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Research Article

THE INCIDENCE RATE OF INVASIVE LUNG AND BRONCHUS CANCER IN THE UNITED STATES OF AMERICA: AN OBSERVATIONAL DESCRIPTIVE EPIDEMIOLOGICAL ANALYSIS OF DATA FROM THE CENTERS FOR DISEASE CONTROL AND PREVENTION 1999-2014

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A R T I C L E I N F O

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Key words:

Cancer epidemiology; Invasive colon and rectum cancer; the United States of America; Age adjusted Incidence rate.

A B S T R A C T

Background: This study provides descriptive epidemiological data of invasive lung and bronchus cancer diagnosed from 1999 to 2014 in the United States of America.

Methods: This is a retrospective descriptive epidemiological analysis of invasive lung and bronchus cancer recorded in the Centres for Disease Control and Prevention from 1999 to 2014. The statistical analyses were performed using descriptive statistics to calculate the overall age-adjusted incidence rate stratified by state, race, and gender.

Results: The state of Kentucky, West Virginia, Missouri, Indiana, Detroit, and Maine had the highest overall age-adjusted incidence rate of invasive lung and bronchus cancer among males and females White American, from 1999 to 2014. The state of Kentucky, Wisconsin, Iowa, Nebraska, and Pennsylvania had the highest overall age-adjusted incidence rate of invasive lung and bronchus cancer among males and females Black American, from 1999 to 2014. While, the state of Hawaii, Detroit, and Connecticut had the highest overall age-adjusted incidence rate of invasive lung and bronchus cancer among males and females Hispanic American, from 1999 to 2014.

Conclusion: This study revealed that the state of Kentucky, West Virginia, Missouri, Indiana, Detroit, and Maine are the best geographic areas in the United States of America, for studying the most important risk factors of invasive lung and bronchus cancer among males and females White American. While, the states of Kentucky, Wisconsin, Iowa, Nebraska, and Pennsylvania are the best geographic areas for males and females Black American. In addition, the state of Connecticut, Detroit, and Hawaii, are the best geographic areas for studying the most important risk factors of invasive lung and bronchus cancer among males and females Hispanic American. However, the secret for confirming the real risk factor for lung and bronchus cancer can be found among males and females Hispanic American living in the state of Hawaii. Therefore, multiple case-control studies adjusted by race and gender should be conducted in the mentioned states to identify the major risk factors that can be controlled.

INTRODUCTION

Lung cancer is the leading cause of morbidity and mortality worldwide.[1-2] It has become the first killer among cancers globally.[1-2] The incidence and mortality of lung cancer has increased steadily since 1930s, due to the popularity of smoking cigarette.[3-4] It is estimated that 80 to 85% of cancer deaths from lung cancer, are attributable to smoking.[5-6] In the United States of America, the International Agency for Research on Cancer estimated that the age-adjusted incidence rate for lung and bronchus cancer was 38.4 per 100,000 population in 2012, and the age-adjusted mortality rate was 8.9 per 100,000 population.[4-6] The purpose of this study is to describe the pattern of invasive lung and bronchus cancer in the United States of America from 1999 to 2014, while focusing on the age adjusted incidence rate, stratified by state, race, and gender.[7-8]

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MATERIALS AND METHODS

This is a retrospective descriptive epidemiological study of invasive lung and bronchus cancer diagnosed between 1999 and 2014 in the United States of America. The data were available and easily accessible from the website of the Centres for Disease Control and Prevention, through the Official Federal Statistics on cancer incidence registries. Based on these data, there are comprehensive cancer data for the 50

States in the United States of America, from 1999 to 2014, exploring the age-adjusted incidence rate stratified by state, race, and gender. For data analysis, the Statistical Package for the Social Sciences version 20.0 (SPSS) was used to calculate the mean age-adjusted incidence rate of lung and bronchus cancer from 1999 to 2014.

RESULTS

Invasive Lung and Bronchus Cancer in the North East of the United States of America

The overall age-adjusted incidence rate of invasive lung and bronchus cancer from 1999 to 2014 per 100,000 persons was calculated from the Centres for Disease Control and Prevention. The highest overall age-adjusted incidence rate of invasive lung and bronchus cancer was documented in the state of Maine with an estimated average for male (94.7 per 100,000 persons), and for the female (66.0 per 100,000 persons). The estimated overall age-adjusted incidence rates in the state of Maine from 1999 to 2014 were higher among males and females White American, compared to other White American living in the North East and Middle Atlantic of the United States.

The state of Pennsylvania had the highest overall age-adjusted incidence rate (113.5 and 69.7 per 100,000 persons) of invasive lung and bronchus cancer among males and females Black American, compared to other races living in the northeast of the United States of America.

The state of Connecticut had the highest overall age-adjusted incidence rate of invasive lung and bronchus cancer among males and females Hispanic American from 1999 to 2014, with an estimated average of (68.2 and 43.1 per 100,000 persons) **(Table 1)**. However, most of the male races living in the northeast of the United States were more affected by lung and bronchus cancer compared to other female races.

