Assessing how children modify the impact of having health insurance on smoking status using the 2021 Behavioral Risk Factor Surveillance System Survey

Zak Lippert[1], Anthony Blake[1], Nicole Kolm-Valdivia[1], Patrick Maloney[1]

1. University of Nebraska Medical Center, College of Public Health

Abstract:

Objective: To understand if children living in the home modify the relationship between health insurance and smoking.

Methods: This analysis used the 2021 Behavioral Risk Factor Surveillance System Survey. The outcome was being a current smoker with health insurance as the exposure. The analysis was stratified by children to determine if children changed how having health insurance impacted smoking. The odds ratios for each stratum were compared to determine if children was a modifying factor.

Results: Children had a modifying effect on health insurance. For someone with children, if they had insurance, their odds of smoking were 0.91 (95% CI: 0.80-1.03) times that of someone without insurance. For someone without kids, if they had insurance, their odds of smoking was 1.45 (95% CI: 1.31-1.60) times that of someone without insurance.

Conclusion: Children can have a modifying effect on the smoking status of the adults they live with. This shows that the effects of insurance differ based on if there are children in the home. In terms of altering someone's smoking status, knowing their household makeup could be valuable information to understanding how insurance will impact them.

Introduction:

Cigarette use in adults in the United States causes 480,000 deaths per year and costs an estimated $300 billion to the US economy each year.[1] Smoking has both short-term and life-long health implications for the smoker, including cancer, heart disease, and chronic obstructive pulmonary disease.[2] Of the 480,000 deaths, about 41,000 were non-smoking adults, and 400 were infants who died from secondhand smoke.[1] Investigating the interaction between different personal factors like health insurance status and whether an individual has children living with them can help public health officials understand how to address smoking in different individuals.

One way to lessen the long-term impacts of smoking is by providing insurance that allows people to get routine checkups to mitigate the short- and long-term impacts of smoking.[3] By not letting things go unchecked, there is not as big of a risk that they will spiral into costly, lifelong ailments. In addition, doctors in the United States are recommended to counsel patients on smoking cessation.[4] The Affordable Care Act (ACA) increased the prevalence of health insurance in the United States, with more than 40 million Americans insured through the program through early 2023.[5] Although the program allowed for surcharges for tobacco users to curb smoking, results were mixed.[6] Some smokers chose to skip getting health insurance altogether rather than pay the premium associated with being an insured smoker. Efforts to alter smoker status through providing health insurance options may not be sufficient to understand the relationship between health insurance and smoking.

Researchers looking into the ACA specifically found that tobacco use surcharges under the ACA made coverage prohibitively expensive or complicated for some smokers.[7] The surcharges meant smokers could be less likely than non-smokers to purchase insurance through the ACA marketplace or less likely to purchase the right insurance. Despite the intentions of the ACA to reduce smoking either by discouraging the person from smoking with penalties or increasing access to smoking cessation programs, results were inconclusive.

Health insurance on its own, at least through the ACA marketplace, wasn't a big enough encouragement for people not to smoke.

In a study of the Medicaid expansion following the passing of the ACA, researchers using the Behavioral Risk Factor Surveillance System (BRFSS) from 2011 to 2016 found that smokers in states that participated in the Medicare expansion were more likely to have insurance than those in states that did not participate in the expansion.[8] Based on these recent investigations, the relationship between health insurance and smoking does not appear to be only about the availability of insurance. Other factors could influence the relationship that haven't been fully explored yet.

The idea that health insurance on its own is insufficient to understand smoking is backed up in a study by Jerant, et al.[9] Researchers found that while having access to preventative care increased consumption of primary care, it did not increase the uptake in healthy behaviors. The preventative care measured revolved around single screenings and tests rather than counseling on cessation. The authors noted that the study did not mention any sort of counseling on health behaviors on the part of the primary care providers that would have directly addressed the health behavior measured in the later part of the study. For health behaviors that persist through phases of a patient's life, a single primary care visit may not be sufficient to change the behaviors of patients.

In a study focused on smoking cessation and having dependent children, researchers found that women with one or more dependent children at home had greater odds of smoking cessation compared to women without dependent children at home.[10] The effect was less evident in men and did not increase as the number of children increased, as was found in women. The odds ratio for men for smoking cessation with two or more children was 1.30 (95% CI: 1.09, 1.50), and the odds ratio for three or more children was 1.23 (95% CI: 0.97-1.51). This study used data from 1988 to 1992 to measure change over time but did not include any measures for insurance.

A study conducted on smoking parents taking their children to the pediatric emergency department showed that parents who acknowledged health

risks to their children from smoking were more likely to be motivated to quit.[11] Researchers also noted that parents sometimes lacked the knowledge of the risks smoking posed to their children. This study was conducted on a relatively small sample of families at a single pediatric emergency department, limiting its general applicability. In a similar study conducted outside of the pediatric emergency department, researchers found similar behavior in parents of children with asthma.[12] In the asthma study, the severity of symptoms in the child was not associated with motivation in the parents to quit smoking.[12] In contrast, their perception of the severity of their child's symptoms was associated with a greater motivation to change. Neither of these studies directly referenced the adult's health insurance status beyond the fact that the studies were conducted in a health care setting.

