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# Socioeconomic Status Impact on Smoking Rates in Ohio in 2019

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Population Health and Public Health

Scholarship in Medicine Proposal

**By checking this box, I indicate that my mentor has read and reviewed my draft proposal prior to submission (I am in the April super short course)**

## **Abstract**

*Objective:* To study the impact of socioeconomic status on smoking. *Research Questions:* This research study aims to determine the impact of socioeconomic status on smoking rates across counties in Ohio in 2019. It is investigating how different variables such as education, income, and employment status are correlated with smoking rates across different counties. *Methods:* Correlation studies and ANOVA were conducted to show how smoking affects premature deaths and how socioeconomic indicators affect smoking rates. *Results:* Smoking is associated with increased numbers of premature deaths in Ohio 2019 ( $p < 0.001$ ). Higher levels of education, higher income, and lower unemployment rates has been associated with lower smoking rates in Ohio 2019 ( $p < 0.001$ ).

**Key Words:** Smoking, poverty, unemployment, education, socioeconomic status, premature death.

## **Introduction/Literature review:**

In 2018, the United States had an estimated 34.2 million active adult smokers, accounting for 13.7% of the population.<sup>1</sup> Smoking is known to have various negative consequences on people's health such as lung cancer and premature death. Approximately 480,000 premature deaths are attributable to smoking each year in the United States.<sup>2</sup> Smoking creates a large burden on the healthcare system in the United States. Every year, there are \$300 billion in healthcare costs due to illnesses from smoking.<sup>3</sup>

Smoking and premature death have been associated with various socioeconomic influences such as poverty, and lower education level.<sup>4</sup> In the United States, it has been found that men in the top 1% of income distribution live 14.5 years longer than men in the lower 1%.<sup>5</sup> Despite the decrease in smoking rates in the United States over the last few decades, the relationship between socioeconomic status (SES) and smoking rates still exists.<sup>6</sup> In 2013, the prevalence of smokers in adults living at or under the poverty line was 33.8%, whereas it was 18.7% in adults living above the poverty line.<sup>7</sup> These results point to additional financial burden and stress that people living at or under poverty line face beside paying for necessities, such as healthcare, food and housing.

Additional demographic levels have also been associated with smoking rates. Recent studies have also suggested a relationship between living in higher poverty neighborhoods and how it is associated with increased smoking rates among individuals from age 30-39.<sup>8</sup> Cigarette smoking has also been found to be higher individuals who reside in federally assisted housing, and that they are more prone to the negative consequences of smoking and secondhand smoke exposure.<sup>6</sup>

Over the years, there has been an established relationship between education and health outcomes. It is well known now that higher education is associated with better is associated with healthier lifestyles.<sup>9,10</sup> More specifically, education is associated with smoking prevalence in communities with different demographics and SES. Even within the smokers' community, it has been found that smokers with higher education are more likely to intend and attempt to quit smoking, and to be abstinent for a minimum of 1 and 6 months.<sup>11</sup>

Another important SES indicator that has been associated with different smoking rates is the employment status. In one prospective study on the effect of smoking status on employment, it has been found that smokers had a lower chance of reemployment and were paid significantly less than nonsmokers after reemployment.<sup>7</sup>

Ohio has one of the highest rates of smoking rates in the United States. In 2017, smoking rate in Ohio was 21.1%, considerably higher than the national average of 13.7%.<sup>13</sup> In 2017, Ohio had a population of 11.66 million people, which means 2.46 million people are smokers in Ohio.<sup>13</sup> Rates of new lung and bronchus cancer cases in Ohio in 2016 were 65 per 100,000 people, higher than the national average of 56.<sup>14</sup> In a cross-sectional study in Cuyahoga county in Ohio, it was found the Black and low-income adults are more likely to report use of different forms of tobacco, such as little cigars, further contributing to the disproportionate tobacco use across different SES levels.<sup>5</sup> In Cincinnati, Ohio, it has been found that people in the top 25% of income distribution have a life expectancy that is 8.5 years longer than residents in the lower 25%.<sup>5</sup> This leads up to the conclusion that income disparity influences life expectancy even on the local level as well.