Invasive Lung and Bronchus Cancer in the Midwest of the United States of America

The highest overall age-adjusted incidence rate of invasive lung and bronchus cancer was observed in the state of Missouri, Indiana, and Detroit with an estimated average for male (98.0, 98.0, and 93.0 per 100,000 persons), and for the female (63.2, 63.0, and 67.8 per 100,000 persons). The estimated overall age-adjusted incidence rates of invasive lung and bronchus cancer in the state of Missouri, Indiana, and Detroit, from 1999 to 2014 were higher among males and females White American, compared to the same race living in the other states of the Midwest of the United States. While, the state of Wisconsin, Iowa, and Nebraska recorded the highest overall age-adjusted incidence rate of invasive lung and bronchus cancer among males Black American at (131.3, 130.8 and 120.7 per 100,000 persons), and females Black American at (70.0, 79.1 and 74.0 per 100,000 persons). The state of Detroit had the highest overall age-adjusted incidence rate of invasive lung and bronchus cancer among males and females Hispanic from 1999 to 2014, with an estimated average of (79.6 and 59.5 per 100,000 persons) **(Table 2)**. However, most of the male races living in the Midwest of the United States were more affected by lung and bronchus cancer compared to other female races.

Invasive Lung and Bronchus Cancer in the South of the United States of America

The highest overall age-adjusted incidence rate of invasive lung and bronchus cancer was documented in the state of Kentucky with an estimated average for male White and Black Americans at (129.1 and 139.1 per 100,000 persons), and for the female White and Black Americans at (78.4 and 81.1 per 100,000 persons). The estimated overall age-adjusted incidence rates in the state of Kentucky, from 1999 to 2014, were higher among males and females White and Black Americans compared to other races living in all states of America. Furthermore, the state of West Virginia was the second highest area in the south of the United States, affected by lung and bronchus cancer among males and females White American, with estimated overall age-adjusted incidence rates (111.5 and 70.4 per 100,000 persons).

Table 1 Overall age-adjusted incidence rate of invasive lung and bronchus cancer in the north east of the United States from 1999 to 2014

Geographic Area	Overall age-adjusted incidence rate of invasive lung and bronchus cancer in the North East of the United States from 1999 to 2014							
	All Races		White		Black		Hispanic	
	Male	Female	Male	Female	Male	Female	Male	Female
United States	82.8	54.8	82.2	56.3	99.8	50.6	48.4	27.2
Northeast	80.6	57.0	81.2	59.1	84.8	48.6	53.8	30.5
New England	82.0	61.8	82.6	63.2	77.3	44.6	61.2	38.5
Connecticut	77.7	58.4	77.8	60.0	82.3	46.5	**68.2**	**43.1**
Maine	94.4	65.9	**94.7**	**66.0**	-	-	-	-
Massachusetts	80.7	62.7	81.6	64.7	75.1	42.4	-	-
New Hampshire	80.5	62.8	80.0	62.7	-	-	-	-
Rhode Island	89.3	63.3	90.5	64.5	-	-	-	-
Vermont	80.9	58.4	80.8	58.3	-	-	-	-
Middle Atlantic	80.1	55.3	80.7	57.5	85.8	49.1	52.7	29.4
New Jersey	75.6	55.4	76.4	58.0	86.3	50.5	53.5	30.1
New York	77.4	54.7	79.3	59.2	74.1	40.7	51.9	28.8
Pennsylvania	86.6	56.3	84.7	55.3	**113.5**	**69.7**	58.2	33.3

(-) Means in all tables: Rates are suppressed if fewer than 16 cases were reported in a specific category (area, race, ethnicity)

However, most of the male races living in the south of the United States were more affected by lung and bronchus cancer compared to other female races **(Table 3)**. However, the south of the United States was the highest geographic area affected by invasive lung and bronchus cancer compared to Midwest, Northeast, and West of the United States, the overall age-adjusted incidence rates for males and females of all races were (89.1 and 56.1 per 100,000 persons).

Invasive Lung and Bronchus Cancer in the West of the United States of America

The highest overall age-adjusted incidence rate of invasive lung and bronchus cancer was recorded in the state of Hawaii, with an estimated average for male (92.1 per 100,000 persons), and for the female (66.7 per 100,000 persons). The estimated overall age-adjusted incidence rates of invasive lung and bronchus cancer in the state of Hawaii were the highest among males and females Hispanic, compared to other Hispanic Americans living in all states of America. However, most of the male races living in the west of the United States were more affected by lung and bronchus cancer compared to other female races **(Table 4)**. Furthermore, the west of the United States was the lowest geographic area affected by invasive lung and bronchus cancer compared to Midwest, Northeast, and South of the United States, the overall age-adjusted incidence rates for males and females of all races were (64.8 and 47.7 per 100,000 persons).

Table 2 Overall Age-Adjusted Incidence Rate Of Invasive Lung And Bronchus Cancer In The Midwest Of The United States From 1999 To 2014

Geographic Area	Overall age-adjusted of invasive lung and bronchus cancer in the Midwest of the United States from 1999 to 2014							
	All Races		White		Black		Hispanic	
	Male	Female	Male	Female	Male	Female	Male	Female
United States	82.8	54.8	82.2	56.3	99.8	50.6	48.4	27.2
Midwest	87.5	57.8	85.8	57.5	113.3	65.0	47.2	31.4
East North Central	89.6	59.3	87.8	59.1	113.2	65.0	47.6	31.4
Illinois	88.7	58.8	87.1	59.4	112.1	63.9	43.4	29.2
Indiana	98.3	62.5	**98.0**	**63.0**	111.3	65.0	46.2	35.1
Michigan	88.1	60.7	85.4	60.0	113.5	65.9	68.6	42.8
Detroit	96.5	66.7	**93.0**	**67.8**	117.5	66.8	**79.6**	**59.5**
Ohio	93.6	59.9	92.0	59.6	112.1	64.5	45.0	29.3
Wisconsin	76.7	53.5	74.4	52.4	**131.3**	**70.0**	56.6	42.5
West North Central	82.9	54.4	81.7	53.9	114.0	65.3	45.3	31.7
Iowa	85.9	53.4	85.5	53.3	**130.8**	**79.1**	-	-
Kansas	80.1	51.4	79.0	51.1	108.8	57.9	45.6	31.8
Minnesota	67.1	49.4	66.3	49.0	91.5	55.1	-	-
Missouri	99.1	63.4	**98.0**	**63.2**	119.3	68.6	56.6	38.4
Nebraska	78.6	50.0	77.7	49.6	**120.7**	**74.0**	-	-
North Dakota	72.2	46.1	70.9	44.0	-	-	-	-
South Dakota	76.0	48.4	74.7	47.5	-	-	-	-