In a study conducted in Germany,[13] researchers found mixed results on the association between having children and different health behaviors. They found that parents having children in the household was associated with better health outcomes in a variety of categories, including smoking. When stratifying by age, they found that younger parents had worse health behaviors, while older parents had better results for those same outcomes. This analysis shows that children can have an impact on the health behaviors of their parents. The study by Jarvis[10] hypothesized that stress may impact the behavior of young parents but does not impact older parents in the same manner, but the specific impact that having children provides is not necessarily straightforward.

The analysis conducted here attempts to understand the impact that having children in the home has on the association between health insurance and smoking. While previous research has shown that insurance status can have relationships to smoking depending on different factors, there is insufficient research on whether children have an effect on the impact of insurance. The presence of children has only been studied as a factor for smoking cessation, but those studies did not include insurance. By including both aspects, insurance and children, this analysis addresses multiple factors and how they both can impact smoking. By looking at both factors together, public health officials can gain a

greater understanding of how and when insurance can be most effective at altering smoking status and when other methods could be more effective.

Methods:

Study Design:

This analysis was conducted using the Behavioral Risk Factor Surveillance System (BRFFS) 2021 dataset without any additional packages or sources included. The analysis was based on a survey using a cross-sectional study design. Since there was no contact with study participants and the data was already collected, no IRB approval was needed for the analysis. The BRFFS survey is a nationwide survey conducted over cell phones and landlines using a standardized question set, and the CDC aggregates the results for research on health behavior and risk factors.[14] Landline numbers were chosen using disproportionate stratified sampling (DSS) to split the number into one of two groups based on the presumed density of known landline numbers. Numbers are taken from the high-density group at a ratio of 1:1.5. For cell phones, numbers are randomly generated from known combinations of area codes and prefixes. The BRFFS survey is only administered to noninstitutionalized adults aged 18 and older.

Population:

Within the dataset, observations were excluded for either refusing to respond to or being unsure of any variable included in the analysis besides income. Datapoints included in the analysis were smoking status, child status, insurance status, gender, income, age, self-reported general health, education, and marital status. In total, 47,548 records were removed from the original dataset, leaving 89.2% of respondents who completed all the questions and were not missing data. The total sample size used for analysis was 391,145 respondents.

Outcome:

The outcome, smoking status, was limited to only current smokers who responded that they smoked every day or some days and had smoked over 100 cigarettes in their lives. Former smokers and smokers who had consumed less

than 100 cigarettes in their lives were classified as non-smokers for this analysis. This measure is used by the Centers for Disease Control and Prevention National Health Interview Survey to classify someone as an 'everyday smoker,' formerly called a 'regular smoker.'[15]

Exposure:

Insurance status was measured as anyone who stated they had insurance at the time of the questionnaire, regardless of insurance source. All insurance types were counted equally as the respondents having insurance; no difference was recorded for the analysis for insurance provided by employers, Medicare/Medicaid, the ACA marketplace, or other sources.

Modifier:

The variable for children was measured as the presence of any children under the age of 18 in the home of the respondent. This was converted to a dichotomous variable to indicate if there were any children in the home rather than the total number of children.

Metrics:

Additional covariates in the model included gender, age group, marital status, level of education completed, income bracket, and self-reported level of general health. Age played an essential part in influencing smoking in multiple studies,[8,13] and a lot of the smoking research mentioned previously revolved around family and gender.[10,12,13] Education[16] and income[17] variables were included to account for socioeconomic differences in smoking rates due to income or education. Self-reported level of general health was included to measure how someone's beliefs about their own health impacted their health behaviors. Marital status was reported in one of six categories: married, divorced, widowed, separated, never married, or part of an unmarried couple. Age was grouped into categories for 18-24, 25-34, 35-44, 45-54, 55-64, and 65 and over. Income was grouped into categories for Under $50,000, $50,000-$100,000, over $200,000, and not reported. Those not reporting their income made up a significant portion of the study sample (17.1%), so they were grouped together instead of being removed. Of the people remaining in the dataset, none were

missing an answer for income. Level of education was grouped as did not complete high school, graduated high school, completed some college, and graduated college. Self-reported general health was grouped into two levels: good or better and fair or poor.

Statistical Analysis:

Logistic regression was conducted with smoking as the outcome variable. Univariate and bivariate analyses were run to examine the impacts of the different covariates on the exposure and the outcome, and a stratified weighted multivariate logistic regression was used to measure the difference in odds ratios for insurance in the groups with and without children.

The univariate and bivariate analyses were used to aid in the model design and to help understand the distribution of the data. The univariate analysis helped to show distribution of the covariates, exposure, modifier, and outcome, while the bivariate analysis helped to determine the appropriate covariates to include in the model. In the bivariate analysis, crude odds ratios were constructed from the covariates and the outcome, with covariates that were significantly associated with the outcome being added to the final multivariate model.

Since smoking status was reduced to a binary outcome, the logistic regression was chosen to show how each covariate contributed to the single outcome of smoking status. A stratified analysis was used to demonstrate the impact of children as a modifier for insurance rather than simply as another covariate or exposure to help understand the impact children have on how insurance influenced smoking status. The stratified model was chosen over a model with an insurance and children interaction term to allow comparison of all terms in the model. This helped to be able to compare the outcomes of the analysis to previous research on tangential topics and make it more generalizable.

