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Smoking History, Age of Smoking and Myocardial Infarction: A Cross-Sectional Analysis of U.S. Adults

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Abstract:

- ***Background:***

Cigarette smoking is a well-established risk factor for myocardial infarction (MI), yet the relationship between the age at which individuals last smoked and MI has been less extensively studied. This study examined the association between smoking history, measured by age last smoked, and self-reported heart attack among U.S. adults.

- ***Methods:***

A cross-sectional analysis was conducted using the 2024 Behavioral Risk Factor Surveillance System (BRFSS) dataset. Adults with complete data on smoking history and myocardial infarction were included in our study. Poisson regression with robust standard errors was used to estimate adjusted prevalence ratios (PRs), while controlling for demographic, socioeconomic, and clinical covariates. Interaction and stratified analyses were performed to evaluate effect modification by age and sex.

- ***Results:***

Among 454,555 participants, 26,672 reported a history of myocardial infarction. Although crude analyses showed a significant association between smoking history and MI, this association was attenuated after adjustment for confounders. Older age, male sex, and diabetes remained strong independent predictors of MI. Effect modification by age was observed, with smoking. This demonstrated a stronger association with MI among younger adults (18–39 years; PR = 2.47, 95% CI: 2.10–2.91) than older adults (≥60 years; PR = 1.52, 95% CI: 1.47–1.57). No significant interaction between smoking and sex was identified in our study.

- ***Conclusions:***

The association between smoking history and myocardial infarction is influenced by age with relatively greater effects observed in younger adults. These findings underscore the importance of early smoking prevention and cessation strategies to reduce long-term cardiovascular risk. Further longitudinal studies are needed to clarify the causal relationship between smoking history and myocardial infarction.

Keywords: *Smoking; Myocardial Infarction; Cross-Sectional Studies; BRFSS; Risk Factors*

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I. INTRODUCTION

Cigarette smoking is one of the main causes of heart disease, including heart attack (myocardial infarction). Many studies have showed that people who smoke have higher risk of heart attack compared to people who never smoke. For example, the INTERHEART study found that smoking is one of the most important risk factor for heart attack in many countries.[1] Also another study showed that when people smoke more cigarettes per day, the risk also increases, which means there is dose–response relationship.[2]

Stopping smoking can reduce this risk. Research shows that after quitting smoking, the risk of heart disease becomes lower and keeps decreasing over time. One study found that women who quit smoking had lower risk of heart disease, and the benefit increased as time goes.[3] Another study showed that people who stop smoking after heart attack have better outcome and lower chance of another heart problem.[4] Also one meta-analysis showed that quitting smoking reduces death after heart attack.[5]

Public health organizations also support these findings. The CDC say that risk of heart attack drops quickly within 1–2 years after quitting smoking and continues to decrease with time.[6,..,11] So overall, smoking increases heart attack risk, and quitting helps to reduce it.

However, many studies only look at smoking status like current smoker or former smoker, but they do not look at the age when a person stopped smoking. This is important because age last smoked can give idea how long person was exposed to smoking. But this part is not studied much, so there is a gap.

In this study, we have used BRFSS 2024 data to study the relationship between age last smoked and heart attack. The main objective of this study is to see if people who stop smoking at older age have higher risk of heart attack compared to those who stop at younger age. We also want to check if this relationship is different by age group and sex.

II. METHODS

A. Data Source

The data for this study was taken from the Behavioral Risk Factor Surveillance System (BRFSS) 2024 dataset. BRFSS is a large cross-sectional survey conducted every year by the Centers for Disease Control and Prevention (CDC). It collects information from adults in all 50 states in the United States about their health behaviors, chronic diseases, and preventive care.

The data is collected using telephone interviews, and only adults aged 18 years or older are included. BRFSS uses a complex sampling design, so survey weights are provided to make the data representative of the U.S population. No ethical approval is needed for this.[12] In our study, we used these data to study smoking history and heart attack.