Table 3 Overall age-adjusted incidence rate of invasive lung and bronchus cancer in the south of the United States from 1999 to 2014

Geographic Area	**Overall age-adjusted of invasive lung and bronchus cancer in the south of the United States from 1999 to 2014**							
	All Races		White		Black		Hispanic	
	Male	Female	Male	Female	Male	Female	Male	Female
United States	82.8	54.8	82.2	56.3	99.8	50.6	48.4	27.2
South	89.1	56.1	88.1	58.4	99.5	46.8	50.8	26.2
South Atlantic	88.5	56.1	87.8	59.1	95.6	43.9	57.2	28.4
Delaware	92.2	65.3	91.7	66.8	99.1	61.1	-	-
District of Columbia	80.9	49.4	47.6	35.8	101.7	56.2	-	-
Florida	83.4	57.6	83.6	60.1	83.0	37.5	61.1	28.7
Georgia	97.7	53.9	98.2	58.5	100.0	41.8	43.8	27.2
Atlanta	78.3	49.6	75.2	53.1	92.0	44.8	51.1	31.1
Maryland	78.5	56.4	77.8	59.6	87.4	51.1	38.0	27.3
North Carolina	96.8	55.4	95.0	58.2	107.2	44.1	38.8	32.5
South Carolina	98.5	53.6	97.5	58.0	102.3	40.1	-	-
Virginia	81.9	52.1	80.1	53.9	98.6	48.3	39.0	26.5
West Virginia	111.1	69.7	**111.5**	**70.4**	107.8	59.1	-	-
East South Central	108.5	62.6	108.2	65.5	112.2	49.5	38.4	26.4
Alabama	103.0	52.5	102.8	56.4	104.5	38.6	-	-
Kentucky	129.0	78.1	**129.1**	**78.4**	**139.1**	**81.1**	-	-
Mississippi	109.4	56.3	105.1	60.3	120.9	47.6	-	-
Tennessee	101.6	58.6	101.4	59.7	105.1	53.3	37.1	39.8
West South Central	88.7	52.9	86.2	53.3	115.6	51.7	50.7	25.0
Arkansas	106.5	60.0	104.8	61.7	119.3	46.5	-	-
Louisiana	103.2	57.0	97.8	59.6	122.6	51.0	56.7	37.3
Oklahoma	100.1	62.2	97.8	61.0	114.5	58.3	56.7	47.5
Texas	82.5	49.5	80.5	49.9	114.6	52.4	51.0	24.4

DISCUSSION

This descriptive epidemiological study of invasive lung and bronchus cancer among males and females across all races in the United States of America, explores a valuable information about the pattern of the disease in the entire population. It focuses on the age-adjusted incidence rate of the invasive lung and bronchus cancer stratified by state, race, and gender. The result of the study is based on the data recorded in the Centres for Disease Control and Prevention, from 1999 to 2014. In the North East of the United States, we have observed that the

highest overall age-adjusted incidence rates of invasive lung and bronchus cancer among males and females White American were documented in the state of Maine, from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rate in the state of Maine was higher among males and females White American,

identify the most important risk factor for invasive lung and bronchus cancer among males and females Black American living in the state of Pennsylvania. The risk factor can be identified by conducting two case-control studies among males and females Black American. It is very important to be sure that the smoking is the first potential risk factor in both

Table 4 Overall age-adjusted incidence rate of invasive lung and bronchus cancer in the west of the United States from 1999 to 2014

Geographic Area	Overall age-adjusted of invasive lung and bronchus cancer in the west of the United States from 1999 to 2014							
	All Races		White		Black		Hispanic	
	Male	Female	Male	Female	Male	Female	Male	Female
United States	82.8	54.8	82.2	56.3	99.8	50.6	48.4	27.2
West	64.8	47.7	65.0	49.7	85.5	52.2	41.4	25.8
Mountain	62.1	46.2	62.5	47.1	72.6	47.7	45.4	29.5
Arizona	65.3	48.5	66.4	49.6	72.3	49.3	46.5	26.7
Colorado	57.9	44.1	57.7	44.5	70.6	45.6	47.9	35.2
Idaho	65.0	47.1	65.0	47.3	-	-	-	-
Montana	72.1	56.6	70.2	54.9	-	-	-	-
Nevada	78.7	64.9	80.4	69.0	75.1	53.7	44.4	33.6
New Mexico	54.9	37.9	56.8	40.1	-	-	43.5	27.7
Utah	37.2	23.1	37.0	23.0	-	-	42.4	34.1
Wyoming	58.8	45.6	59.2	45.5	-	-	-	-
Pacific	65.4	48.0	65.7	50.7	87.4	52.8	39.6	24.3
Alaska	81.7	60.7	76.4	59.6	-	-	-	-
California	62.1	45.2	62.1	47.6	86.8	52.8	38.8	23.4
San Francisco-Oakland	60.5	45.5	56.8	48.6	94.1	62.8	42.9	28.0
San Jose-Monterey	53.5	40.0	54.0	43.3	84.3	74.4	40.1	24.6
Los Angeles	56.5	37.9	53.8	38.7	87.6	50.6	34.5	19.2
Hawaii	64.6	39.0	65.2	50.4	-	-	**92.1**	**66.7**
Oregon	74.5	58.8	74.1	59.1	110.8	76.4	55.8	51.3
Washington	75.5	58.0	75.7	59.5	95.5	55.2	48.6	37.0
Seattle-Puget Sound	76.2	58.8	76.4	60.9	97.9	55.5	53.6	50.7

