Descriptive Epidemiology Group Project – Part II

PUBH 3351-01 Epidemiology and Vital Statistics

Work by Audrey Cortes, Alaina Le, and Harshitha Swaminathan

PUBH 3351 Descriptive Epidemiology Group Project Part I Corrections

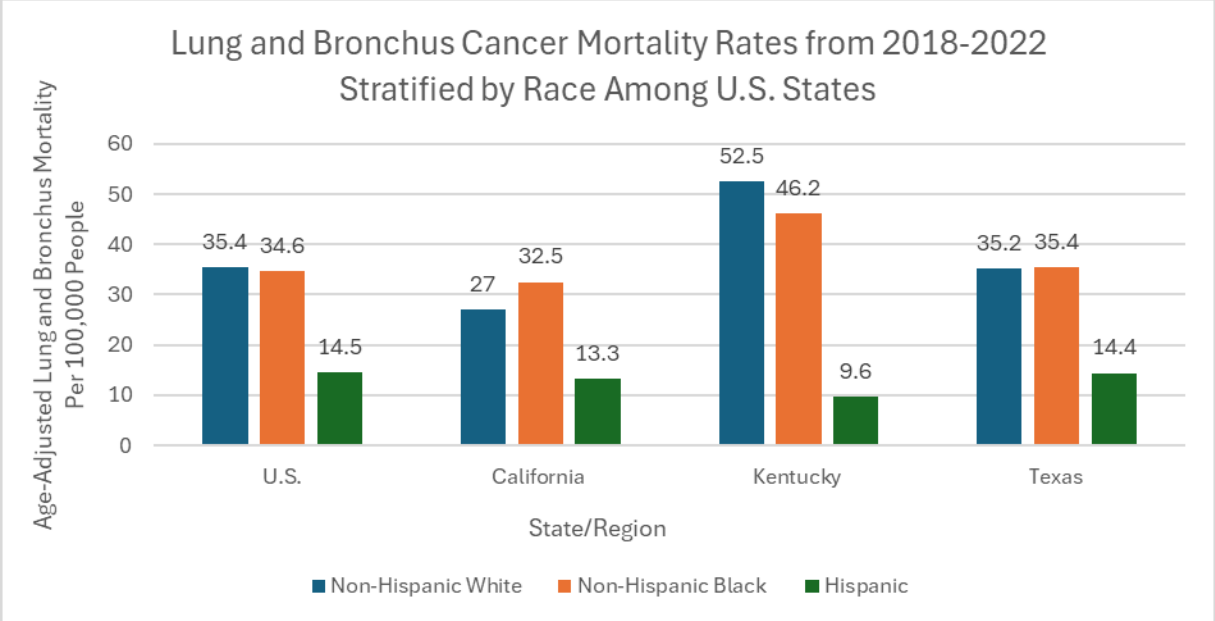
5. Is the colon cancer incidence rate significantly (statistically) different between the United States and the state of Texas? Is the prostate cancer incidence rate significantly (statistically) different between the United States and the state of Kentucky? How do you know? [Word Limit; 150 words maximum]

The colon cancer incidence rate is **significantly different** between the United States (36.4 per 100,000; 95% CI: 36.3-36.5) and Texas (37.9 per 100,000; 95% CI: 37.6-38.3). This is based on how the confidence intervals do not overlap; The table from Question 3 does not provide specific data for prostate cancer incidence rates, but the same principle applies. If the confidence intervals for the U.S. and Kentucky rates do not overlap, it would mean that the difference is **statistically significant**. But, if the confidence intervals do overlap, the difference would not be statistically significant. This method of comparing confidence intervals allows us to determine statistical significance without formal hypothesis testing. This analysis shows how disparities in cancer rates are more pronounced for lung and colorectal cancers compared to pancreatic or breast cancers.