The goal of this paper is to compare smoking rates and premature deaths across different socioeconomic groups in Ohio in 2019. While the relationship between socioeconomic indicators

and smoking has been well established on a community level, the relationship on the county level in Ohio in 2019 remains unclear. The aim of this paper is to understand if there is a relationship between smoking rates and socioeconomic indicators, such as income, education and employment status, on a county level in Ohio in 2019.

## **Research Questions**

RQ1: How is smoking associated with premature death in 2019 in Ohio?

RQ2: What is the relationship between education and rates of smoking in Ohio in 2019?

RQ3: What is the relationship between income and rates of smoking in Ohio in 2019?

RQ4: What is the relationship between employment status and rates of smoking in Ohio in 2019?

## **Methods**

### *Context/Protocol*

The data used in this study was accessed from County Health Rankings (CHR). CHR program is a collaboration between the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute. One of the goals of CHR is to provide reliable data that can be used to improve health on a local level.

In our study, smoking percentages data used was collected via the Behavioral Risk Factor Surveillance System (BRFSS), which utilizes random digit dial telephone surveys. Therefore, this data is representative of population over 18 years who own a land line telephone in their houses. This BRFSS data was age-adjusted and obtained over several years 2006-2012.

The data for premature deaths, defined as potential life lost before age 75 per 100,000 population (age-adjusted), were provided by the National Center for Health Statistics and

accessed from the National Vital Statistics System. CHR used the data from the 2008-2010 for this premature death measure.

The data on employment status was collected from the Local Area Unemployment Statistics (LAUS) program of the Bureau of Labor Statistics. The estimates used by LAUS are in agreement with the measure from the Current Population Survey data.

CRH used data from 2012 for this measure.

The data on post-secondary education was collected by the American Community Survey (ACS), which conducts yearly surveys to obtain information on social and economic factors and how it is changing every year. This factor is often described as Some College, which is the percentage of the population ages 25-44 with any education in any of the institutions such as vocational/technical schools, junior colleges, or four-year colleges. This can also be described as having post-secondary education regardless of degree completion.

The data on the median household income was obtained from the US Census Bureau, which created the Small Area Income and Poverty Estimates (SAIPE) program to obtain updated estimates on income in school districts, counties, and states.

### *Data Collection*

Premature death is defined as the years of potential life lost before age 75 per 100,000 population. In our study, this measurement, rather than overall mortality, provides better assessment of deaths that could have been prevented. Premature death rate was measured by dividing the number of deaths by the average number of people at risk during a certain period of time, in our case it was over the year of 2019. In order to better assess the influence of

socioeconomic status in a specific county on smoking rate and premature deaths, the deaths were counted where the person lived, rather than where they died.

Smoking prevalence were measured as the percentage of adults, over 18 years of age, in a county that had reported to smoke every day or most days or have smoked a minimum of 100 cigarettes in their lifetime. The limitation on the prevalence of smoking is the lack of data on adolescent smoking, as well as the effects of secondhand smoke.

Median household income is the value at which half of the county earn more and the other half earn less. Income is defined as the total income including salary, self-employment, estates and trust, Social Security, retirement income, welfare payments, disability income; and all other income.

The data on education was measured as the percentage of people ages 25-44 who have attained some post-secondary education, such as enrollment in vocational/technical schools, junior colleges, or four-year colleges, regardless of completeness of a degree. Although there is a variety of educational backgrounds that these respondents might have had, our study is evaluating whether education, of any type, has a correlation with smoking rates.

Unemployment was measured as the percentage of civilians ages 16 or above in the labor force in a county, who are currently unemployed but seeking work. This measurement was limited by the number of individuals who are unemployed but have given up seeking work for any particular reason.