compared to the same race living in the northeast of the United States. However, adult smoking rates in all states of America were recorded by National rate CDC, "Current Cigarette Smoking Among Adults-United States, 2005-2015, Smoking Rank (1=Low)". The smoking rate in the state of Maine was 19.5% (Rank =37th), therefore, males and females White American should be the majority of smokers in the state of Maine, because they had the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer from 1999 to 2014. **Figure 1**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females White American living in the state of Maine. The risk factor can be identified by conducting two case-control studies among males and females White American. It is very important to be sure that the smoking is the first risk factor in both genders, otherwise, there is another potential risk factor contributing to the increase of the overall age-adjusted incidence rates of invasive lung and bronchus cancer in the state of Maine.

The state of Pennsylvania was the highest area affected, in the northeast of the United States, by invasive lung and bronchus cancer among males and females Black American, from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rate in the state of Pennsylvania was higher among males and females Black American, compared to the same race living in the northeast of the United States. However, the smoking rate in the state of Pennsylvania was 18.1% (Rank =30th), therefore, males and females Black American should be the majority of smokers in the state of Pennsylvania, because they had the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer from 1999 to 2014. **Figure 2**, shows how one can

genders, otherwise, there is another risk factor contributing to the increase of the overall age-adjusted incidence rates of invasive lung and bronchus cancer in the state of Pennsylvania. The state of Connecticut was the highest area affected, in the northeast of the United States, by invasive lung and bronchus cancer among males and females Hispanic American, from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rate in the state of Connecticut was higher among males and females Hispanic American, compared to the same race living in the northeast of the United States. However, the smoking rate in the state of Connecticut was 13.5% (Rank =3rd). It is very important to check the smoking rates in males and females Hispanic across all states in the northeast of the United States of America. If the smoking rates are higher among males and females American Hispanic, in the state of Connecticut, compared to the same race living in other states of the northeast, this will give a good evidence that the smoking is the real risk factor for lung and bronchus cancer in the state of Connecticut, but if it is not, this means there is another risk factor contributing to the increase of overall age-adjusted incidence rates of invasive lung and bronchus cancer in the state of Connecticut. **Figure 3**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females Hispanic American living in the state of Connecticut. The risk factor can be identified by conducting two case-control studies among males and females Hispanic American. In the Midwest of the United States, we have observed that the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer among males and females White American were documented in the state of Missouri, Indiana, and Detroit from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that

