited to depression treatment within Black communities, along with higher rates of poverty, may collectively contribute to increased stress and lower overall chance of depression treatment in Black populations. Chronic stressors can exacerbate depressive symptoms and make treatment-seeking more challenging for Black individuals. As a result, Black individuals with depression are less likely to seek care and receive adequate mental health care<sup>23</sup>. Moreover, cultural factors play a role in the manifestation

**Table 3:** Logistic regressions for the associations between depression and ever and current use of conventional cigarettes

	Ever								Current							
	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p
Depressed	1.637	1.345	1.992	.000	1.519	1.163	1.983	.002	2.048	1.606	2.612	.000	1.659	1.176	2.338	.004
Race/Ethnicity																
Non-Hispanic Whites	Ref				Ref				Ref				Ref			
Hispanic White	.429	.358	.513	<.001	.447	.369	.541	<.001	.419	.312	.561	<.001	.431	.313	.595	<.001
Non-Hispanic Black	.630	.531	.749	<.001	.594	.495	.713	<.001	1.066	.841	1.353	.596	.934	.718	1.216	.613
Other/Mixed Race	.603	.500	.727	<.001	.585	.480	.714	<.001	.983	.751	1.286	.898	.918	.682	1.235	.571
Education																
Less than High school Diploma	Ref				Ref				Ref				Ref			
High school Diploma	.724	.557	.943	.017	.724	.556	.943	.017	.563	.408	.777	<.001	.564	.408	.779	.001
Some College	.750	.583	.965	.025	.754	.586	.969	.028	.513	.378	.697	<.001	.519	.382	.705	<.001
College or More	.371	.289	.477	<.001	.373	.290	.479	<.001	.170	.122	.236	<.001	.171	.123	.238	<.001
Fully Employed	.753	.660	.859	<.001	.753	.660	.859	<.001	.866	.711	1.053	.150	.865	.710	1.053	.149
Married	.790	.700	.891	<.001	.786	.696	.886	<.001	.595	.492	.720	<.001	.586	.484	.710	<.001
Obese	.981	.870	1.107	.755	.977	.866	1.102	.704	.798	.664	.958	.016	.790	.657	.950	.012
Age (Yrs)	1.016	1.012	1.020	<.001	1.016	1.012	1.020	<.001	.990	.985	.996	.001	.991	.985	.996	.001
Gender (Male)	1.430	1.268	1.613	<.001	1.430	1.268	1.612	<.001	1.210	1.008	1.451	.040	1.212	1.010	1.454	.039
Race/Ethnicity x Depression																
Hispanic White x Depressed					.775	.458	1.313	.344					.946	.459	1.948	.880
Non-Hispanic Black x Depressed					1.781	1.017	3.121	.044					2.275	1.208	4.283	.011
Other/Mixed Race x Depressed					1.311	.722	2.381	.374					1.529	.749	3.122	.243

**Table 4:** Logistic regressions for the associations between depression and ever and current e-cigarettes use

	Ever								Current							
	OR	95% CI		P	OR	95% CI		P	OR	95% CI		P	OR	95% CI		p
Depressed	1.748	1.388	2.202	.000	1.635	1.193	2.242	.002	2.283	1.575	3.310	.000	1.875	1.132	3.108	.015
Race/Ethnicity																
Non-Hispanic Whites	Ref				Ref				Ref				Ref			
Hispanic White	.484	.383	.612	<.001	.462	.356	.598	<.001	.406	.261	.630	<.001	.324	.187	.560	<.001
Non-Hispanic Black	.399	.305	.522	<.001	.390	.291	.523	<.001	.349	.204	.595	<.001	.355	.194	.649	.001
Other/Mixed Race	.706	.548	.910	.007	.714	.543	.938	.015	.625	.378	1.033	.067	.574	.320	1.030	.063
Education																
Less than High school Diploma	Ref				Ref				Ref				Ref			
High school Diploma	.747	.514	1.085	.126	.749	.515	1.088	.129	.821	.451	1.496	.520	.831	.455	1.519	.548
Some College	.915	.645	1.299	.620	.916	.645	1.301	.624	.590	.329	1.058	.076	.591	.329	1.063	.079
College or More	.515	.361	.733	<.001	.514	.361	.732	<.001	.255	.138	.470	<.001	.255	.138	.471	<.001
Fully Employed	.967	.808	1.156	.710	.968	.809	1.158	.722	1.099	.785	1.537	.583	1.103	.788	1.544	.568
Married	.558	.470	.662	<.001	.557	.470	.662	<.001	.444	.309	.639	<.001	.447	.310	.643	<.001
Obese	.982	.829	1.163	.833	.982	.829	1.162	.829	1.132	.822	1.559	.448	1.139	.827	1.569	.425
Age (Yrs)	.951	.946	.956	<.001	.951	.946	.956	<.001	.950	.940	.959	<.001	.950	.940	.959	<.001
Gender (Male)	1.381	1.170	1.631	<.001	1.383	1.172	1.633	<.001	1.251	.908	1.722	.170	1.253	.910	1.726	.167
Race/Ethnicity x Depression																
Hispanic White x Depressed					1.293	.726	2.304	.383					2.070	.820	5.223	.124
Non-Hispanic Black x Depressed					1.160	.570	2.359	.683					.964	.270	3.449	.956
Other/Mixed Race x Depressed					.938	.454	1.938	.862					1.460	.461	4.621	.520