Data cleaning was done using RStudio 2022.02.3 (http://www.r-project.org), and the resulting dataset was loaded into SAS Studio 3.81 (SAS Institute, Cary, NC) to run the analysis.

Results:

Of the 391,145 people remaining in the study following the exclusion criteria, 51,066 (13.1%) were smokers, 101,666 (26.0%) had children living in the home with them, and 370,151 (94.6%) had some type of health insurance. Full results from the univariate analysis are listed in Table 1. Among respondents, there was a balanced distribution in gender (48.4% male, 51.6% female). Most respondents reported being in good or better health (83.6%), with slightly more respondents who had children reporting to be in good or better health (87.2%). Most respondents also reported that they were married (52.9%), had been married, or were presently in a relationship. Only 4.1% of respondents had never been married and were not presently in a relationship. Distributions for variables for both crude and stratified totals can be found in Table 1. The largest group of respondents were 65 and older (36.0%) and a large proportion of the respondents were college graduates (41.7%) or had at least completed some college (27.7%). There were large differences between the older groups in terms of having children living in their home, likely due to any children they would have had no longer living at home. The same could be seen in the youngest group who may not have had children yet. The core of the respondents with children were between 25 and 54 years old, accounting for 78.6% of respondents with children.

Table 1: Weighted Distribution of BRFFS 2021 demographics and behaviors, including both Crude weights and split by presence of children, N = 391,145

	Crude		Children		No Children	
	No. of responses (391145)	Adjusted %	No. of responses (101666)	Adjusted %	No. of responses (289479)	Adjusted %
Smoking Status						
No	340079	86.9%	86477	86.1%	253602	86.6%
Yes	51066	13.1%	15189	13.9%	35877	13.4%
Health Insurance						
Yes	370151	94.6%	93205	88.5%	276946	93.2%
No	20994	5.4%	8461	11.5%	12533	6.8%
Children in Home						
No	289479	74.0%			289479	
Yes	101666	26.0%	101666			

Gender						
Female	180763	46.2%	44911	44.7%	135852	50.3%
Male	210382	53.8%	56755	55.3%	153627	49.7%
Income Bracket						
Less than $50,000	139119	35.6%	31179	34.0%	107940	36.6%
$50,000-$100,000	101672	26.0%	26571	23.6%	75101	24.5%
More than $100,000	82537	21.1%	30929	28.1%	51608	19.7%
Not Reported	67817	17.3%	12987	14.2%	54830	19.2%
Age						
18-24	20935	5.4%	6299	11.4%	14636	10.7%
25-34	42390	10.8%	19378	24.9%	23012	13.7%
35-44	52517	13.4%	36211	33.7%	16306	7.8%
45-54	59568	15.2%	25583	20.0%	33985	13.2%
55-64	75081	19.2%	8932	6.6%	66149	22.0%
65 or Older	140654	36.0%	5263	3.4%	135391	32.4%
Education						
Did not Graduate HS	22205	5.7%	7326	14.3%	14879	10.3%
HS Graduate	97539	24.9%	23745	25.9%	73794	27.3%
Some College	108287	27.7%	27151	29.3%	81136	31.2%
College Graduate	163114	41.7%	43444	30.6%	119670	31.2%
Marital Status						
Married	207060	52.9%	65528	60.6%	141532	46.3%
Divorced	50747	13.0%	10290	8.1%	40457	11.7%
Widowed	42507	10.9%	2783	2.1%	39724	9.4%
Separated	7535	1.9%	2814	3.1%	4721	2.2%
Never Married	67259	17.2%	14647	19.7%	52612	25.8%
Unmarried couple	16037	4.1%	5604	6.5%	10433	4.7%
General Health						
Good or Better	326170	83.6%	89412	87.2%	236758	81.8%
Fair or Poor	64975	16.4%	12254	12.8%	52721	18.2%

BRFFS= Behavioral Risk Factor Surveillance System Survey, HS = High School

Results for bivariate analysis on the association between the covariates, children, and outcome and smoking are included in Table 2 and the results for the bivariate analysis between the covariates, the children, smoking, and insurance status are included in Table 3. All covariates were significantly associated with both the outcome and exposure variables.

People who reported fair or poor health were 2.05 (95% CI: 1.96, 2.14) times as likely to be smokers as those who reported good or better health. These same people who reported their health as fair or poor were also more likely to not have insurance as well. The least likely group to smoke was the youngest group, 18–24-year-olds. As far as education, the most likely group to smoke were those that did not graduate high school, with the next closest group being high school graduates. This group of 18-24 year olds could span from not having finished high school to people who have completed or are in the process of completing college. High school graduates' odds of smoking were 0.70 (95% CI: 0.65, 0.75) times that of the group that didn't finish high school. The group that didn't finish high school was also the most likely to be uninsured.

