

Prevalence and Sociodemographic Disparities in Exposure to Tobacco Advertising and Imagery Among Youths in the United States

Precious Patrick Edet*, Nwanne Onumah**

* Dept of Population Health Science, School of Population Health, University of Mississippi Medical Center

* Dept of Epidemiology and Biostatistics, School of Public Health, Jackson State University

** Dept of Epidemiology and Biostatistics, School of Public Health, Jackson State University

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ABSTRACT

Background: In 2021, approximately 76% of middle and high school students were exposed to tobacco advertising through traditional media such as TV programs, and other tobacco exposure channels exist. Tobacco companies utilize strategies that diminish risk perception of tobacco products thereby increasing receptivity to tobacco advertising and imagery. We hypothesize that there are disparities in exposure to tobacco advertising and imagery among youths in the United States. This study examines the prevalence and sociodemographic disparities in exposure to cigarettes or other tobacco product advertising and imagery among American youths.

Methods: We analyzed data from the 2021 National Youth Tobacco Survey (NYTS) for 17,456 participants. We examined the prevalence of exposure to cigarettes and other tobacco product advertising and imagery among middle and high school students. We also examined associations between tobacco exposure channels (internet, newspaper/magazine, retail stores, TV/Streaming services) by race, sex, age, and grade level using Chi-Square tests. **Results:** Among youths in the United States, the prevalence of exposure to cigarette or other tobacco product ads via the internet was highest among Native Hawaiians (71.5%), females (65.6%), 14–16-year-olds (65.6%), and high school students (63.9%) ($p=0.000$). The prevalence of exposure to cigarette or other tobacco product ads in newspapers or magazines was highest among Blacks (30.8%), females (28.0%), 17 years or older (30.6%), and high school students (29.9%) ($p=0.000$). The prevalence of exposure to cigarette or other tobacco product ads at convenience stores or supermarkets was highest among Native Hawaiians (81.1%), females (78.8%), 14–16-year-olds (79.1%), and high school students (79.0%) ($p=0.000$). The prevalence of exposure to cigarettes or other tobacco product ads on TV or streaming services was highest among Blacks (54.2%), females (53.9%), 14–16-year-olds (52.6%), and high school students (52.6%) ($p=0.000$). The prevalence of exposure to cigarette or other tobacco product imagery on TV or streaming services was highest among Whites (78.3%), females (80.6%), 14–16-year-olds (78.6%), and high school students (78.1%) ($p=0.000$).

Conclusion: Sociodemographic disparities exist across different avenues of tobacco advertising and imagery exposure. The prevalence of tobacco ads and imagery exposure was highest among females, 14 - 16-year-olds, and high school students compared to their counterparts. This study will help tailor public health intervention needed to address disparities in tobacco exposure among youths in America.

Index Terms- tobacco advertising, tobacco imagery, youths, United States

I. INTRODUCTION

Tobacco use among youths in America remains a public health challenge despite substantial efforts to tackle the problem. Each day, approximately 1,600 youths smoke their first cigarette [1]. In 2022, the Centers for Disease Control (CDC) revealed that an estimated 4.5% of middle school students and 16.5% of high school students currently use tobacco products. In addition, approximately 1.5% of middle school students and 5.0% of high school students are current users of tobacco products [2].

Several avenues of tobacco exposure exist. Youths are exposed to cigarettes or tobacco product advertising and imagery over the internet, in print media (newspaper or magazines), at convenience stores, and while watching TV, among others. Exposure to tobacco advertising and imagery is associated with smoking initiation and continuation among young people [3]. This association was reported in studies which explained that adolescents who were non-smokers and had frequent exposure to cigarette advertising via the internet were more than twice as likely to initiate smoking than adolescents without frequent exposure to tobacco advertising [4], [5]. In 2021, approximately 76% of middle and high school students were exposed to tobacco advertising through traditional media, such as TV programs [6]. An estimated 74% of middle and high school students reported exposure to tobacco advertising via social media posts and content [6]. Among 2,230 stores in the U.S., over 95% displayed tobacco ads, and approximately 75% displayed at least one price promotion of a tobacco product in 2016 [7].