and treatment of depression within Black communities<sup>23</sup>. Stigma surrounding mental health issues can lead to underreporting or misdiagnosis of depression, as seeking help may be viewed as a sign of weakness<sup>24</sup>. Traditional cultural norms and expectations of strength and resilience may prevent individuals from seeking necessary support and treatment, leading to a chronic and untreated state of depression<sup>24</sup>. Trust is also lower toward mental health treatment in Black communities. Additionally, there is evidence to suggest that Black individuals may experience racial discrimination in the healthcare system, which can negatively impact their mental health treatment outcomes. Finally, disparities in access to quality mental health care can also contribute to the increased chronicity and larger consequences of depression in Black than White communities. Lack of culturally and structurally competent mental health services, shortage of Black mental health professionals, and disparities in insurance coverage and affordability of care also reduce the chance of receiving timely and effective treatment for Black patients. These combined can result in delayed or prolonged periods of untreated or under-treated depression, leading to a more chronic and severe course of the depression for Black communities<sup>21,22</sup>. As a result, we may observe higher prevalence of depression in Black smokers.

This study bridges the gap in the current literature by documenting universality of the associations between conventional cigarette smoking, e-cig use, and depressive symptoms. The results pave the way for universal approaches to effectively address smoking and depression in clinical and public health settings. Lack of race, ethnic, or gender differences identified in this study may have important implications for approaches to addressing smoking cessation and mental health interventions for people across all groups<sup>30</sup>. Understanding that Black people are more susceptible to the adverse effects of depressive symptoms on smoking or vice versa can inform tailored interventions for Black populations. It is essential to develop tailored strategies that address depression comorbidities in smokers of White and Black people<sup>30</sup>. Additionally, research on the stronger link in Black people is needed as well.

To further enhance our understanding of relationships between smoking, e-cigarette use, and depressive symptoms, we explored racial variation in this regard. Our findings illustrate this relationship to be non-linear, nuanced, and complex. The results showed an increased need for addressing smoking conventional cigarettes and vaping e-cigs among adults with high depressive symptoms among all groups. However, the need to address smoking in depressed individuals is more prominent for Black than White people. That is, Black adults with depression may be at an even higher risk for smoking than their White counterparts.

Several directions for future research in this area can be pursued. Longitudinal studies, for example, are needed to explore the temporal dynamics and causal relationships between these variables, shedding light on how changes in smoking behavior and depressive symptoms can influence each other over time. Secondly, mechanistic studies should delve into the biological and social mechanisms underlying the observed links. Additionally, exploring the intersectionality of race, ethnicity, and gender with socioeconomic status, and sexual orientation can provide a more nuanced understanding of the associations. Furthermore, identifying mediating and moderating factors, including stress, social support, coping strategies, self-esteem, and body image, can illuminate the mechanisms through which the smoking-depression relationship emerges. Given the limited research on group differences in the association between e-cig use and depressive symptoms, future studies should focus on examining this relationship in depth, considering group differences in motivations, perceptions, and patterns of cigarette smoking and e-cig use. Incorporating diverse cultural contexts and populations in research can also shed light on the influence of cultural norms, values, and social factors on the relationship between smoking, vaping, and depressive symptoms. By addressing these research directions, we can advance our knowledge and develop targeted interventions, policies, and public health strategies to reduce the burden of smoking-related risks and promote mental well-being among diverse populations.

This study has a few limitations that should be acknowledged. Firstly, we relied on self-reported measures of depressive symptoms as well as tobacco use, which are subject to recall and measurement bias<sup>31</sup>. Additionally, due to the cross-sectional study design, our ability to establish causal relationships between depression as a risk factor and tobacco use as an outcome is limited<sup>32</sup>. Additional studies with longitudinal design are needed to provide a more comprehensive understanding of the complex dynamics between smoking, vaping, and depression across various social and demographic groups. Furthermore, the study focused on U.S. adults and the generalizability of the findings to other age groups is limited. In addition, current users of e-cigarette group had a small sample size. This may have contributed to no observation of race x depression effect on e-cig use.

## Conclusions

In conclusion, this study expands the existing literature on the association between smoking, vaping, and depressive symptoms. The findings suggest that Black adults may be more vulnerable to smoking if they are depressed. This observation emphasizes the need for race-based tailored approaches to promote mental health of men and women who smoke cigarettes or enter cessation programs. Future

research should explore the underlying social, behavioral, psychological, economical, or biological mechanisms driving racial variation in the associations observed here. It is also unknown why Black-White differences in the association can be seen for conventional cigarettes but not for e-cigs. For e-cig users, universal programs may be better than tailored interventions because various racial groups may similarly need depression treatment if the individual uses e-cigs.

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