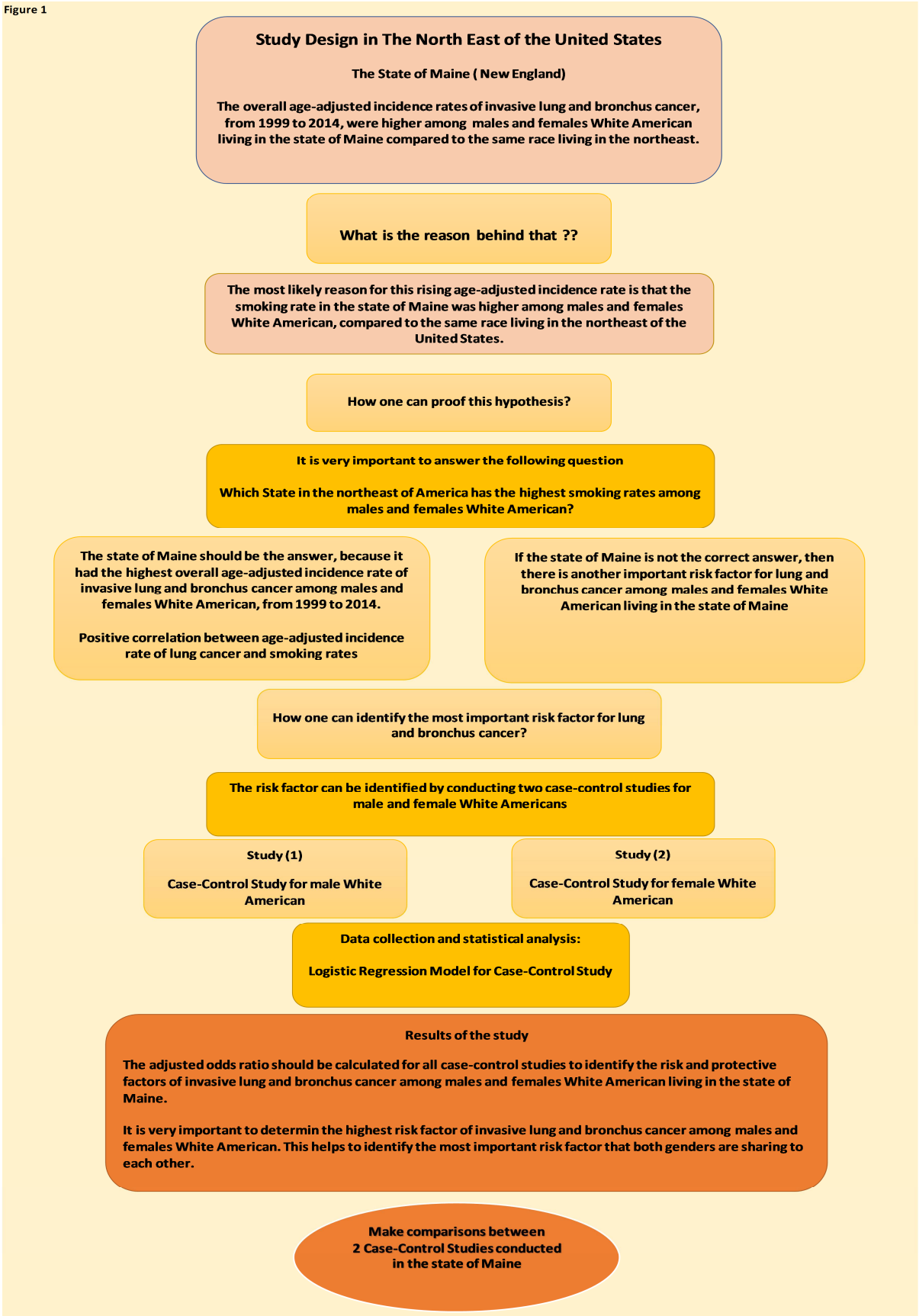

Figure 1 Study Design in The North East of the United States (The state of Maine)

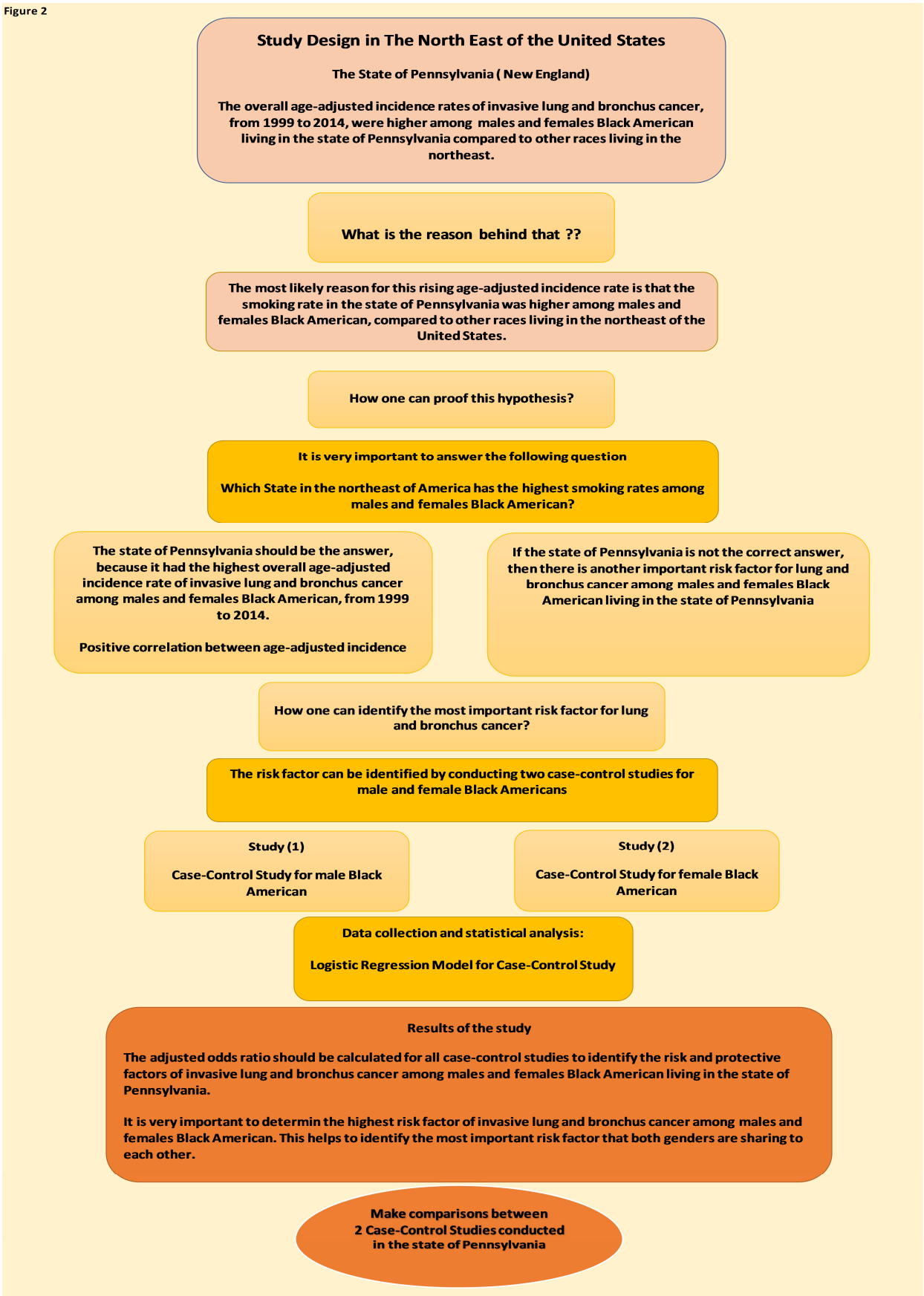

Figure 2 Study Design in The North East of the United States (The state of Pennsylvania)