PUBH 3351 Descriptive Epidemiology Group Project Part II

1. Obtain the lung and bronchus cancer mortality rate from 2018 through 2022 for the United States, California, Kentucky, & Texas stratified by non-Hispanic White, non-Hispanic Black, and Hispanic race/ethnicity. Plot using a bar chart to compare morality rates between white, non-Hispanic Black, and Hispanic populations among the four locations. (Hint: you will have 12 columns or bars).

2018-2022 Lung and Bronchus Cancer Mortality Rates Stratified by Race per 100,000 People			
State/Region	Non-Hispanic White	Non-Hispanic Black	Hispanic
U.S.	35.4	34.6	14.5
California	27	32.5	13.3
Kentucky	52.5	46.2	9.6
Texas	35.2	35.4	14.4



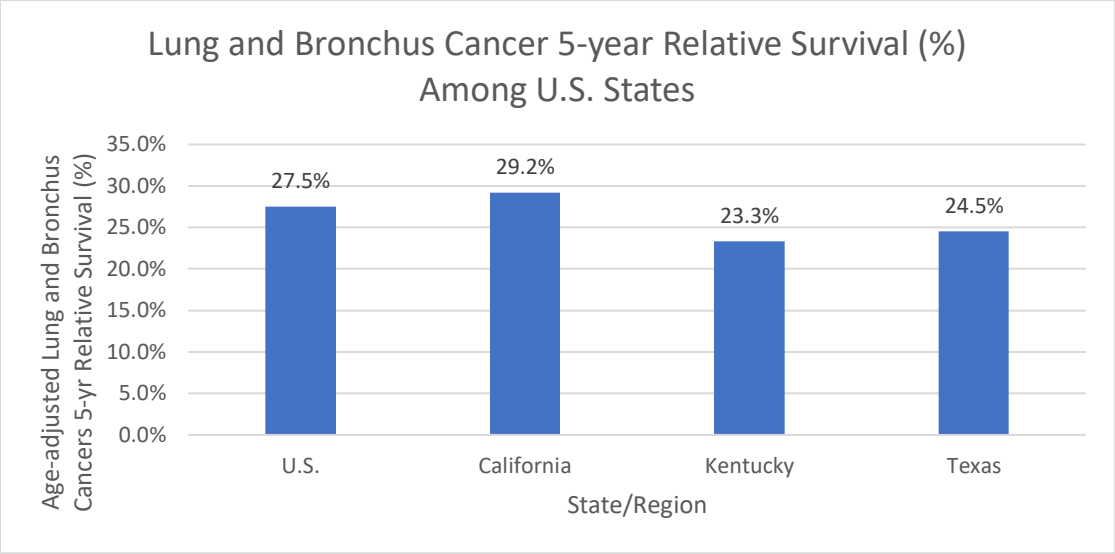
2. Describe/explain how the lung and bronchus morality rates compare between non-Hispanic White, non-Hispanic Black, and Hispanic populations among the four locations. [Word Limit; 250 words maximum]

Lung and bronchus cancer mortality rates from 2018 to 2022 vary noticeably by race/ethnicity and location. Non-Hispanic Whites have the highest mortality rates across all four locations (U.S., California, Kentucky, and Texas) shown in the graph above. Kentucky shows particularly high rates in this group, likely due to higher smoking prevalence and limited healthcare access. Non-Hispanic Black populations show lower mortality rates than Non-Hispanic Whites but still have significant disparities. Contributing factors may include socioeconomic inequities, limits to healthcare access, and racism, especially in Texas and Kentucky.

Hispanic populations consistently have the lowest mortality rates in all locations. California and Texas, with large Hispanic populations, reflect this trend. Geographic differences really show these disparities. Kentucky has the highest rates across all groups, linked to higher smoking rates and fewer preventive measures. In contrast, California reports lower rates, this may be due to stricter tobacco control policies and better access to healthcare services.

3. Obtain the lung and bronchus cancer 5-year survival rates for the United States, California, Kentucky, & Texas. Plot using a bar chart.