Table 2: Crude Odds ratios for demographic and behaviors for smoking, BRFFS 2021, N = 391,145

	No Smoking	Smoking	Crude Odds Ratio (95% CI)	P Value
	No. of responses (Adjusted %)	No. of responses (Adjusted %)		
Health Insurance				<.0001
Yes	324593 (92.6)	45558 (85.3)	Reference	
No	15486 (7.4)	5508 (14.7)	2.15 (2.00, 2.30)	
Children in Home				0.042
No	253602 (66.1)	35877 (65.1)	Reference	
Yes	86477 (33.9)	15189 (34.9)	1.04 (1.00, 1.09)	
Gender				<.0001
Female	155776 (47.5)	24987 (54.1)	0.77 (0.74, 0.80)	
Male	184303 (52.5)	26079 (45.9)	Reference	
Income Bracket				<.0001
Less than $50,000	111583 (33.12)	27536 (52.26)	Reference	
$50,000-$100,000	90773 (24.67)	10899 (21.15)	0.54 (0.52, 0.57)	
More than $100,000	77369 (24.38)	5168 (11.02)	0.29 (0.27, 0.30)	
Not Reported	60354 (17.83)	7463 (15.58)	0.55 (0.52, 0.59)	
Age				<.0001
18-24	19362 (11.8)	1573 (5.62)	Reference	
25-34	36080 (17.21)	6310 (19.65)	2.40 (2.17, 2.65)	
35-44	42937 (15.89)	9580 (21.52)	2.84 (2.58, 3.13)	
45-54	49943 (15.13)	9625 (18.12)	2.51, (2.27, 2.78)	
55-64	62794 (16.21)	12287 (20.31)	2.63 (2.39, 2.90)	
65 or Older	128963	11691 (14.78)	1.30 (1.18, 1.44)	

	(23.76)			
Education				<.0001
Did not Graduate HS	16311 (10.19)	5894 (20.81)	Reference	
HS Graduate	78498 (25.35)	19041 (36.13)	0.70 (0.65, 0.75)	
Some College	91807 (30.47)	16480 (31.31)	0.50 (.047, 0.54)	
College Graduate	153463 (33.99)	9651 (11.76)	0.17 (0.16, 0.18)	
Marital Status				<.0001
Married	188398 (53.27)	18662 (37.93)	Reference	
Divorced	39518 (9.37)	11229 (17.38)	2.60 (2.47, 2.75)	
Widowed	37357 (6.82)	5150 (7.21)	1.48 (1.38, 1.60)	
Separated	5458 (2.15)	2077 (4.59)	3.00 (2.69, 3.34)	
Never Married	56410 (23.4)	10849 (25.66)	1.54 (1.46, 1.62)	
Part of unmarried couple	12938 (4.98)	3099 (7.22)	2.04 (1.87, 2.22)	
General Health				<.0001
Good or Better	289221 (85.18)	36949 (73.73)	Reference	
Fair or Poor	50858 (14.82)	14117 (26.27)	2.05 (1.96, 2.14)	

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In the bivariate analysis for insurance status, smokers were 2.15 (95% CI : 2.00, 2.30) times as likely as non-smokers to be uninsured. Additionally, those without children in the home were 1.77 (95% CI: 1.69, 1.88) times as likely as those with children to be uninsured. There was relationship between income, age, and education that showed as the level of one increased, the odds of being uninsured decreased. A similar relationship between income and education existed for the odds of being a non-smoker, but it was not as consistent with age. Additionally, those who reported to be in fair or poor health were 1.36 (95% CI: 1.26, 1.36) times as likely to be uninsured as those who are insured.

Table 3: Crude Odds ratios for demographic and behaviors for health insurance, BRFFS 2021, N = 391,145

	No Insurance	Insurance	Crude Odds Ratio (95% CI)	P Value
	No. of responses (Adjusted %)	No. of responses (Adjusted %)		
Smoking Status				<.0001
Yes	5508 (23.7)	45558 (12.7)	2.15 (2.00, 2.30)	
No	15486 (76.3)	324593 (87.3)	Reference	

Children in Home				<.0001
No	12533 (53.5)	276946 (67.1)	Reference	
Yes	8461 (46.5)	93205 (32.9)	1.77 (1.69, 1.88)	
Gender				<.0001
Female	11770 (56.6)	168993 (47.6)	0.70 (0.66, 0.74)	
Male	9224 (43.4)	201158 (52.4)	Reference	
Income Bracket				<.0001
Less than $50,000	12409 (59.46)	126710 (33.54)	Reference	
$50,000-$100,000	3384 (15.05)	98288 (25.03)	0.34 (0.31, 0.37)	
More than $100,000	1127 (5.00)	81410 (24.17)	0.12 (0.10, 0.13)	
Not Reported	4074 (20.49)	63743 (17.26)	0.67 (0.62, 0.72)	
Age				<.0001
18-24	2210 (14.47)	18725 (10.64)	Reference	
25-34	4994 (30.98)	37396 (16.31)	1.40 (1.26, 1.54)	
35-44	4844 (23.16)	47673 (16.06)	1.06 (.96, 1.17)	
45-54	4299 (17.48)	55269 (15.36)	0.84 (0.75, 0.94)	
55-64	3782 (11.35)	71299 (17.26)	0.48 (0.43, 0.54)	
65 or Older	865 (2.57)	139789 (24.37)	.08 (0.6, 0.9)	
Education				<.0001
Did not Graduate HS	4504 (33.92)	17701 (9.59)	Reference	
HS Graduate	7549 (33.26)	89990 (26.22)	0.36 (0.33, 0.39)	
Some College	5307 (23.13)	102980 (31.27)	0.21 (0.19, 0.23)	
College Graduate	3634 (9.69)	159480 (32.92)	0.08 (0.08, 0.09)	
Marital Status				<.0001
Married	7197 (34.33)	199863 (52.73)	Reference	
Divorced	3197 (10.71)	47550 (10.44)	1.58 (1.44, 1.73)	
Widowed	722 (2.44)	41785 (7.28)	0.52 (0.42, 0.63)	
Separated	1034 (5.61)	6501 (2.20)	3.92 (3.40, 4.53)	
Never Married	6600 (34.38)	60659 (22.73)	2.32 (2.16, 2.50)	
Unmarried couple	2244 (12.52)	13793 (4.62)	4.17 (3.76, 4.62)	
General Health				<.0001
Good or Better	16824 (79.47)	309346 (84.00)	Reference	
Fair or Poor	4170 (20.53)	60805 (16.00)	1.36 (1.26, 1.46)	