Figure 3

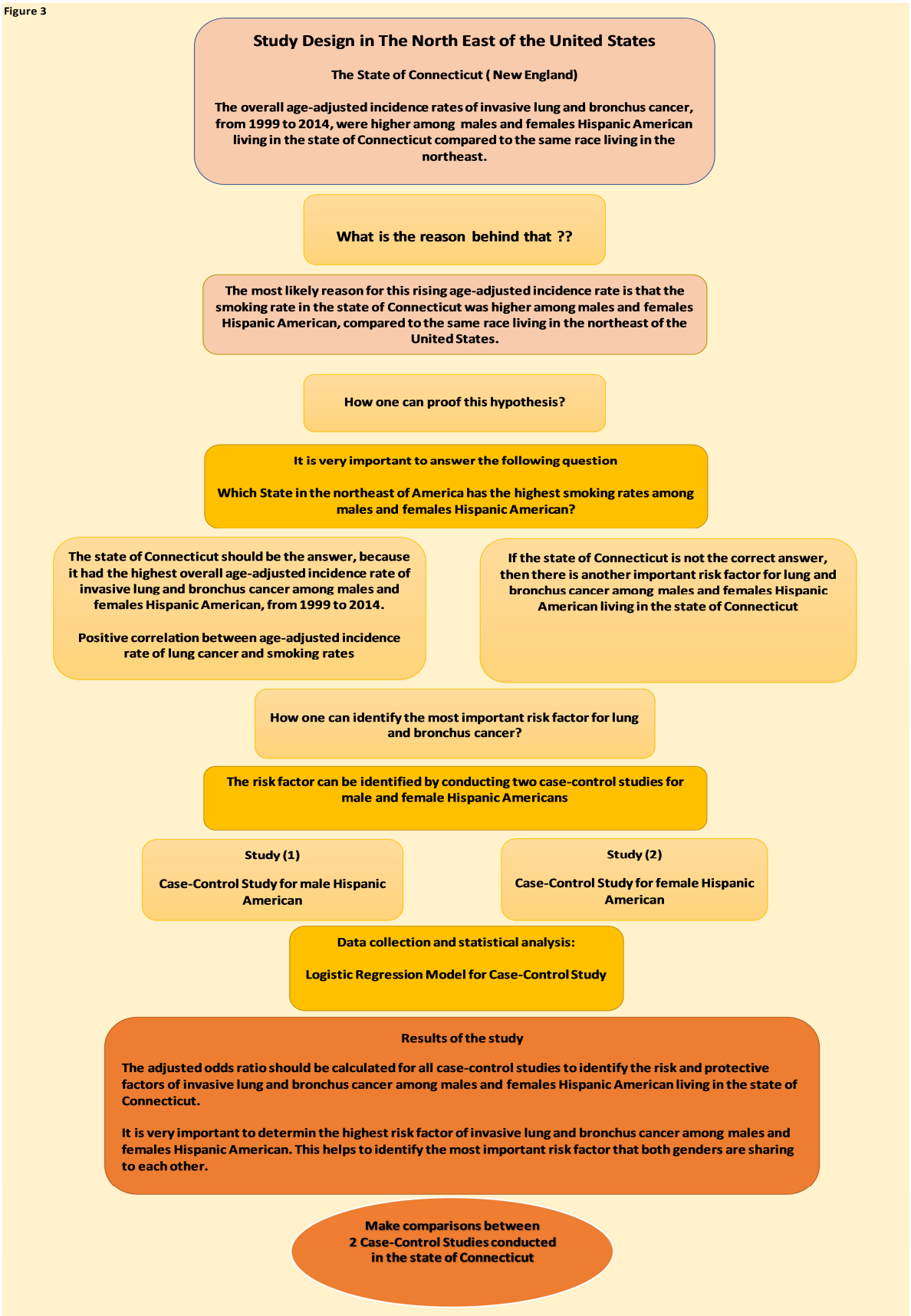

Figure 3 Study Design in The North East of the United States (The state of Connecticut)