	Lung and Bronchus 5-yr Relative Survival
U.S.	27.5%
California	29.2%
Kentucky	23.3%
Texas	24.5%

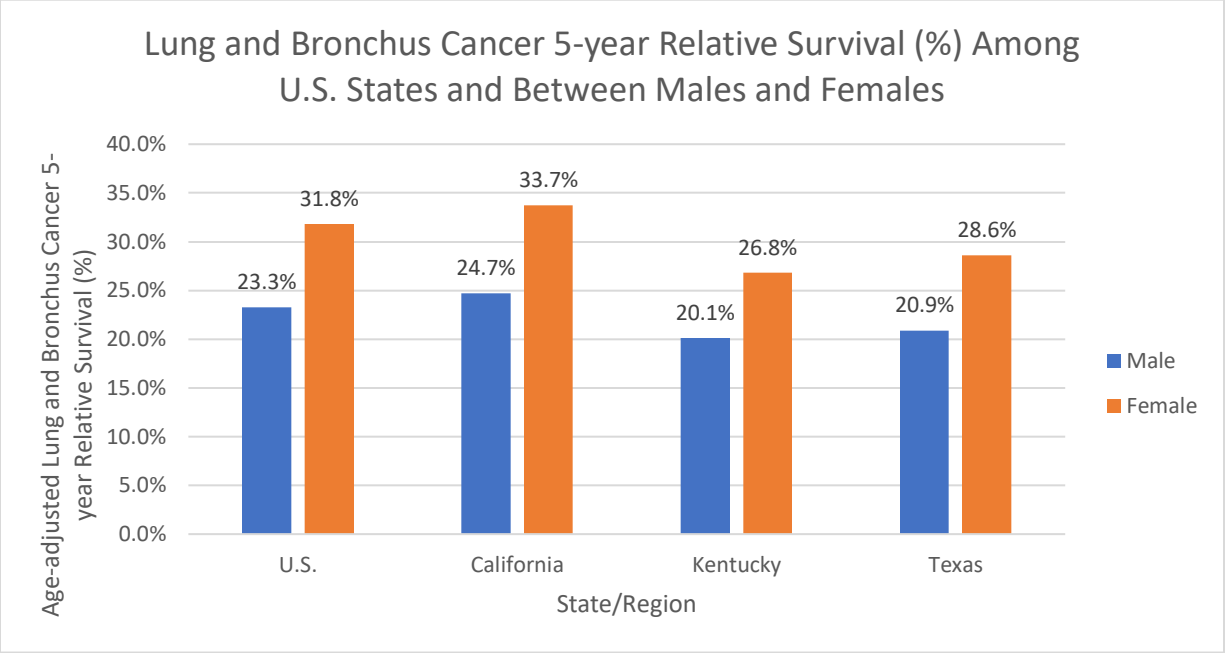


4. Describe how the 5-year survival rates compare between the states (Kentucky, Texas, and California) and between each state and the United States. [Word Limit; 250 words maximum]

The 5-year survival rates for lung and bronchus cancer vary across the United States, California, Kentucky, and Texas, most likely reflecting differences in healthcare access, early detection, and treatment quality. Nationally, the 5-year survival rate is 27.5%. California has the highest survival rate at 29.2%. This could be because of better healthcare infrastructure, early detection programs, and stricter public health policies, such as tobacco control. But Kentucky has the lowest survival rate at 23.3%. This is consistent with the state's higher smoking prevalence, limited healthcare access, and socioeconomic challenges, which make it harder for early detection and treatment plans. Texas, with a survival rate of 24.5%, is slightly below the national average. Factors like disparities in healthcare access, especially in rural areas, may contribute to this lower rate. When comparing each state to the national average, California stands out for exceeding it, while Kentucky and Texas fall behind. The data shows the role that regional healthcare policies and resources play in improving survival outcomes. It shows how disparities in smoking programs, early screening, and treatment accessibility could help address these disparities.