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All covariates were significant and were included in the final multivariate model. For someone with children living with them, if they are uninsured, their odds of smoking are 0.91 (95% CI: 0.80, 1.03) times that of someone with insurance. For someone without children, if they are uninsured, their odds of smoking are 1.45 (95% CI 1.31, 1.60) times that of someone with insurance. The results of the crude odds ratios and the adjusted odds ratios from the multivariate

stratified weighted model are in Table 4. Among other covariates, there were differences in the odds of smoking with or without kids in the 24-34 group and the 65 and Older group. For someone with children, being 25-34 increases their odds of smoking by 4.18 (95% CI: 3.49, 5.01) times that of someone who was 18-24. In the same age group (25-34) without children, the odds of smoking was 2.62 (95% CI: 2.29, 2.99) times that of someone who was 18-25. There was not a significant change in the odds of smoking between the strata for income, marital status, or college graduates. For both education and income, both strata saw similar relationships as were in the crude model, an increase in one saw the odds of the outcome decreasing over the range of the response options. For someone without children, if they completed high school, their odds of smoking is 0.79 (95% CI: 0.72, 0.86) times that of someone who did not complete high school. For someone with children, if they only completed high school, their odds of smoking are the same as someone who did not complete high school, 1.05 (95% CI: 0.93, 1.19).

The R-squared value for the model without children was .08, and the model with children was .07, showing limited explanatory power for the smoking status.

Table 4: Crude and adjusted Odds ratios split by presence of children for association between health insurance and smoking, BRFFS 2021, N = 391,145

		No Children	Children
	Crude OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Health Insurance			
Yes	Reference	Reference	Reference
No	2.15 (2.00, 2.30)	1.45 (1.31, 1.60)	0.91 (0.80, 1.03)
Gender			
Female	0.77 (0.74, 0.80)	0.80 (0.76, 0.84)	0.67 (0.63, 0.73)
Male	Reference	Reference	Reference
Income Bracket			
Less than $50,000	Reference	Reference	Reference
$50,000-$100,000	0.54 (0.52, 0.57)	0.75 (0.70, 0.80)	0.78 (0.70, 0.86)
More than $100,000	0.29 (0.27, 0.30)	0.54 (0.49, 0.59)	0.47 (0.42, 0.53)
Not Reported	0.55 (0.52, 0.59)	0.73 (0.68, 0.78)	0.74 (0.66, 0.83)
Age			
18-24	Reference	Reference	Reference
25-34	2.40 (2.17, 2.65)	2.62 (2.29, 2.99)	4.18 (3.49, 5.01)
35-44	2.84 (2.58, 3.13)	4.27 (3.73, 4.9)	4.99 (4.16, 6.00)

45-54	2.51, (2.27, 2.78)	3.8 (3.32, 4.33)	3.52 (2.88, 4.29)
55-64	2.63 (2.39, 2.90)	3.12 (2.74, 3.55)	3.91 (3.15, 4.87)
65 or Older	1.30 (1.18, 1.44)	1.41 (1.23, 1.61)	2.43 (1.82, 3.23)
Education			
Did not Graduate HS	Reference	Reference	Reference
HS Graduate	0.70 (0.65, 0.75)	0.79 (0.72, 0.86)	1.05 (0.93, 1.19)
Some College	0.50 (.047, 0.54)	0.60 (0.55, 0.65)	0.80 (0.71, 0.91)
College Graduate	0.17 (0.16, 0.18)	0.24 (0.22, 0.27)	0.29 (0.26, 0.34)
Marital Status			
Married	Reference	Reference	Reference
Divorced	2.60 (2.47, 2.75)	1.95 (1.82, 2.1)	2.04 (1.83, 2.28)
Widowed	1.48 (1.38, 1.60)	1.45 (1.33, 1.59)	2.02 (1.59, 2.57)
Separated	3.00 (2.69, 3.34)	1.71 (1.47, 2)	1.70 (1.43, 2.03)
Never Married	1.54 (1.46, 1.62)	1.40 (1.29, 1.51)	1.78 (1.59, 1.98)
Unmarried couple	2.04 (1.87, 2.22)	1.56 (1.38, 1.76)	1.86 (1.6, 2.16)
General Health			
Good or Better	Reference	Reference	Reference
Fair or Poor	2.05 (1.96, 2.14)	1.45 (1.37, 1.55)	1.34 (1.21, 1.48)