Several marketing restrictions by the U.S. Food and Drug Administration have been implemented to limit tobacco advertising and imagery exposure. Pierce et al. [8] argued that the application of these restrictions varied depending on the tobacco product. The marketing budget for e-cigarettes is higher than for traditional cigarettes, which has caused an increased presence of e-cigarette imagery in the media [8]. There is a remarkable increase in e-cigarette use among high-school students from 1.5% to 27.5% between 2011 and 2019 [9], which supports [8] findings. To increase receptivity to tobacco advertising and susceptibility to tobacco products, tobacco companies utilize strategies that diminish health consequences associated with using tobacco products, thus reducing the risk perception of these products among adolescents [5]. Other strategies include using appealing flavors, introducing new portable e-cigarette devices, and advertising price promotions at retail stores [6], [10]. These strategies consequently lead to a misconception of harm. Past studies have reported disparities in exposure to tobacco advertising and imagery. A systematic review by [11] identified disparities in the prevalence of exposure to e-cigarette advertising. Grilo et al. [11] findings showed a higher prevalence of exposure to cigarette advertising among youths than their older counterparts. Furthermore, a study [12] reported ethnic and educational level disparities in exposure to tobacco advertising among young adults. Results [12] showed a weaker inverse relationship between exposure to tobacco advertising and high school graduation in Hispanics compared to non-Hispanics. Nicksic, Bono, Ruby, Cobb, and Barnes [13] explained that exposure to tobacco advertising was higher among racial minority youths than their counterparts.

The period of adolescence is often associated with high risk-taking behaviors such as the initiation of substance use and risky sexual behaviors. Therefore, research on this population is crucial in understanding the prevalence of tobacco use, exposure to risk factors, and associated disparities. Despite public health efforts to tackle tobacco advertising and imagery exposure among youths, this problem persists. While reducing the prevalence of current tobacco use among adolescents and the proportion of adolescents exposed to tobacco marketing are among the goals set by Healthy People 2030 [14], research data addressing the prevalence of tobacco advertising and imagery exposure among youths is limited. In addition, studies assessing disparities in tobacco advertising and imagery exposure among youths are scarce. This study utilizes a nationally representative survey to investigate the prevalence and sociodemographic disparities in exposure to tobacco advertising and imagery among youth in the United States.

II. METHODS

We analyzed data from the 2021 National Youth Tobacco Survey (NYTS). The NYTS is a national survey that uses a cross-sectional research design. The survey is delivered to middle school (6th - 8th grade) and high school (9th - 12th grade) students in the United States to examine trends, patterns, and factors associated with tobacco use among American youths. The NYTS is administered by the Centers for Disease Control and Prevention across all 50 U.S. states and territories and is collected annually using a three-stage cluster sampling procedure to obtain a nationally representative sample of U.S. middle and high school students. The data collection period for the 2021 NYTS was from January 18, 2021, to May 21, 2021. Due to COVID-19 protocols, data was collected using an online survey which enabled students to participate in the study regardless of their mode of learning (face-to-face, virtual, or hybrid). A total of 25,149 students were enrolled in the study, but 69.4% (n = 17,456) of youths participated in this study.

We defined exposure to tobacco advertising and imagery as exposure to at least one type of tobacco advertising or imagery based on responses to the following five questions: "When you are using the Internet, how often do you see ads or promotions for cigarettes or other tobacco products?"; "When you read newspapers or magazines, how often do you see ads or promotions for cigarettes or other tobacco products?"; "When you go to a convenience store, supermarket, gas station, kiosk/storefront, or shopping center, how often do you see ads or promotions for cigarettes or other tobacco products?"; "When you watch TV or streaming services (such as Netflix, Hulu, or Amazon Prime) or go to the movies, how often do you see ads or promotions for cigarettes or other tobacco products?"; "When you watch TV or streaming services (such as Netflix, Hulu, or Amazon Prime), or go to the movies, how often do you see people or characters using cigarettes or other tobacco products?" Possible responses were, 1=Never; 2=Rarely; 3=Sometimes; 4=Most times; 5=Always. Each variable was dichotomized into 'Yes' and 'No' responses to compute the prevalence of exposure across several sociodemographic characteristics: Race, Sex, Age, and Grade School. Participants who selected 'Yes' had been exposed to tobacco advertising.