5. Obtain the lung and bronchus cancer 5-year survival rates for the United States, California, Kentucky, & Texas stratified by sex. Plot using a bar chart to compare survival rates between females and males among the four geographic areas. (Hint: you will have 8 bars)

	Lung and Bronchus 5-yr Relative Survival	
State/Region	Male	Female
U.S.	23.3%	31.8%
California	24.7%	33.7%
Kentucky	20.1%	26.8%
Texas	20.9%	28.6%



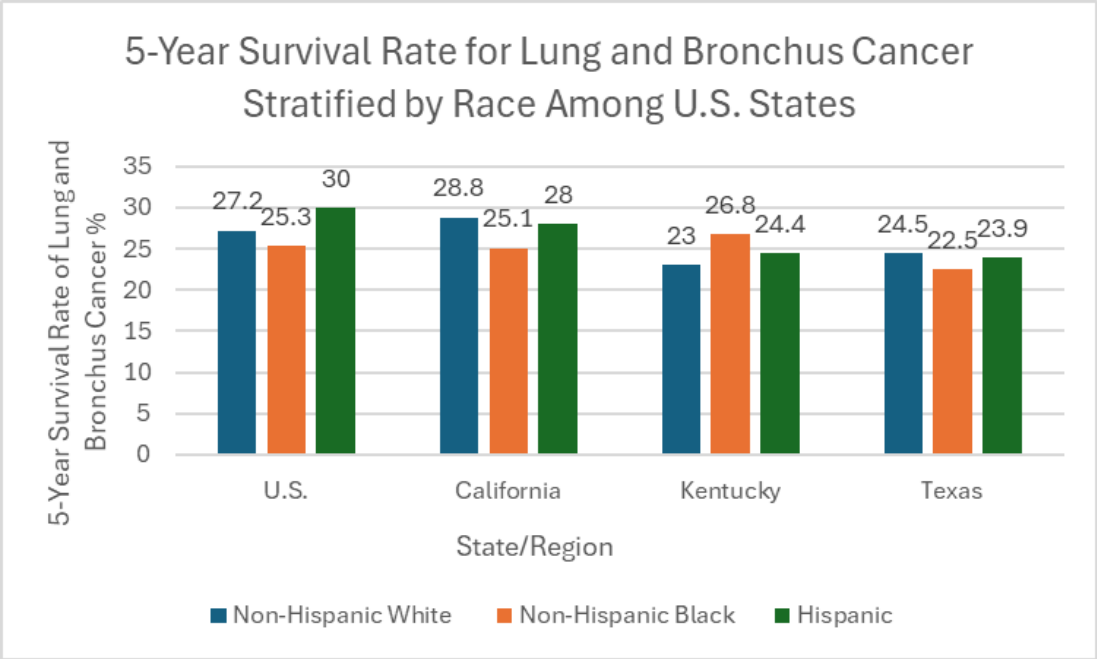
6. Describe how the 5-year survival rates compare between females and males among the four locations. [Word Limit; 250 words maximum]

- Male and female 5-year relative survival rates for lung and bronchus cancer in the United States, California, Kentucky, and Texas are contrasted in the graph. Females have significantly greater survival rates than males in every location. The national survival rate for females is 31.8%, while the national survival rate for males is 23.3%, showing an 8.5 percentage point difference. California has a similar pattern, with males at 24.7% and females at 33.7%, showing a 9-percentage point gap. The gender difference in Kentucky is significantly less severe with women at 26.8% and men at 20.1%, a 6.7 percent difference. With women at 28.6% and men at 20.9%, Texas has a disparity that is like the national average, resulting in a 7.7 percentage point gap. Overall, female survival rates are consistently higher, with California having the highest

gender disparity and Kentucky having the least. The disparities bring attention to disparities in early identification, successful treatment, and healthcare access in different areas.