B. Sample

The study population includes adults aged 18 years or older who participated in BRFSS 2024. We included only those participants who had valid (non-missing) data for both the exposure variable (age last smoked) and the outcome variable (heart attack). Participants who answered “don’t know,” “refused,” or had missing values for these key variables were excluded from the main analysis. However, for some variables like income or education, missing values were kept as a separate “Unknown” category to keep sample size large. After applying inclusion and exclusion criteria, the final sample included a large number of participants, making the results more reliable and generalizable.

C. Exposure

The main exposure variable in this study is smoking history, measured as the age when a person last smoked cigarette regularly. In BRFSS 2024, this is represented by the variable LCSLAST_. We used this variable to understand how long a person was exposed to smoking. This variable was also grouped into categories to make analysis easier. In some parts of analysis, smoking was also grouped into categories like “Never,” “Recent,” “Intermediate,” and “Long-term” based on smoking behavior. This helps to compare people who stopped smoking early versus those who stopped later in life.

D. Outcome

The outcome variable in this study is heart attack (myocardial infarction). In BRFSS 2024, this is measured using the variable CVDINFR4, which asks if a doctor ever told the participant that they had a heart attack. This variable was coded as a binary variable (Yes vs No). People who answered “Yes” were considered to have a history of heart attack, and those who answered “No” were considered as not having heart attack.

E. Covariates

We included several covariates in the analysis because they are related to both smoking and heart attack and can act as confounders. These variables include age, sex, race/ethnicity, education, and income. We also included clinical and lifestyle factors such as diabetes, body mass index (BMI), and exercise. These variables are important because they are known risk factors for heart attack and may also be related to smoking behavior. Age was grouped into three categories: 18–39, 40–59, and 60+. Sex was categorized as male and female. Income and education were grouped into simple categories to make analysis easy. In addition, we also considered age group and sex as possible effect modifiers, because the relationship between smoking and heart attack may be different in these groups.

F. Statstical Analysis

All analyses were performed using R software. First, we conducted descriptive analysis to understand the distribution of variables in the study population. We created tables to show characteristics of participants by heart attack status. Next, we performed bivariate (crude) analysis to examine the relationship between each variable and heart attack. Chi-square tests were used for categorical variables to check if there is association. After that, we used regression models to study the association between smoking history and heart attack. We used Poisson regression with a log link and robust standard errors to

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estimate prevalence ratios (PR) with 95% confidence intervals. This method is suitable for cross-sectional data with binary outcome. We also adjusted for confounders such as age, sex, race, income, education, diabetes, BMI, and exercise to get adjusted estimates.

To assess effect modification, we included interaction terms between smoking and age group, and between smoking and sex in the regression model. We also performed stratified analysis by age group and sex, where we ran separate models within each subgroup. This helps to see if the effect of smoking is different in different groups.

Both interaction model and stratified analysis were used because interaction gives statistical test, while stratified analysis shows practical difference between groups.

III. RESULTS

Weighted prevalence distributions of selected characteristics are presented by heart attack status (Table 1). Of the 454,555 adults included in this study, 26,672 had a history of heart attack while 427,883 did not. This shows that heart attack cases were much lower compared to non-cases. The prevalence of heart attack increased with age. Among participants with heart attack, 79% were aged 60 and above, 17% were aged 40–59, and only 3.2% were aged 18–39. In comparison, among those without heart attack, only 45% were aged 60+, while 25% were aged 18–39. This clearly shows that heart attack is more common in older people.

There were also differences by sex. Among participants with heart attack, 61% were male and 39% were female, while among those without heart attack, females were slightly more (53%) compared to males (47%). This shows that males have higher prevalence of heart attack. In addition, participants with heart attack were more likely to have lower income and lower education levels. For example, 42% of heart attack cases were in the low-income group compared to only 26% in the high-income group.

There were no very big differences in some lifestyle factors like exercise, but people who did not exercise had higher percentage of heart attack (38%) compared to those who exercised (62%). Also, diabetes was more common among heart attack cases (36%) compared to those without heart attack. Overall, higher prevalence of heart attack was seen among older adults, males, people with low income, lower education, and those with health conditions like diabetes.