BRFFS= Behavioral Risk Factor Surveillance System Survey, HS = High School

Discussion:

In this sample of smokers and non-smokers, the presence of children in the home had an impact on how being insured influenced the likelihood of smoking, making it a modifying factor for the relationship with insurance. In the group without children, people without insurance were more likely than people with insurance to smoke. In the group with children, people with insurance were not any more likely than people without insurance to smoke. This finding is in line with the research done in Germany showing that parenthood had an impact on health behaviors.[13] However, this analysis goes further to show that children have an impact on the effects of insurance as well. Existing research was focused mainly on the general impact of children on smoking or the impact of health insurance on smoking. By narrowing in on the impact that children play as a modifier, this research attempts to fill the gap on how insurance works in different social situations, particularly with and without children. Rather than approaching the issue from the perspective of having insurance or children, this analysis takes into account insurance and how children modify its effects.

This analysis is also in line with existing literature showing that age plays a significant role in health behavor.[8, 13] The analysis showed the different age groups not only had different risks of smoking, but the presence of children impacted them differently. This is in line with the hypothesis from Jerant et al.,[9] about increased stress on younger parents. With almost half (49%)[18] of Americans getting insurance from their employers, younger people may not have jobs that provide insurance or be in a position to pay for it on their own, especially if they have less education. Lack of insurance could make having a child more stressful, leading to worse health outcomes. [9]

Despite what previous studies showed about having health insurance not necessarily leading to not smoking[9], this analysis showed that those with health insurance were less likely to smoke than those without health insurance. This result may have been impacted by other factors in each study, and measures for other health behaviors or primary care visits were not included in this analysis.

Similar to the smoking cessation study[10], this study found that there was a difference in how men and women were impacted by children in regard to smoking. This analysis doesn't get into smoking cessation and that study established a familial relationship that this data does not, but a similar trend can be seen in both cases.

Limitations:

This study was conducted using a dataset that lacked any sort of temporal data. As such, there was no way to determine at what point respondents either gained or lost insurance, started or stopped smoking, or gained or lost someone under the age of 18 in their household. There was also no way to determine the relationship between the respondent and the child in the home, if there was one. The Rattay and von der Lippe[13] study was based on parenthood, not just the presence of children, and this analysis is unable to establish a relationship between the respondent and the child. Another limitation is that due to the low R-Squared value, this analysis only explains a small portion of smoking status. In the future, a prospective cohort study that includes the adult/child relationship

could help to address the temporality issues as well as showing differences in types of family relationships.

Public Health Implications:

If the goal of a public health program is to implement smoking cessation programs or prevent people from smoking, knowing their immediate surroundings and family situations may offer a route to more consistent and effective public health measures. There may also be other factors that can modify the effects of health insurance on health outcomes. Understanding the behavior of adults and how it can be modified by children could lead to a variety of ways to influence health outcomes beyond just smoking. In terms of improving health behavior, knowing how adults interact with insurance and why may help drive policy change. Providing health insurance shouldn't be treated like a single solution to smoking. Since children had an impact on the effects of insurance, different methods or approaches could be used to help reach the desired outcome. As education and age were both significant in this analysis and in previous literature, education on the risks of smoking and the possible benefits of insurance should start as early as possible to ensure young people are able to get the most benefit over the course of their lives. For young people and those who are lower income, there may be an opportunity for smoking education or insurance education as well. Providing opportunities to educate people who are at risk could be an important avenue towards addressing smoking.

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Tables:

Table 1: Weighted Distribution of BRFFS 2021 demographics and behaviors, including both Crude and split by presence of children, N = 391,145

	Crude		Children		No Children	
	No. of responses (391145)	Adjusted %	No. of responses (101666)	Adjusted %	No. of responses (289479)	Adjusted %
Smoking Status						
No	340079	86.9%	86477	86.1%	253602	86.6%
Yes	51066	13.1%	15189	13.9%	35877	13.4%
Health Insurance						
Yes	370151	94.6%	93205	88.5%	276946	93.2%
No	20994	5.4%	8461	11.5%	12533	6.8%
Children in Home						
No	289479	74.0%			289479	
Yes	101666	26.0%	101666			
Gender						
Female	180763	46.2%	44911	44.7%	135852	50.3%
Male	210382	53.8%	56755	55.3%	153627	49.7%
Income Bracket						
Less than $50,000	139119	35.6%	31179	34.0%	107940	36.6%
$50,000-$100,000	101672	26.0%	26571	23.6%	75101	24.5%
More than $100,000	82537	21.1%	30929	28.1%	51608	19.7%
Not Reported	67817	17.3%	12987	14.2%	54830	19.2%
Age						
18-24	20935	5.4%	6299	11.4%	14636	10.7%
25-34	42390	10.8%	19378	24.9%	23012	13.7%