Demographic characteristics included race/ethnicity (White, Black, Asian, American Indian, and Native Hawaiian), grade level (sixth, seventh, eighth, ninth, tenth, eleventh, and twelfth), gender, age (13 or younger, 14 - 16, and 17 or older), and grade school (middle school and high school). The estimated prevalence of tobacco advertising and imagery exposure among participants was calculated based on students' race, sex, age, and grade school using the 2021 NYTS data. We used Chi-Square statistical analysis to examine the association between sociodemographic characteristics (race, sex, age, and grade school) and exposure to cigarette or other tobacco product advertising and imagery through four exposure channels: internet, newspaper/magazines, convenience stores or supermarkets, and TV/streaming services. The significance level was established based on a p-value less than 0.05. SPSS v. 26.0 was used to conduct this analysis.

III. RESULTS

Our sample consisted of 66% Whites, 22.5% Blacks, 5.5% Asians, 4.4% American Indians, and 1.5% Native Hawaiians. There were 8997 (51.5%) males and 8409 (48.2%) females in this study. Youths who were 13 years or younger comprised 38.9% of the sample, followed by 41.7% of youths between ages 14 and 16 years old, and then 19.1% of youths aged 17 years or older. A total of 8309 (47.6%) middle school students and 9093 (52.1%) high school students participated in this study (Table 1). Chi-Square analysis showed an association between sociodemographic characteristics and tobacco exposure channels (Table 2-6). Among youths in the United States, the prevalence of exposure to cigarette or other tobacco product ads via the internet was highest among Native Hawaiians (71.5%), females (65.6%), 14–16-year-olds (65.6%), and high school students (63.9%) ($p=0.000$) (Table 2). The prevalence of exposure to cigarette or other tobacco product ads in newspapers or magazines was highest among Blacks (30.8%), females (28.0%), 17 years or older (30.6%), and high school students (29.9%) ($p=0.000$) (Table 3). The prevalence of exposure to cigarette or other tobacco product ads at convenience stores or supermarkets was highest among Native Hawaiians (81.1%), females (78.8%), 14–16-year-olds (79.1%), and high school students (79.0%) ($p=0.000$) (Table 4). The prevalence of exposure to cigarettes or other tobacco product ads on TV or streaming services was highest among Blacks (54.2%), females (53.9%), 14–16-year-olds (52.6%), and high school students (52.6%) ($p=0.000$) (Table 5). The prevalence of exposure to cigarette or other tobacco product imagery on TV or streaming services was highest among Whites (78.3%), females (80.6%), 14–16-year-olds (78.6%), and high school students (78.1%) ($p=0.000$) (Table 6).

Table 1. Demographic Characteristics for National Youth Tobacco Survey, 2021

Characteristics	Total		Male		Female	
	Total (n)	Percentage (%)	Total (n)	Percentage (%)	Total (n)	Percentage (%)
Race						
White	11496	69.8	5922	68.8	5574	70.8
Black	3924	17.6	2004	18.2	1920	17.0
Asian	956	6.3	492	6.4	464	6.2
American Indian	761	4.6	430	4.7	331	4.4
Native Hawaiian	269	1.7	149	1.8	120	1.5
Age						
≤13yrs	6715	35.0	3466	34.2	3249	35.9
14-16yrs	7312	42.7	3724	42.6	3588	42.7
≥17yrs	3357	22.4	1793	23.2	1564	21.4
Grade						
6th	2831	14.4	1437	14.2	1394	14.6
7th	2732	14.4	1456	14.0	1276	14.8
8th	2716	14.2	1444	14.2	1272	14.2
9th	2679	15.1	1358	15.4	1321	14.9
10th	2180	14.4	1122	14.6	1058	14.1
11th	2239	13.8	1132	13.8	1107	13.8
12th	1977	13.5	1024	13.5	953	13.5
Grade School						
Middle School	8279	43.1	4337	42.6	3942	43.7
High School	9075	56.9	4636	57.4	4439	56.3

Table 2. "When you are using the Internet, how often do you see ads or promotions for cigarettes or other tobacco products?"