In the crude (bivariate) analysis (Table 2), several variables showed strong association with heart attack. Age had the strongest relationship, where participants aged 60+ had the highest percentage of heart attack compared to younger groups. Sex also showed strong association, with males having higher proportion of heart attack cases. Smoking was also related to heart attack, where long-term smokers had higher percentage (75%) of heart attack cases compared to other groups. However, some variables like current smoking status did not show strong association in crude analysis.

After adjusting for confounders such as age, sex, race, income, education, diabetes, BMI, and exercise (Table 3 and Table 4), the association between smoking history and heart attack became weaker. For example, long-term smoking had an adjusted prevalence ratio (PR) of 0.92 (95% CI: 0.64, 1.33), which is not statistically significant. Similarly, intermediate and recent smoking also did not show strong significant association after adjustment. This suggests that the crude association was affected by confounding factors, especially age and sex.

However, other variables still showed strong association even after adjustment. Age remained the strongest factor, where participants aged 60+ had much higher risk of heart attack (PR = 11.64, 95% CI: 9.05, 14.98) compared to younger group. Male sex was also associated with higher risk (PR = 2.05, 95% CI: 1.93, 2.18). Diabetes also showed strong association, where participants with diabetes had higher risk of heart attack (PR = 1.94, 95% CI: 1.82, 2.06).

Table 5 shows the interaction model between smoking and age group. Among participants aged 18–39, those who ever smoked had about 2.39 times higher risk of heart attack compared to those who never smoked. For the 40–59 age group, the interaction was not statistically significant (PR = 0.86, $p = 0.098$), showing no strong difference in this group. However, for the 60+ age group, the interaction term was significant and less than 1 (PR = 0.63, $p < 0.001$), which means the effect of smoking becomes weaker in older adults.

Table 6 shows stratified analysis by age group. Smoking had strongest effect in younger group (18–39) with PR = 2.47, followed by 40–59 group (PR = 1.96), and weakest in 60+ group (PR = 1.52). All these results were statistically significant. This shows that smoking increases risk of heart attack in all age groups, but the strength of this effect decreases with increasing age.

Table 7 shows the interaction model by sex. Smoking increased the risk of heart attack among females (PR = 1.65), and males had higher baseline risk compared to females (PR = 1.90). However, the interaction between smoking and sex was not statistically significant (PR = 0.97, $p = 0.282$), which means the effect of smoking is similar in males and females.

Table 8 shows stratified analysis by sex. Among females, smokers had about 1.60 times higher risk of heart attack, while among males the risk was about 1.63 times higher. Both were statistically significant. This again shows that smoking increases heart attack risk in both males and females in similar way.

Overall, heart attack was more common among older people, males, and those with health conditions. Smoking showed association in crude analysis, but after adjustment it became weaker. However, effect modification analysis showed that age is an important factor, where the effect of smoking is stronger in younger people and becomes weaker in older people, while sex did not show strong effect modification.

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IV. DISCUSSION

This study looked at the relationship between smoking history and heart attack and found that smoking was related with higher risk of heart attack in crude analysis, but after adjusting for other factors the association became weaker. People who smoked longer or stopped smoking at older age did not show strong statistically significant association after adjustment. This means smoking alone may not fully explain the risk, and other factors like age and health condition also play very big role.

In this study, age showed the strongest association with heart attack. Older adults, especially those aged 60 and above, had much higher risk compared to younger people. Also, males had higher risk compared to females. Diabetes also showed strong association with heart attack. These findings are similar with previous studies which show that age, sex, and chronic diseases are major risk factors for heart disease. [1,2]

Even though adjusted results were not strong for smoking, the interaction analysis showed something important. The effect of smoking was not same in all age groups. Smoking had stronger effect in younger adults (18–39 years), where smokers had around 2.4 times higher risk of heart attack compared to non-smokers. In middle age group (40–59), the effect was still there but smaller. In older adults (60+), the effect of smoking was weakest. This means age modifies the effect of smoking. One possible reason is that older people already have many other risk factors, so the relative effect of smoking becomes less visible.

Previous research also supports that smoking increases risk of heart attack, and quitting smoking reduces this risk over time. [3, 5] Some studies also show that people who stop smoking after heart attack have better outcomes and lower risk of another event.[4] So even if our adjusted results were weaker, smoking is still an important risk factor and should not be ignored.