7. Obtain the lung and bronchus cancer 5-year survival rates for the United States, California, Kentucky, & Texas stratified by non-Hispanic White, non-Hispanic Black, and Hispanic race/ethnicity. Plot using a bar chart to compare survival rates between White, non-Hispanic Black, and Hispanic populations among the four geographic areas.

5-Year Survival Rate for Lung and Bronchus Cancer Stratified by Race			
State/Region	Non-Hispanic White	Non-Hispanic Black	Hispanic
U.S.	27.2%	25.3%	30%
California	28.8%	25.1%	28%
Kentucky	23%	26.8%	24.4%
Texas	24.5%	22.5%	23.9%



8. Describe how the 5-year survival rates compare between non-Hispanic White, non-Hispanic Black, and Hispanic populations among the four locations. [Word Limit; 250 words maximum]

The 5-year survival rates for lung and bronchus cancer differ across racial/ethnic groups and locations. Nationally, Hispanic individuals have the highest survival rate (30%), followed by Non-Hispanic White (27.2%) and Non-Hispanic Black (25.3%). In California, Non-Hispanic White individuals (28.8%) are marginally better than Hispanics (28%), with Non-Hispanic Black individuals (25.1%) showing the lowest rates. Kentucky has lower survival rates overall, with Non-Hispanic White (26.8%) and Hispanic populations (24.4%) which are better than Non-Hispanic Black individuals (23%). Texas has the poorest survival rates, with Non-Hispanic White (24.5%) showing the highest survival, followed by Hispanic (23.9%) and Non-Hispanic Black populations (22%). Across all regions, Non-Hispanic Black individuals have been recorded to have the lowest survival rates, while Hispanic populations generally have shown better except in California. These disparities may reflect differences in access to healthcare, early diagnosis, and treatment quality.

9. What is the difference between incidence rate, mortality rate, and 5-year survival rate? Which rate do you think is most indicative of how well preventative interventions are working in a geographic area? Why? Which rate do you think is most indicative of the healthcare quality and access in the geographic area? Why? [Word Limit; 350 words maximum]

Lung and bronchus cancer results are reflected differently by incidence, death, and 5-year survival rates. Incidence rates quantify the number of new occurrences of cancer and show how well preventative measures, such as quitting smoking, work. Mortality rates show how many people die and how severe an illness is, but they can also be a reflection of a late diagnosis or limited access to treatment. One important measure of the quality of healthcare, including early identification and treatment success, is the 5-year survival rate, which shows the proportion of patients still living five years after diagnosis. Since lower rates indicate successful public health initiatives, the incidence rate is the one of them which most accurately reflects the success rate of preventative interventions. The best measure of healthcare quality and accessibility, however, is the 5-year survival rate since it reflects better care, more advanced therapy, and quick diagnosis. With Non-Hispanic Black communities constantly facing the most obstacles, regional and race disparities in survival rates draw focus on inequities in access to healthcare and equal resources.

10. Use the Behavioral Risk Factor Surveillance System Data to identify differences in the prevalence of **smoking** between the three states (California, Texas, and Kentucky), males and females, and different racial/ethnic populations. For example, you will show: 1) how prevalence of smoking status differs across the three states, 2) how prevalence of smoking differs between males and females within each of the three states, 3) how prevalence of smoking differs between ethnic/racial groups within each of the three states. You may use tables or figures to display these data. (Note: Use the **2018** prevalence data).