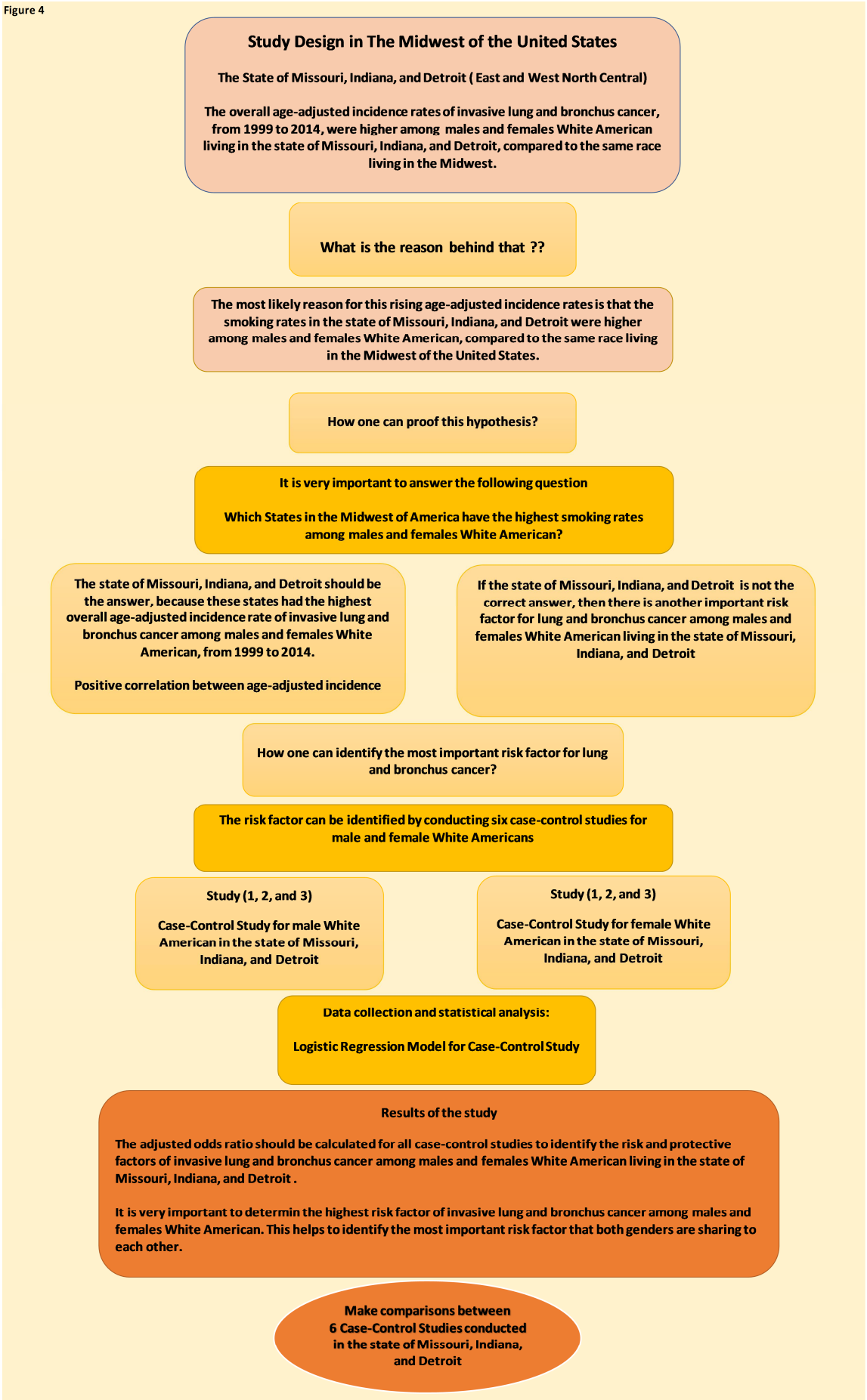

Figure 4 Study Design in The Midwest of the United States (The state of Missouri, Indiana, and Detroit)