On the other hand, sex did not show strong effect modification. Smoking increased the risk of heart attack in both males and females in similar way. This suggests that biological effect of smoking on heart disease may be similar in both sexes. This finding is also supported by previous studies which show smoking is harmful for both men and women.[2]

Overall, this study suggests that smoking is still an important factor, but its effect depends on age. Younger smokers may have relatively higher increase in risk compared to older adults. This is very important for public health, because it shows that early smoking prevention is very important. If people stop smoking earlier, the risk of heart disease can reduce over time. [6,...,11]

A. Strengths and Limitations

The main strength of this study is the use of a large national dataset BRFSS 2024, which includes very large sample size. This makes the results more reliable and more generalizable to the U.S population. Also, we included many important variables like age, sex, income, education, and health conditions, which helped us to adjust for confounding. Another strength is that we tested effect modification using both interaction model and stratified analysis, so we get better understanding of the relationship.

However, there are some limitations. First, the study is cross-sectional, so we cannot say smoking causes heart attack directly. We can only say there is association. Second, all data are self-reported, so there can be recall bias or reporting error. Some people may not remember correctly when they stopped smoking or may not report honestly.

Another limitation is missing data. Some participants were excluded due to missing values, which may cause selection bias. Also, even after adjusting for many variables, there may still be some residual confounding which we cannot control. For example, diet, genetics, or access to healthcare were not fully included in this study.

Also, the variable "age last smoked" may not fully capture smoking exposure. It does not show how many cigarettes per day or total duration clearly, so some misclassification can happen.

V. CONCLUSION

In conclusion, this study found that smoking is associated with heart attack, but the association becomes weaker after adjusting for other factors. Age is very strong factor, and it also modifies the effect of smoking. Smoking has stronger effect in younger adults compared to older adults. Sex did not significantly modify the relationship. These findings suggest that public health programs should focus more on preventing smoking at younger age, because early exposure can increase long-term risk of heart disease. More future studies, especially longitudinal studies, are needed to better understand the causal relationship between smoking and heart attack.

- Conflict of Interest: None.
- Financial Disclosure: None

Table 1 Characteristics of Study Participants by Heart Attack Status

Characteristic	Overall	Heart Attack (%)	
	N = 454,555[1]	No N = 427,883[1]	Yes N = 26,672[1]
Age Group			
18–39	108,142 (24%)	107,287 (25%)	855 (3.2%)
40–59	131,659 (29%)	127,005 (30%)	4,654 (17%)
60+	214,754 (47%)	193,591 (45%)	21,163 (79%)
Sex			