35-44	52517	13.4%	36211	33.7%	16306	7.8%
45-54	59568	15.2%	25583	20.0%	33985	13.2%
55-64	75081	19.2%	8932	6.6%	66149	22.0%
65 or Older	140654	36.0%	5263	3.4%	135391	32.4%
Education						
Did not Graduate HS	22205	5.7%	7326	14.3%	14879	10.3%
HS Graduate	97539	24.9%	23745	25.9%	73794	27.3%
Some College	108287	27.7%	27151	29.3%	81136	31.2%
College Graduate	163114	41.7%	43444	30.6%	119670	31.2%
Marital Status						
Married	207060	52.9%	65528	60.6%	141532	46.3%
Divorced	50747	13.0%	10290	8.1%	40457	11.7%
Widowed	42507	10.9%	2783	2.1%	39724	9.4%
Separated	7535	1.9%	2814	3.1%	4721	2.2%
Never Married	67259	17.2%	14647	19.7%	52612	25.8%
Unmarried couple	16037	4.1%	5604	6.5%	10433	4.7%
General Health						
Good or Better	326170	83.6%	89412	87.2%	236758	81.8%
Fair or Poor	64975	16.4%	12254	12.8%	52721	18.2%

BRFFS= Behavioral Risk Factor Surveillance System Survey, HS = High School

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Table 2: Crude Odds ratios for demographic and behaviors for smoking, BRFFS 2021, N = 391,145

	No Smoking	Smoking	Crude Odds Ratio (95% CI)	P Value
	No. of responses (Adjusted %)	No. of responses (Adjusted %)		
Health Insurance				<.0001
Yes	324593 (92.6)	45558 (85.3)	Reference	
No	15486 (7.4)	5508 (14.7)	2.15 (2.00, 2.30)	
Children in Home				0.042
No	253602 (66.1)	35877 (65.1)	Reference	
Yes	86477 (33.9)	15189 (34.9)	1.04 (1.00, 1.09)	
Gender				<.0001
Female	155776 (47.5)	24987 (54.1)	0.77 (0.74, 0.80)	
Male	184303 (52.5)	26079 (45.9)	Reference	
Income Bracket				<.0001
Less than $50,000	111583 (33.12)	27536 (52.26)	Reference	
$50,000-$100,000	90773 (24.67)	10899 (21.15)	0.54 (0.52, 0.57)	
More than $100,000	77369 (24.38)	5168 (11.02)	0.29 (0.27, 0.30)	
Not Reported	60354 (17.83)	7463 (15.58)	0.55 (0.52, 0.59)	
Age				<.0001
18-24	19362 (11.8)	1573 (5.62)	Reference	

25-34	36080 (17.21)	6310 (19.65)	2.40 (2.17, 2.65)	
35-44	42937 (15.89)	9580 (21.52)	2.84 (2.58, 3.13)	
45-54	49943 (15.13)	9625 (18.12)	2.51, (2.27, 2.78)	
55-64	62794 (16.21)	12287 (20.31)	2.63 (2.39, 2.90)	
65 or Older	128963 (23.76)	11691 (14.78)	1.30 (1.18, 1.44)	
Education				<.0001
Did not Graduate HS	16311 (10.19)	5894 (20.81)	Reference	
HS Graduate	78498 (25.35)	19041 (36.13)	0.70 (0.65, 0.75)	
Some College	91807 (30.47)	16480 (31.31)	0.50 (.047, 0.54)	
College Graduate	153463 (33.99)	9651 (11.76)	0.17 (0.16, 0.18)	
Marital Status				<.0001
Married	188398 (53.27)	18662 (37.93)	Reference	
Divorced	39518 (9.37)	11229 (17.38)	2.60 (2.47, 2.75)	
Widowed	37357 (6.82)	5150 (7.21)	1.48 (1.38, 1.60)	
Separated	5458 (2.15)	2077 (4.59)	3.00 (2.69, 3.34)	
Never Married	56410 (23.4)	10849 (25.66)	1.54 (1.46, 1.62)	
Part of unmarried couple	12938 (4.98)	3099 (7.22)	2.04 (1.87, 2.22)	
General Health				<.0001
Good or Better	289221 (85.18)	36949 (73.73)	Reference	
Fair or Poor	50858 (14.82)	14117 (26.27)	2.05 (1.96, 2.14)	

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Table 3: Crude Odds ratios for demographic and behaviors for health insurance, BRFFS 2021, N = 391,145

	No Insurance	Insurance	Crude Odds Ratio (95% CI)	P Value
	No. of responses (Adjusted %)	No. of responses (Adjusted %)		
Smoking Status				<.0001
Yes	5508 (23.7)	45558 (12.7)	2.15 (2.00, 2.30)	
No	15486 (76.3)	324593 (87.3)	Reference	
Children in Home				<.0001
No	12533 (53.5)	276946 (67.1)	Reference	
Yes	8461 (46.5)	93205 (32.9)	1.77 (1.69, 1.88)	
Gender				<.0001
Female	11770 (56.6)	168993 (47.6)	0.70 (0.66, 0.74)	
Male	9224 (43.4)	201158 (52.4)	Reference	
Income Bracket				<.0001
Less than $50,000	12409 (59.46)	126710 (33.54)	Reference	
$50,000-$100,000	3384 (15.05)	98288 (25.03)	0.34 (0.31, 0.37)	