### *Data Analysis*

To investigate how smoking is associated with premature death in Ohio in 2019 (RQ1), I used a Spearman correlation to look at the correlation between smoking and premature deaths in Ohio. To investigate the relationship between education and rates of smoking in Ohio in 2019 (RQ2), I used a Spearman correlation to study the association of post-secondary education with rate of smoking in counties in Ohio 2019. To investigate the relationship between income and rates of smoking in Ohio in 2019 (RQ3), I used Pearson/Spearman correlation to look at the relationship between income and smoking rates in counties in Ohio 2019. I also used an ANOVA to compare the rates of smoking in counties with different ranges of median income in Ohio in 2019. To investigate the relationship between employment status and rates of smoking in Ohio in 2019 (RQ4), I used a Spearman correlation to study the relationship between unemployment rates and rates of smoking in counties in Ohio 2019.

## **Results**

Our first question asked if smoking rates were associated with premature deaths in Ohio in 2019. Smoking percentages were moderately significantly correlated with premature deaths ( $r = 0.689$ ,  $p < 0.001$ ). As smoking percentages increase, premature deaths also increase (Fig. 1).



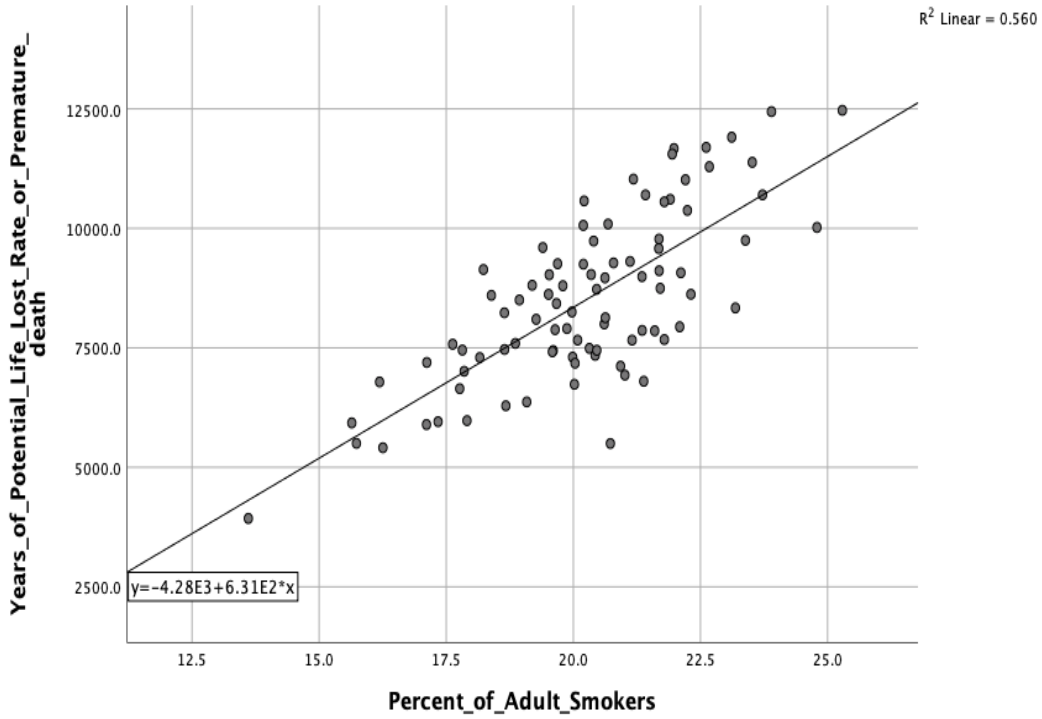


Figure 1: Correlation Between Smoking and Premature Death in counties in Ohio 2019. Higher smoking rates are associated with higher rate of premature deaths ( $p < 0.001$ ).

Results for our second question has also showed that level of post-secondary education is moderately significantly correlated with rate of smoking ( $r = - 0.565$ ,  $p < 0.001$ ). As level of post-secondary education increases, rate of smoking decreases (Fig. 2).