Four-Level Smoking Status	2018 Age-adjusted Prevalence (%)			Gender	2018 Crude Prevalence (%)			Race/Ethnicity	2018 Crude Prevalence (%)		
	California	Kentucky	Texas		California	Kentucky	Texas		California	Kentucky	Texas
Smoke everyday	6.3	17.5	9.2	Male	8.3	16.4	10.6	White, non-Hispanic	7.1	17.8	10.7
								Black, non-Hispanic	6.7	10.2	14.6
								American Indian or Alaskan native, non-Hispanic	*	36	*
								Asian, non-Hispanic	4.3	*	*
				Female	4.3	17.8	8	Native Hawaiian or other Pacific Islander, non-Hispanic	*	**	**
								Other, non-Hispanic	*	*	*
								Multiracial, non-Hispanic	10.5	10.4	*
								Hispanic	5.7	12.1	6.3
Smoke some days	5.1	6.7	5.1	Male	6.5	7	6.9	White, non-Hispanic	4.7	5.5	4.1
								Black, non-Hispanic	6.8	14.6	6.1
								American Indian or Alaskan native, non-Hispanic	*	*	*
								Asian, non-Hispanic	2.9	*	*
				Female	3.5	5.5	3.4	Native Hawaiian or other Pacific Islander, non-Hispanic	*	**	*
								Other, non-Hispanic	*	*	*
								Multiracial, non-Hispanic	8.5	*	*
								Hispanic	5.7	*	5.7
Former smoker	21.4	25.7	21.3	Male	26.3	30.7	26.6	White, non-Hispanic	28.9	28.6	28.3
								Black, non-Hispanic	19.3	16.8	9.8
								American Indian or Alaskan native, non-Hispanic	29.2	*	*
								Asian, non-Hispanic	15.6	*	10.1
				Female	18	23.4	16.7	Native Hawaiian or other Pacific Islander, non-Hispanic	*	*	*
								Other, non-Hispanic	28	*	*
								Multiracial, non-Hispanic	21.7	*	35.2
								Hispanic	17.1	*	18.1
Never smoked	67.3	50.1	64.4	Male	58.9	45.8	55.9	White, non-Hispanic	59.3	48.2	56.8
								Black, non-Hispanic	67.3	58.5	69.6
								American Indian or Alaskan native, non-Hispanic	50.7	45	50.1
								Asian, non-Hispanic	77.2	*	82.5
				Female	74.3	53.3	71.9	Native Hawaiian or other Pacific Islander, non-Hispanic	*	*	*
								Other, non-Hispanic	57.9	59.5	61.1
								Multiracial, non-Hispanic	59.3	63.7	46
								Hispanic	71.5	63.1	69.9

*Prevalence estimates not available, **No responses

1) Between California, Kentucky, and Texas, Kentucky consistently displayed higher prevalence of smokers (everyday, some days, former) and had lower prevalence of non-/never smokers in 2018. California had the highest prevalence of non-/never smokers among the three states.
2) Within each state (California, Kentucky, and Texas), males consistently displayed higher prevalence of smokers (everyday, some days, former) than females in 2018, and females had higher prevalence of non-/never smokers. The data between states cannot be compared, as only crude data could be found.
3) Within California and Texas, those who identified as Asian (non-Hispanic) had the highest prevalence of non-/never smokers in 2018. Kentucky did not have prevalence estimates for non-/never smokers in the Asian (non-Hispanic category), but out of the available racial/ethnicity data on smoking prevalence, those who identified as multiracial (non-Hispanic) had the highest prevalence of non-/never smokers in 2018. Overall, comparisons of smoking prevalence between races/ethnicities in each state are challenged by lack of prevalences estimates or data responses. The data between states cannot be compared, as only crude data could be found.

11. Discuss some of the possible reasons for the lung cancer disparities by geographic location, sex, and race using the data obtained from question 10. [Word Limit; 300 words maximum]