More than $100,000	1127 (5.00)	81410 (24.17)	0.12 (0.10, 0.13)	
Not Reported	4074 (20.49)	63743 (17.26)	0.67 (0.62, 0.72)	
Age				<.0001
18-24	2210 (14.47)	18725 (10.64)	Reference	
25-34	4994 (30.98)	37396 (16.31)	1.40 (1.26, 1.54)	
35-44	4844 (23.16)	47673 (16.06)	1.06 (.96, 1.17)	
45-54	4299 (17.48)	55269 (15.36)	0.84 (0.75, 0.94)	
55-64	3782 (11.35)	71299 (17.26)	0.48 (0.43, 0.54)	
65 or Older	865 (2.57)	139789 (24.37)	.08 (0.6, 0.9)	
Education				<.0001
Did not Graduate HS	4504 (33.92)	17701 (9.59)	Reference	
HS Graduate	7549 (33.26)	89990 (26.22)	0.36 (0.33, 0.39)	
Some College	5307 (23.13)	102980 (31.27)	0.21 (0.19, 0.23)	
College Graduate	3634 (9.69)	159480 (32.92)	0.08 (0.08, 0.09)	
Marital Status				<.0001
Married	7197 (34.33)	199863 (52.73)	Reference	
Divorced	3197 (10.71)	47550 (10.44)	1.58 (1.44, 1.73)	
Widowed	722 (2.44)	41785 (7.28)	0.52 (0.42, 0.63)	
Separated	1034 (5.61)	6501 (2.20)	3.92 (3.40, 4.53)	
Never Married	6600 (34.38)	60659 (22.73)	2.32 (2.16, 2.50)	
Unmarried couple	2244 (12.52)	13793 (4.62)	4.17 (3.76, 4.62)	
General Health				<.0001
Good or Better	16824 (79.47)	309346 (84.00)	Reference	
Fair or Poor	4170 (20.53)	60805 (16.00)	1.36 (1.26, 1.46)	

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Table 4: Crude and adjusted Odds ratios split by presence of children for association between health insurance and smoking, BRFFS 2021, N = 391,145

		No Children	Children
	Crude OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Health Insurance			
Yes	Reference	Reference	Reference
No	2.15 (2.00, 2.30)	1.45 (1.31, 1.60)	0.91 (0.80, 1.03)
Gender			
Female	0.77 (0.74, 0.80)	0.80 (0.76, 0.84)	0.67 (0.63, 0.73)
Male	Reference	Reference	Reference
Income Bracket			
Less than $50,000	Reference	Reference	Reference
$50,000-$100,000	0.54 (0.52, 0.57)	0.75 (0.70, 0.80)	0.78 (0.70, 0.86)
More than $100,000	0.29 (0.27, 0.30)	0.54 (0.49, 0.59)	0.47 (0.42, 0.53)
Not Reported	0.55 (0.52, 0.59)	0.73 (0.68, 0.78)	0.74 (0.66, 0.83)
Age			
18-24	Reference	Reference	Reference
25-34	2.40 (2.17, 2.65)	2.62 (2.29, 2.99)	4.18 (3.49, 5.01)

35-44	2.84 (2.58, 3.13)	4.27 (3.73, 4.9)	4.99 (4.16, 6.00)
45-54	2.51, (2.27, 2.78)	3.8 (3.32, 4.33)	3.52 (2.88, 4.29)
55-64	2.63 (2.39, 2.90)	3.12 (2.74, 3.55)	3.91 (3.15, 4.87)
65 or Older	1.30 (1.18, 1.44)	1.41 (1.23, 1.61)	2.43 (1.82, 3.23)
Education			
Did not Graduate HS	Reference	Reference	Reference
HS Graduate	0.70 (0.65, 0.75)	0.79 (0.72, 0.86)	1.05 (0.93, 1.19)
Some College	0.50 (.047, 0.54)	0.60 (0.55, 0.65)	0.80 (0.71, 0.91)
College Graduate	0.17 (0.16, 0.18)	0.24 (0.22, 0.27)	0.29 (0.26, 0.34)
Marital Status			
Married	Reference	Reference	Reference
Divorced	2.60 (2.47, 2.75)	1.95 (1.82, 2.1)	2.04 (1.83, 2.28)
Widowed	1.48 (1.38, 1.60)	1.45 (1.33, 1.59)	2.02 (1.59, 2.57)
Separated	3.00 (2.69, 3.34)	1.71 (1.47, 2)	1.70 (1.43, 2.03)
Never Married	1.54 (1.46, 1.62)	1.40 (1.29, 1.51)	1.78 (1.59, 1.98)
Unmarried couple	2.04 (1.87, 2.22)	1.56 (1.38, 1.76)	1.86 (1.6, 2.16)
General Health			
Good or Better	Reference	Reference	Reference
Fair or Poor	2.05 (1.96, 2.14)	1.45 (1.37, 1.55)	1.34 (1.21, 1.48)

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