Characteristics	n	%	p-value
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Race			
White	6900	63.9	0.000
Black	2121	62.8	
Asian	538	59.3	
American Indian	433	65.0	
Native Hawaiian	167	71.5	
Gender			
Male	4967	61.7	0.000
Female	5164	65.6	
Age			
≤ 13yrs	3914	63.1	0.000
14-16yrs	4405	65.6	
≥ 17yrs	1830	60.6	
Grade			
Middle School	4813	63.1	0.000
High School	5321	63.9	

Table 3. "When you read newspapers or magazines, how often do you see ads or promotions for cigarettes or other tobacco products?"

Characteristics	n	%	p-value
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Race			
White	2840	26.4	0.000
Black	1068	30.8	
Asian	239	26.6	
American Indian	187	29.8	
Native Hawaiian	72	26.0	
Gender			
Male	2172	26.6	0.000
Female	2225	28.0	
Age			
≤ 13yrs	1477	23.0	0.000
14-16yrs	1977	29.1	
≥ 17yrs	948	30.6	
Grade			
Middle School	1857	23.8	0.000
High School	2536	29.9	

Table 4. “When you go to a convenience store, supermarket, gas station, kiosk/storefront, or shopping center, how often do you see ads or promotions for cigarettes or other tobacco products?”

Characteristics	n	%	p-value
Race			
White	8363	78.9	0.000
Black	2270	69.2	
Asian	595	68.5	
American Indian	488	72.3	
Native Hawaiian	181	81.1	
Gender			
Male	5832	74.2	0.000
Female	6035	78.8	
Age			
≤ 13yrs	4391	72.2	0.000
14-16yrs	5204	79.1	
≥ 17yrs	2292	77.9	
Grade			
Middle School	5426	73.0	0.000
High School	6443	79.0	

Table 5. “When you watch TV or streaming services (such as Netflix, Hulu, or Amazon Prime), how often do you see ads or promotions for cigarettes or other tobacco products?”

Characteristics	n	%	p-value
Race			
White	5330	49.9	0.000
Black	1820	54.2	
Asian	385	43.9	
American Indian	348	52.7	
Native Hawaiian	128	52.1	
Gender			
Male	3756	47.2	0.000
Female	4237	53.9	
Age			
≤ 13yrs	2919	47.4	0.000
14-16yrs	3545	52.6	
≥ 17yrs	1538	50.8	
Grade			
Middle School	3623	47.5	0.000
High School	4368	52.6	

Table 6. “When you watch TV or streaming services (such as Netflix, Hulu, or Amazon Prime), how often do you see people or characters using cigarettes or other tobacco products?”

Characteristics	n	%	p-value
Race			
White	8346	78.3	0.000
Black	2291	70.7	
Asian	653	74.0	
American Indian	475	72.1	
Native Hawaiian	171	71.2	
Gender			
Male	5733	72.5	0.000
Female	6171	80.6	
Age			
≤ 13yrs	4505	73.9	0.000
14-16yrs	5171	78.6	
≥ 17yrs	2245	76.2	
Grade			
Middle School	5564	74.2	0.000
High School	6345	78.1	

Data provided were self-reported by respondents and refer to exposure to ads or imagery of cigarettes or other tobacco products. Percentages are weighted to account for the complex sampling design of the survey.

IV. DISCUSSION

This paper examined the prevalence of exposure to cigarette or other tobacco product ads and imagery across offline and online avenues of exposure using data from the 2021 National Youth Tobacco Survey. The prevalence of exposure to cigarette or other tobacco product ads or imagery among youths was predominant among females, 14-16 year-olds, and high school students. In addition, the prevalence of exposure to cigarette or other tobacco product ads was highest for convenience stores (68.2%), followed by the internet (58.2%), TV/Streaming services (45.9%), and Newspapers or magazines (25.2%). Our findings were consistent with the CDC, which found that a high number of youths were exposed to e-cigarette ads at stores, on the internet, and on TV [15]. An increase in e-cigarette use is exceptionally high among adolescents, and a direct correlation between exposure to e-cigarette ads and e-cigarette use exists [15]. Li et al. [5] found an increase in cigarette advertising among 139 795 adolescents aged 11 to 19 from 2017-2020, resulting

from exposure to internet-based and retail store-based ads. Access to internet ads and tobacco websites should be prohibited for adolescents. Despite the Food and Drug Administration (FDA) restrictions on tobacco marketing and ads, youths still access tobacco ads and websites [16]. Our findings showed that youth exposure to cigarette and other tobacco ads was highest across several racial groups depending on the avenue of exposure. Youth exposure to cigarette or tobacco ads over the internet was highest among Native Hawaiian youths (71.5%), followed by American Indians (65.0%), Whites (63.9%), Blacks (62.8%), and Asians (59.3%). Rosaria et al. [17] highlighted that Native Hawaiian youths were disproportionately affected by tobacco use compared to other ethnic minority groups and called for more research studies and culturally relevant interventions targeting this population.