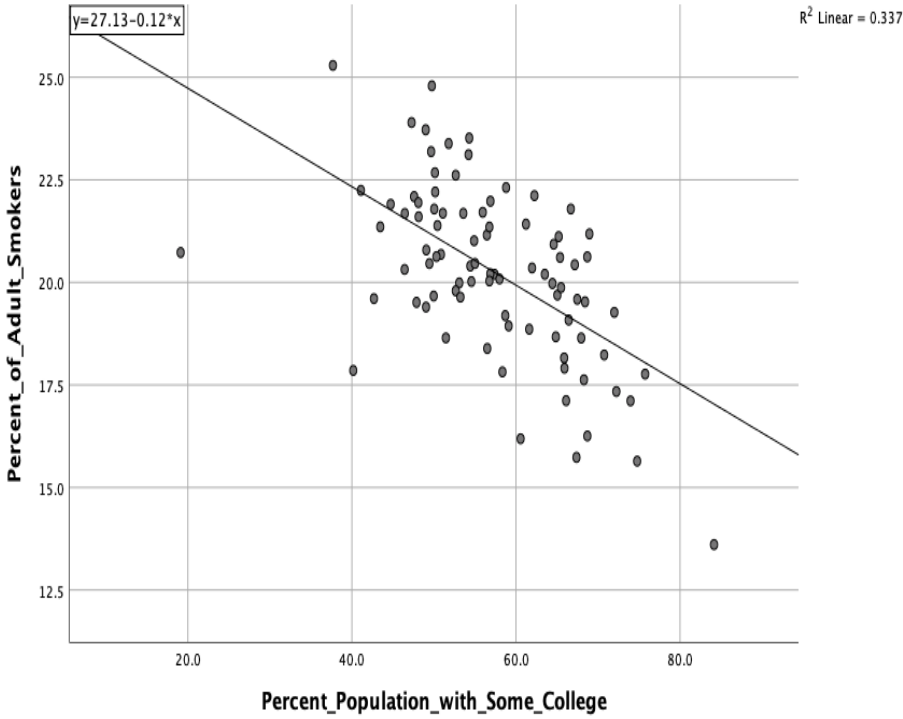
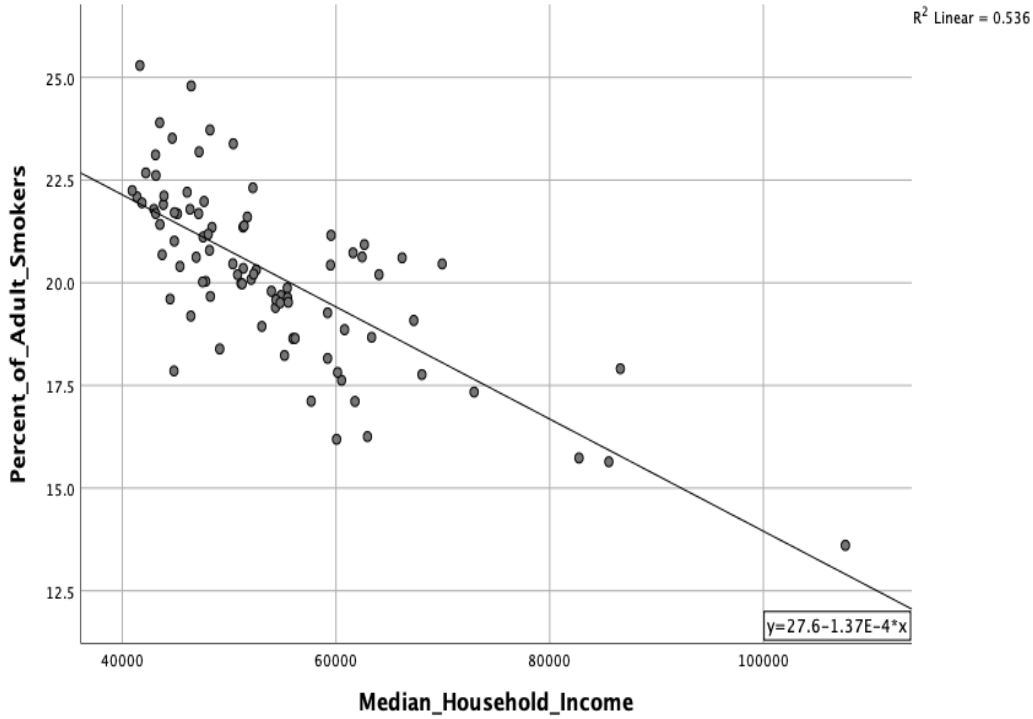


Figure 2: Relationship between education and smoking in Ohio 2019 showing that higher levels of education are associated with lower rates of smoking ( $p < 0.001$ ).