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Female	238,819 (53%)	228,364 (53%)	10,455 (39%)
Male	215,736 (47%)	199,519 (47%)	16,217 (61%)
Race/Ethnicity			
Black, Non-Hispanic	34,816 (7.8%)	33,067 (7.9%)	1,749 (6.7%)
Hispanic	48,221 (11%)	46,466 (11%)	1,755 (6.7%)
Multiracial, Non-Hispanic	10,393 (2.3%)	9,769 (2.3%)	624 (2.4%)
Other, Non-Hispanic	24,550 (5.5%)	23,386 (5.6%)	1,164 (4.5%)
White, Non-Hispanic	327,713 (74%)	306,923 (73%)	20,790 (80%)
Unknown	8,862	8,272	590
Income Group			
High	163,509 (44%)	157,880 (46%)	5,629 (26%)
Low	94,924 (26%)	85,871 (25%)	9,053 (42%)
Middle	109,817 (30%)	102,887 (30%)	6,930 (32%)
Unknown	86,305	81,245	5,060
Education			
College graduate	190,844 (42%)	182,967 (43%)	7,877 (30%)
Elementary (Grades 1–8)	9,041 (2.0%)	8,242 (1.9%)	799 (3.0%)
High school graduate	114,777 (25%)	106,667 (25%)	8,110 (31%)
Never attended / Kindergarten	708 (0.2%)	661 (0.2%)	47 (0.2%)
Some college / technical school	120,037 (27%)	111,946 (26%)	8,091 (30%)
Some high school	16,912 (3.7%)	15,264 (3.6%)	1,648 (6.2%)
Unknown	2,236	2,136	100
Marital Status			
Divorced	58,340 (13%)	53,420 (13%)	4,920 (19%)
Married	228,291 (51%)	215,896 (51%)	12,395 (47%)
Never married	84,217 (19%)	81,945 (19%)	2,272 (8.6%)
Separated	9,338 (2.1%)	8,681 (2.0%)	657 (2.5%)
Unmarried couple	21,673 (4.8%)	21,083 (5.0%)	590 (2.2%)
Widowed	48,628 (11%)	42,932 (10%)	5,696 (21%)
Unknown	4,068	3,926	142
Smoking Group			
Intermediate	14,267 (23%)	13,267 (24%)	1,000 (18%)
Long-term	40,524 (66%)	36,446 (66%)	4,078 (75%)
Never	368 (0.6%)	337 (0.6%)	31 (0.6%)
Recent	5,904 (9.7%)	5,553 (10.0%)	351 (6.4%)
Unknown	393,492	372,280	21,212
Alcohol Use			
Unknown	43,243	40,727	2,516
Diabetes			
No	374,085 (82%)	357,932 (84%)	16,153 (61%)
Prediabetes	11,176 (2.5%)	10,287 (2.4%)	889 (3.3%)
Pregnancy-related	3,379 (0.7%)	3,266 (0.8%)	113 (0.4%)
Yes	65,079 (14%)	55,616 (13%)	9,463 (36%)
Unknown	836	782	54
BMI			
Normal weight	120,337 (29%)	114,324 (30%)	6,013 (24%)
Obese	138,756 (34%)	129,439 (33%)	9,317 (38%)
Overweight	145,722 (35%)	136,716 (35%)	9,006 (36%)
Underweight	7,308 (1.8%)	6,860 (1.8%)	448 (1.8%)
Unknown	42,432	40,544	1,888
Coronary Heart Disease			
No	422,602 (94%)	410,126 (96%)	12,476 (49%)
Yes	28,099 (6.2%)	15,254 (3.6%)	12,845 (51%)
Unknown	3,854	2,503	1,351
Stroke			
No	433,168 (96%)	412,131 (97%)	21,037 (79%)
Yes	20,305 (4.5%)	14,870 (3.5%)	5,435 (21%)
Unknown	1,082	882	200
Exercise			
No	105,095 (23%)	95,065 (22%)	10,030 (38%)

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Yes	348,242 (77%)	331,718 (78%)	16,524 (62%)
Unknown	1,218	1,100	118
Ever Smoked			
No	257,476 (61%)	247,536 (62%)	9,940 (40%)
Yes	166,041 (39%)	151,111 (38%)	14,930 (60%)
Unknown	31,038	29,236	1,802
Current Smoker			
No	376,299 (89%)	355,828 (89%)	20,471 (82%)
Yes	46,676 (11%)	42,333 (11%)	4,343 (18%)
Unknown	31,580	29,722	1,858
Insurance			
No	25,150 (5.8%)	24,417 (5.9%)	733 (2.9%)
Yes	411,265 (94%)	386,383 (94%)	24,882 (97%)
Unknown	18,140	17,083	1,057
Cost Barrier			
No	410,224 (91%)	386,447 (91%)	23,777 (90%)
Yes	42,776 (9.4%)	40,012 (9.4%)	2,764 (10%)
Unknown	1,555	1,424	131
Last Checkup			
Delayed	81,826 (18%)	79,852 (19%)	1,974 (7.5%)
Recent	367,573 (82%)	343,112 (81%)	24,461 (93%)
Unknown	5,156	4,919	237

[1] n (%).