Disparities in lung cancer among geographic locations could be due to the higher prevalence of everyday smokers, as shown in the table in question 10. Kentucky has both the highest prevalence of everyday smokers and the highest rate of mortality for lung and bronchus cancer. California has the lowest prevalence of everyday smokers and the lowest rate of mortality for lung and bronchus cancer. California also has the highest prevalence of never smokers. Showing that there is a correlation between the smoking prevalence of a region and the rate of lung and bronchus mortality. Females across all regions have a higher 5-year survival rate than males. One reason for this is females may be more likely to get early screening and follow-up with treatment than males. Also, looking at the table in number 10, more males are every day and some days smokers than females, except for Kentucky where females have a slightly high prevalence of everyday smokers. When looking at the lung cancer mortality rate among race, non-Hispanic whites, non-Hispanic blacks and Hispanics, Hispanics have the lowest mortality rate in the U.S. as well as Texas, California and Kentucky. This could be due to the prevalence of everyday smokers, in Texas and California Hispanics have the lowest rate of everyday smokers. However, they are not the lowest in Kentucky, but they do have the highest rate of never smokers in this state.

12. Describe an intervention or method of control that you think might eliminate or reduce one or more of the disparities in lung cancer incidence, mortality, or survival. Briefly describe how you

would design a study to test the efficacy of your intervention. A) Include a description of what specific study design you would choose and why you chose that design. B) Include a brief description of your target, source, and study population. C) Include a brief description of your exposure/treatment/intervention to be tested. D) Include a brief description of your outcome of interest and how and when you will measure the outcome. E) Describe what measure of association you will use to quantify the relationship between your exposure/treatment/intervention and your outcome.

The causal relationship between smoking and lung cancer is highly established, as pioneered by the British Doctor's Study conducted by Richard Doll and Austin Bradford Hill. The notion is also accepted that smokers with lung cancer will experience lower relative survival rates than former or nonsmokers with lung cancer. We are aiming to reduce the disparity in lung cancer survival duration between smokers and former/non-smokers by providing education on the effects of smoking on lung cancer survival and overall health to smokers with lung cancer to encourage smoking cessation. It is expected that increasing smoking cessation among lung cancer patients will prolong their duration of survival, but this will not be measured within the scope of this study.

A) We would conduct a prospective cohort study because we want to establish a causal relationship between our intervention and outcome of interest to make a stronger case for the effectiveness of our intervention on our outcome. Additionally, because we are targeting an individual behavior (smoking) among a specific population (lung cancer patients), a cohort study would be beneficial to gather individual data rather than ecological.

B) Our target population is U.S. smokers with lung cancer. We would source our population from Kentucky, which has a much higher prevalence of smoking and lung cancer mortality than the U.S. average. We would first identify lung cancer patients of any stage through available hospital records and cancer registries in the state and reach out to them to participate in our study. We would screen the volunteers for their smoking habits, identifying and choosing only current smokers out of the group to be in our study population. Since the onset of lung cancer is more common among middle-aged adults and older, we will limit our study population to those 45 years and older and stratify the ages in roughly 10-year increments (i.e. 45-55, 56-65, 76-85, etc.). Ideally, we would have a minimum cohort of 200 participants to maintain statistical significance in our findings, giving much leeway for potential losses to follow up.

C) We would be intervening in smoking habits among lung cancer patients by providing an educational session on the effects of smoking on lung cancer survival and overall health to a randomized half of our cohort study population. These participants would also receive printed

and online resources for further information, should they want to learn more. The other randomized half of the cohort would receive the same standard of care that they would normally without any additional education on the effects of smoking. The randomization of our cohort study groups would control for potential confounders, given that we expect the age, gender, cancer stage at diagnosis, and smoking status (e.g. every day, some days), among others, to be comparable between them.

D) Our outcome of interest is the likelihood of smoking cessation and/or efforts to decrease/cease smoking as a result of education on the effects of smoking. To measure this, after 6 months from the educational session, we would send a brief survey to all the participants with a series of questions to ask if they've decreased or ceased their habit of smoking and what may have encouraged them to do so.

E) We would use relative risk to compare the likelihood of smoking cessation and/or decreased smoking behaviors between U.S. smokers with lung cancer who received smoking education and those who didn't receive the education. This ratio, if greater than 1.0, would suggest that smokers with lung cancer who are given deliberate education and resources on the health effects of smoking are more likely to quit or lessen smoking behavior