Our third question asked if smoking rates across counties in Ohio in 2019 were associated with different levels of income. Median household income is strongly significantly associated with rates of smoking ( $r = -0.717$ ,  $p < 0.001$ ). As median household income increases, rates of smoking decreases (Fig. 3).



*Figure 3: Relationship between median income and smoking in Ohio 2019 showing that lower median household income is associated with higher rates of smoking.*

Our fourth research question looked at whether unemployment percentage across counties in Ohio is correlated with rates of smoking. Smoking rates were moderately significantly correlated with unemployment rate ( $r = 0.563$ ,  $p < 0.001$ ). As unemployment rate increased, smoking rate also increased (Fig. 4). A summary of these results is provided in Table 1.

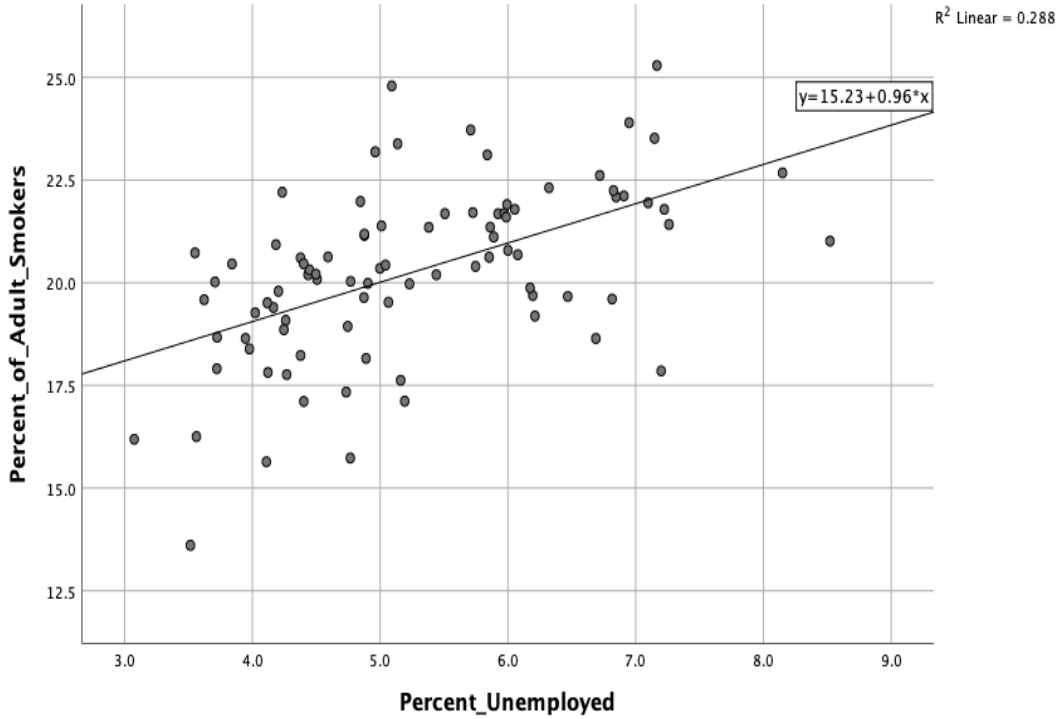


Figure 4: Relationship between unemployment and smoking in Ohio 2019 showing that higher rates of unemployment are associated with higher rates of smoking.

**Table 1:** Summary of Correlation Results Between Socioeconomic Status and Smoking

	Income	Education	Unemployment
Total # of counties	88	88	88
Mean	\$54755	57.22%	5.26%
Standard Deviation	11203	10.11	1.17
Mean smoking %	20.26	20.26	20.26
Correlation Significance	< 0.001	< 0.001	< 0.001
Pearson Correlation	- 0.717	- 0.565	0.563

Additionally, a one-way analysis of variance (ANOVA) was conducted to compare the effect of income smoking rate in Ohio in 2019. Out post hoc test results show that there was a significant effect of median household income on smoking between in groups with the lowest median household income (\$30-40k) compared to all three groups (\$40-50k, \$50-60k, \$80-90k) ( $p < 0.001$ ) (Table 2) (Fig. 5).