Table 2 Bivariate Analysis of Study Participants by Heart Attack Status

Characteristic	**Heart Attack**		**p-value**
	No N = 55,603[1]	**Yes N = 5,460[1]**	
Smoking Group			**<0.001**
Intermediate	13,267 (24%)	1,000 (18%)	
Long-term	36,446 (66%)	4,078 (75%)	
Never	337 (0.6%)	31 (0.6%)	
Recent	5,553 (10.0%)	351 (6.4%)	
Age	60 (16)	70 (10)	<0.001
Age Group			**<0.001**
18–39	7,855 (14%)	74 (1.4%)	
40–59	15,714 (28%)	746 (14%)	
60+	32,034 (58%)	4,640 (85%)	
Sex			**<0.001**
Female	27,419 (49%)	1,785 (33%)	
Male	28,184 (51%)	3,675 (67%)	
Race/Ethnicity			**<0.001**
Black, Non-Hispanic	2,232 (4.1%)	210 (3.9%)	
Hispanic	3,280 (6.0%)	216 (4.0%)	
Multiracial, Non-Hispanic	1,251 (2.3%)	143 (2.7%)	
Other, Non-Hispanic	2,244 (4.1%)	221 (4.1%)	
White, Non-Hispanic	45,736 (84%)	4,568 (85%)	
Unknown	860	102	
Education			**<0.001**
College graduate	21,233 (38%)	1,542 (28%)	
Elementary (Grades 1–8)	716 (1.3%)	131 (2.4%)	
High school graduate	14,609 (26%)	1,691 (31%)	
Never attended / Kindergarten	57 (0.1%)	9 (0.2%)	
Some college / technical school	16,895 (30%)	1,750 (32%)	
Some high school	1,925 (3.5%)	322 (5.9%)	
Unknown	168	15	
Income Group			**<0.001**
High	21,098 (44%)	1,241 (27%)	
Low	11,539 (24%)	1,787 (38%)	
Middle	15,196 (32%)	1,618 (35%)	

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Unknown	7,770	814	
Marital Status			**<0.001**
Divorced	8,647 (16%)	1,005 (18%)	
Married	29,490 (53%)	2,634 (48%)	
Never married	6,587 (12%)	353 (6.5%)	
Separated	1,027 (1.9%)	104 (1.9%)	
Unmarried couple	2,453 (4.4%)	107 (2.0%)	
Widowed	7,106 (13%)	1,237 (23%)	
Unknown	293	20	
Diabetes			**<0.001**
No	44,921 (81%)	3,224 (59%)	
Prediabetes	1,407 (2.5%)	176 (3.2%)	
Pregnancy-related	333 (0.6%)	17 (0.3%)	
Yes	8,868 (16%)	2,033 (37%)	
Unknown	74	10	
BMI			**<0.001**
Normal weight	13,739 (26%)	1,189 (23%)	
Obese	19,155 (36%)	2,014 (38%)	
Overweight	19,277 (36%)	1,985 (38%)	
Underweight	714 (1.4%)	85 (1.6%)	
Unknown	2,718	187	
Coronary Heart Disease			**<0.001**
No	52,111 (94%)	2,323 (45%)	
Yes	3,086 (5.6%)	2,864 (55%)	
Unknown	406	273	
Stroke			**<0.001**
No	52,928 (95%)	4,352 (80%)	
Yes	2,573 (4.6%)	1,066 (20%)	
Unknown	102	42	
Exercise			**<0.001**
No	13,391 (24%)	2,033 (37%)	
Yes	42,089 (76%)	3,401 (63%)	
Unknown	123	26	
Ever Smoked	55,603 (100%)	5,460 (100%)	
Current Smoker			**>0.9**
No	55,600 (100%)	5,460 (100%)	
Yes	3 (<0.1%)	0 (0%)	
Alcohol Use	29,889 (55%)	2,063 (39%)	<0.001
Unknown	1,577	167	
Insurance			**<0.001**
No	2,212 (4.1%)	92 (1.7%)	
Yes	51,907 (96%)	5,201 (98%)	
Unknown	1,484	167	
Cost Barrier			**0.022**
No	50,825 (92%)	5,031 (93%)	
Yes	4,649 (8.4%)	407 (7.5%)	
Unknown	129	22	
Last Checkup			**<0.001**
Delayed	8,290 (15%)	295 (5.4%)	
Recent	46,940 (85%)	5,130 (95%)	
Unknown	373	35	

[1] n (%); Mean (SD)