Our study also reported that racial disparities in the prevalence of exposure to cigarette or other tobacco product ads in newspapers/magazines and TV/streaming services were highest among Black youths (30.8% and 54.2%, respectively). In contrast, the prevalence of exposure to cigarette or other tobacco product ads at convenience stores and tobacco imagery on TV/streaming services were predominant among White youths (78.9% and 78.3%, respectively). Similar to our findings, [18] found that Black youth were more at risk for exposure to cigarette advertising in magazines than their White counterparts. Ribisl et al. [7] found that tobacco retail marketing was predominant in Black neighborhoods with low income and a higher underaged population than their White counterparts. In a statement by [1], *"The tobacco industry targets African American communities with marketing and advertising,"* a statement that corroborates [7]. Study data from [1] and [7] on racial disparities in exposure to retail tobacco advertising are contrary to our findings. More research investigating this issue is needed.

Gender disparities in the prevalence of exposure to cigarette or other tobacco product ads and imagery showed that females were more exposed than males across all four exposure avenues. Despite studies [19], [20] showing a higher prevalence of tobacco use in boys than girls, our findings suggested that girls had a higher risk of exposure to tobacco ads and imagery than boys. Age disparity data revealed that youths aged 14-16 were more exposed to cigarette or other tobacco product ads than other adolescent age groups across all exposure avenues except newspapers or magazines. According to Etim, Pike, and Xie, [21], the probability of e-cigarette use among U.S. adolescents peaks in the mid-teenage years (15 -16 years old), after which it decreases, and exposure to e-cigarette commercials contribute to e-cigarette use.

An estimated 64.3% of middle and high school students are exposed to tobacco at school [22]. Our findings revealed that exposure to cigarette or other tobacco product ads or imagery was higher among high school students compared to their middle school counterparts. The high prevalence of exposure to tobacco ads and imagery among high school students could contribute to high tobacco use in this population. Preferred locations for tobacco use at middle or high school campuses were the bathroom and parking lot [22]. According to [1], the prevalence of ever trying a tobacco product was higher among high school students (34.0%) than middle school students (11.3%) in 2021. Further research examining the exposure to tobacco ads and imagery across a broader range of sociodemographic factors is imperative in understanding trends and patterns in tobacco use among U.S. youths. Additionally, racial disparity data from this study varied considerably across different channels of tobacco exposure and, in some cases, contradicted past studies, which indicates a need for future research investigation on this issue.

V. CONCLUSION

Several sociodemographic disparities exist across different avenues of tobacco advertising and imagery exposure. Racial disparities in the exposure to tobacco ads in newspapers and on TV/streaming services were highest among Black youths. In contrast, White youths had the highest exposure to tobacco ads at convenience stores/supermarkets and tobacco imagery on TV/streaming services. The prevalence of tobacco ads and imagery exposure was generally highest among females, 14 - 16-year-olds, and high school students compared to their counterparts.

VI. IMPLICATION

Exposure to cigarette and other tobacco ads and imagery differed significantly across several sociodemographic factors depending on the exposure channel. This study identified vulnerable populations disproportionately affected by tobacco advertising and imagery. This study will help tailor public health interventions needed to address sociodemographic disparities in tobacco ads and imagery exposure.

VII. CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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AUTHORS

First Author – Precious Patrick Edet, MBBS, MPH, University of Mississippi Medical Center & Jackson State University, MS, USA, pedet2024@gmail.com

Second Author – Nwanne Onumah, MBBS, Jackson State University, MS, USA, nwanne01@yahoo.com

Correspondence Author – Precious Patrick Edet, pedet2024@gmail.com, 601-913-7193