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**Table 2: Smoking Rates Per Median Household Income in Ohio 2019<sup>a</sup>**

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Income	\$40-50k	\$50-60k	\$60-70k	\$70-80k	\$80-90k	\$100-110k	Total
N	38	30	15	1	3	1	88
Smoking	21.6% <sup>&amp;\$^</sup>	19.97% <sup>*^</sup>	18.86% <sup>*</sup>	17.34%	16.43% <sup>*&amp;</sup>	13.61%	20.26%
SD	1.59	1.27	1.67	---	1.28	---	2.09

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<sup>a</sup>Data adapted from County Health Rankings

N = number of counties in this group

\* statistically significantly different from \$40-50k income bracket

& statistically significantly different from \$50-60k income bracket

# statistically significantly different from \$60-70k income bracket

^ statistically significantly different from \$80-90k income bracket

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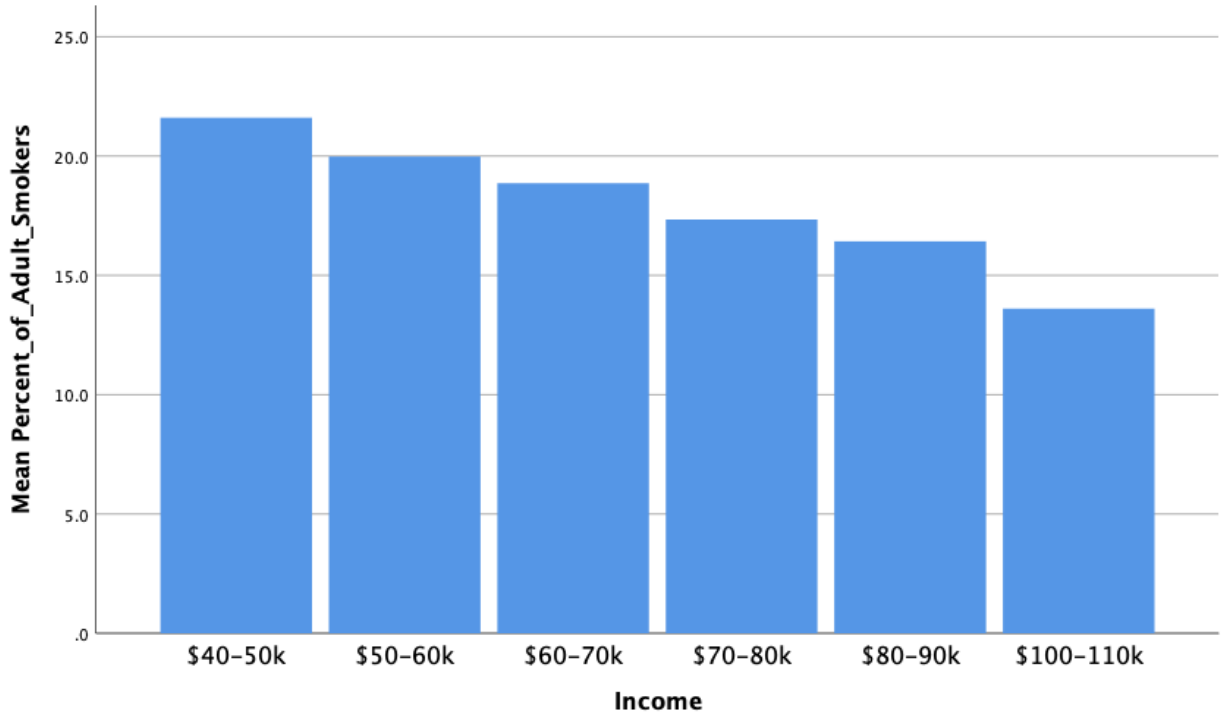


Figure 5: Comparing smoking rates in counties in Ohio in 2019 based on different income levels.