[2] Pearson's Chi-squared test; Wilcoxon rank sum test; NA; Fisher's exact test

Table 3 Adjusted Prevalence Ratios of Heart Attack by Smoking History in Relation to Selected Covariates

Covariate	**Adjusted PR (95% CI)**
Age Group	
18–39 (ref.)	ref.
40–59	4.75 (3.67, 6.14)
60+	11.64 (9.05, 14.98)

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Sex	
Female (ref.)	ref.
Male	2.05 (1.93, 2.18)
Race/Ethnicity	
White, Non-Hispanic (ref.)	ref.
Black, Non-Hispanic	0.85 (0.74, 0.98)
Other, Non-Hispanic	0.98 (0.86, 1.13)
Multiracial, Non-Hispanic	1.27 (1.07, 1.50)
Hispanic	0.82 (0.72, 0.95)
Income Group	
Low (ref.)	ref.
Middle	0.77 (0.72, 0.82)
High	0.54 (0.50, 0.58)
Diabetes	
No (ref.)	ref.
Prediabetes	1.37 (1.17, 1.59)
Yes	1.94 (1.82, 2.06)
Pregnancy-related	1.29 (0.74, 2.24)
BMI Category	
Normal weight (ref.)	ref.
Underweight	1.30 (1.03, 1.64)
Overweight	0.97 (0.90, 1.05)
Obese	0.95 (0.88, 1.03)
Exercise	
No (ref.)	ref.
Yes	0.76 (0.71,0.80)
Smoking Group	
Never (ref.)	ref.
Long-term	0.92 (0.64,1.33)
Intermediate	1.08 (0.75,1.57)
Recent	1.07 (0.73,1.56)

Adjusted for age group, sex, race/ethnicity, income group, diabetes, BMI, exercise, and smoking group.

Table 4 Prevalence and Adjusted Prevalence Ratios of Heart Attack by Smoking History

Smoking Group	n	Heart Attack Yes (%)	Heart Attack No (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
Long-term	40,524	10.1	89.9	1.19 (0.85,1.68)	0.92 (0.64,1.33)
Intermediate	14,267	7.0	93.0	0.83 (0.59,1.17)	1.08 (0.75,1.57)
Recent	5,904	5.9	94.1	0.71 (0.50,1.00)	1.07 (0.73,1.56)
Never	368	8.4	91.6	ref.	ref.
NA	393,492	5.4	94.6	NA	NA

a. Unweighted prevalences.
b. Adjusted for age group, sex, race/ethnicity, education, income group, diabetes, BMI, and exercise.

Table 5 Interaction Model: Ever Smoked × Age Group and Heart Attack

Term	PR (95% CI)	p-value
Ever smoked (Yes vs No) among age 18–39	2.39 (2.03,2.80)	0.0000
Age 40–59 (vs 18–39) among never smokers	4.08 (3.60,4.63)	0.0000
Age 60+ (vs 18–39) among never smokers	11.46 (10.19,12.88)	0.0000
Interaction: Ever smoked × Age 40–59	0.86 (0.73,1.03)	0.0981
Interaction: Ever smoked × Age 60+	0.63 (0.54,0.74)	0.0000

Table 6 Stratified Association Between Ever Smoking and Heart Attack by Age Group

Age Group	Stratum-specific PR (95% CI)	p-value
18–39	2.47 (2.10,2.91)	0.0000
40–59	1.96 (1.83,2.10)	0.0000
60+	1.52 (1.47,1.57)	0.0000

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Table 7 Interaction Model: Ever Smoked × Sex and Heart Attack

Term	PR (95% CI)	p-value
Ever smoked (Yes vs No) among females	1.65 (1.58,1.72)	0.0000
Male (vs Female) among never smokers	1.90 (1.82,1.99)	0.0000
Interaction: Ever smoked × Male	0.97 (0.92,1.03)	0.2821

Table 8 Stratified Association Between Ever Smoking and Heart Attack by Sex

Sex	Stratum-specific PR (95% CI)	p-value
Female	1.60 (1.53,1.68)	0.0000
Male	1.63 (1.57,1.68)	0.0000

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