## Discussion

There are many different social and behavioral reasons why some people are more likely to pick up smoking habits and continue to smoke. In this study, we attempted to address some of these associations. Although premature death is not only caused by smoking, it is a well-known risk factor for many cardiovascular and pulmonary diseases. Our results indeed highlight this correlation between smoking and increased number of potential years of life lost before age 75 in Ohio in 2019 (Fig. 1). As expected, our results highlight the influence of socioeconomic status on smoking and premature death rates on a county level in Ohio in 2019 (Table 1, 2). Our results that used data on counties further validate the cross-sectional studies performed on individuals with regards to their socioeconomic status and its association with smoking.<sup>5,8</sup>

The statistical calculations performed in this study showed a significant correlation relationship between education and smoking rates; counties with higher percentages of post-secondary education have lower smoking rates (Fig. 2). This is possibly due to the fact that highly educated people opt for healthier lifestyles compared to those with no college education, and the fact college campuses are now smoke-free and encourage healthier lifestyles.<sup>9,10</sup> Our results on education and smoking are a further evidence for the need to improve college accessibility statewide, especially in counties with lower college education levels.

In addition, there was a significant relationship between median household income and rate of smoking across counties in Ohio. Counties with lower median household income have been associated with higher rates of smoking (Fig. 3, 5). This association has been a topic in public health for decades and yet the gap in health outcomes exists to this day.<sup>4</sup> Counties with median household income of \$40-50k had a smoking mean of 21.6% compared to only 13.6% for Delaware county where the median income is \$107k. The disparities in health outcomes in Ohio that are inferred from our study are an additional reason to bring attention to these more impoverished counties. Our results point us to the idea that in order to improve the health of a certain population, certain measures need to be taken such as providing more job opportunities and enforcing minimum wage policies that can elevate the standard of living for people in these counties. Our data further validates previous research which showed that smoking is higher in areas below poverty line and that life expectancy is higher in people with higher income.<sup>5,6</sup>

The last social and economic factor discussed this study was unemployment and its association with smoking. The results show that counties with higher percentage of unemployed citizens have higher rates of smoking (Fig 4). This is possibly due to the fact that smokers are less likely to be reemployed than nonsmokers, and because they are paid less than nonsmokers.<sup>7</sup>

This is not to say that being unemployed increases the risk of smoking, but it is more important to use this correlation to look at how smokers might have harder time seeking jobs, and how this can accumulate on top of the negative consequences of living in poverty that were discussed in this paper.

Results from this study have validated our expected hypothesis that lower socioeconomic status is associated with higher smoking rates across counties in Ohio in 2019. The results in this study have shown that education, income, and employment status all have significant relationship with smoking rates in Ohio. Health disparities still exist in our communities due to disparities in income and access to education, and in order to improve the health of people in these counties, these factors need to be seriously considered in future programs and interventions that address community and public health.

## **Conclusion**

Some limitations on the data collection in this study should be noted. First of all, median household income is based on one year of survey data and is used generate estimates for places with small number of residents. This has a drawback in that the smaller the area of survey responders, the more the estimate is reliant on the model, which might create an assumption that is not necessarily true in all cases. Another limitation is on the college education data collection in that it groups people with varying education backgrounds regardless of how it might influence health outcomes, if at all. Finally, a measurement limitation on unemployment is that does not count individuals who are seeking work but got discouraged and gave up later. Also, this measure cannot detect those who are unemployed and cannot find work at the wage that they



prefer. There was also a limitation on the prevalence of smoking as it lacked data on adolescent smoking, as well as the effects of secondhand smoke.

Future research on this topic could include the relationship between socioeconomic status and the prevalence of adolescent smoking rates. Another factor that was not included in this study is second-hand smoke, which could also be included in future research with regard to its association with educational attainment.

Improving people's health on a community and county level is a long and complex process but with understanding some of the associations behind this health gap among different socioeconomic groups, the outcomes might become more successful and sustainable.

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