Figure 5

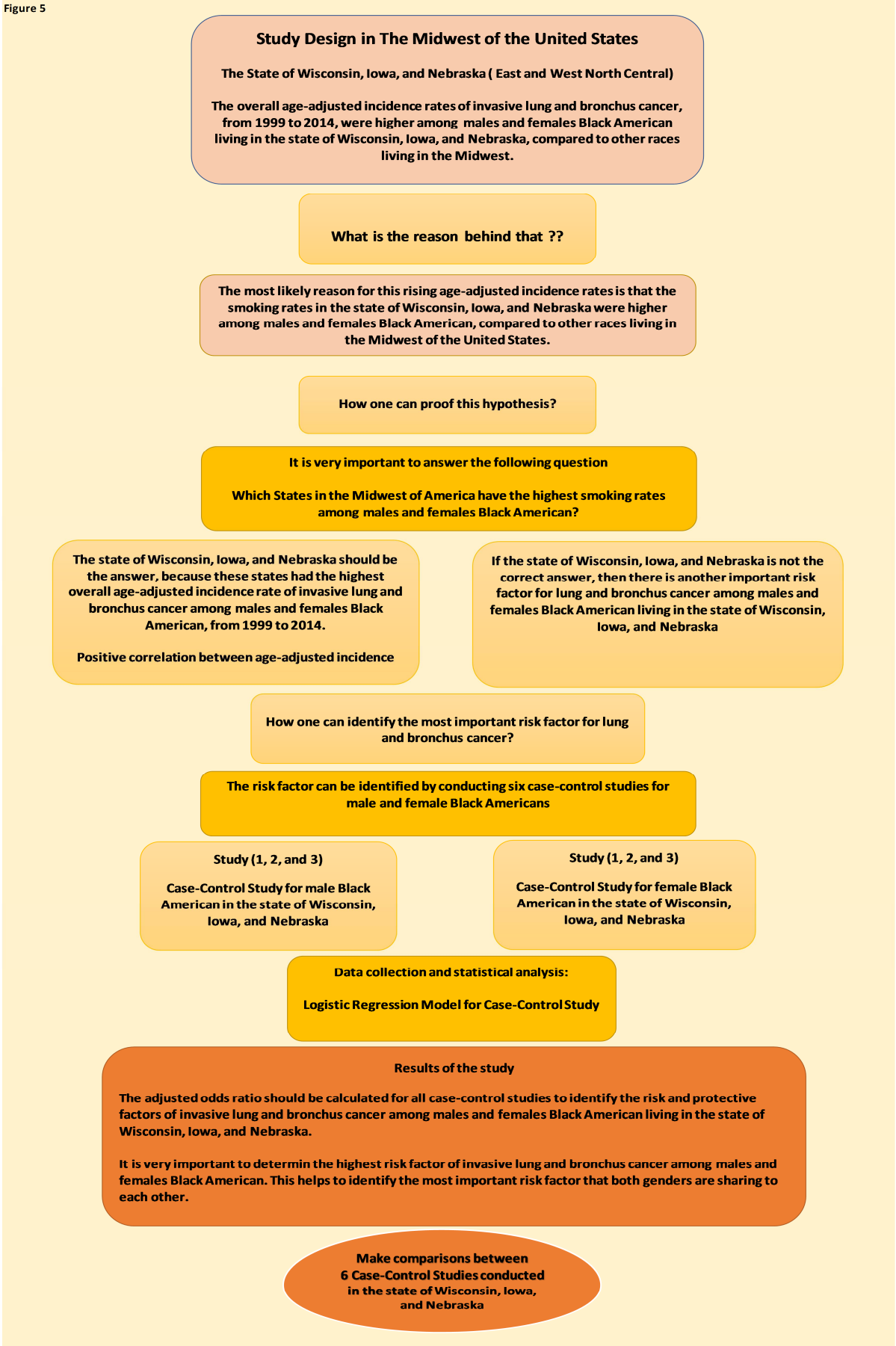

Figure 5 Study Design in The Midwest of the United States (The state of Wisconsin, Iowa, and Nebraska)

Figure 6

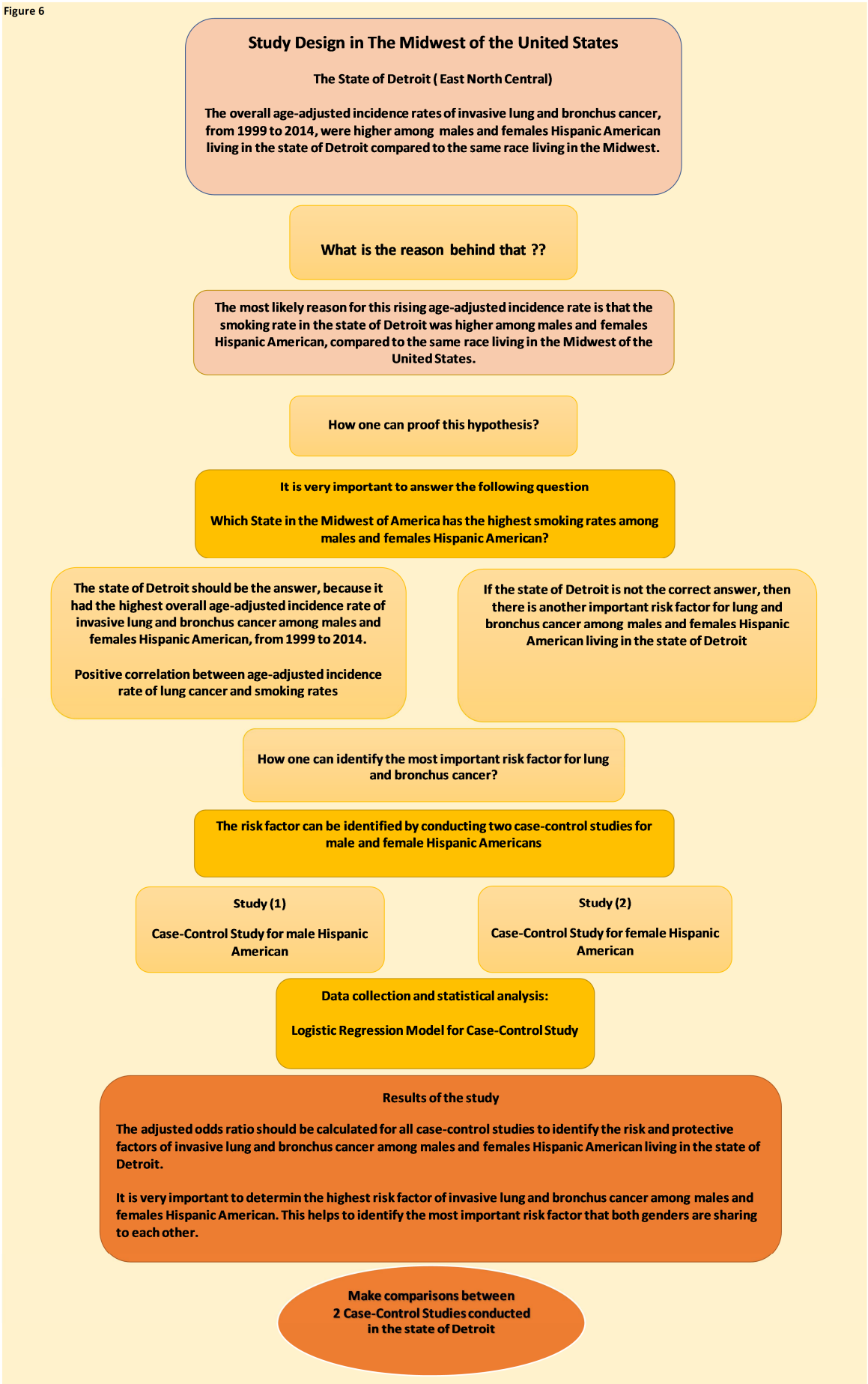

Figure 6 Study Design in The Midwest of the United States (The state of Detroit)

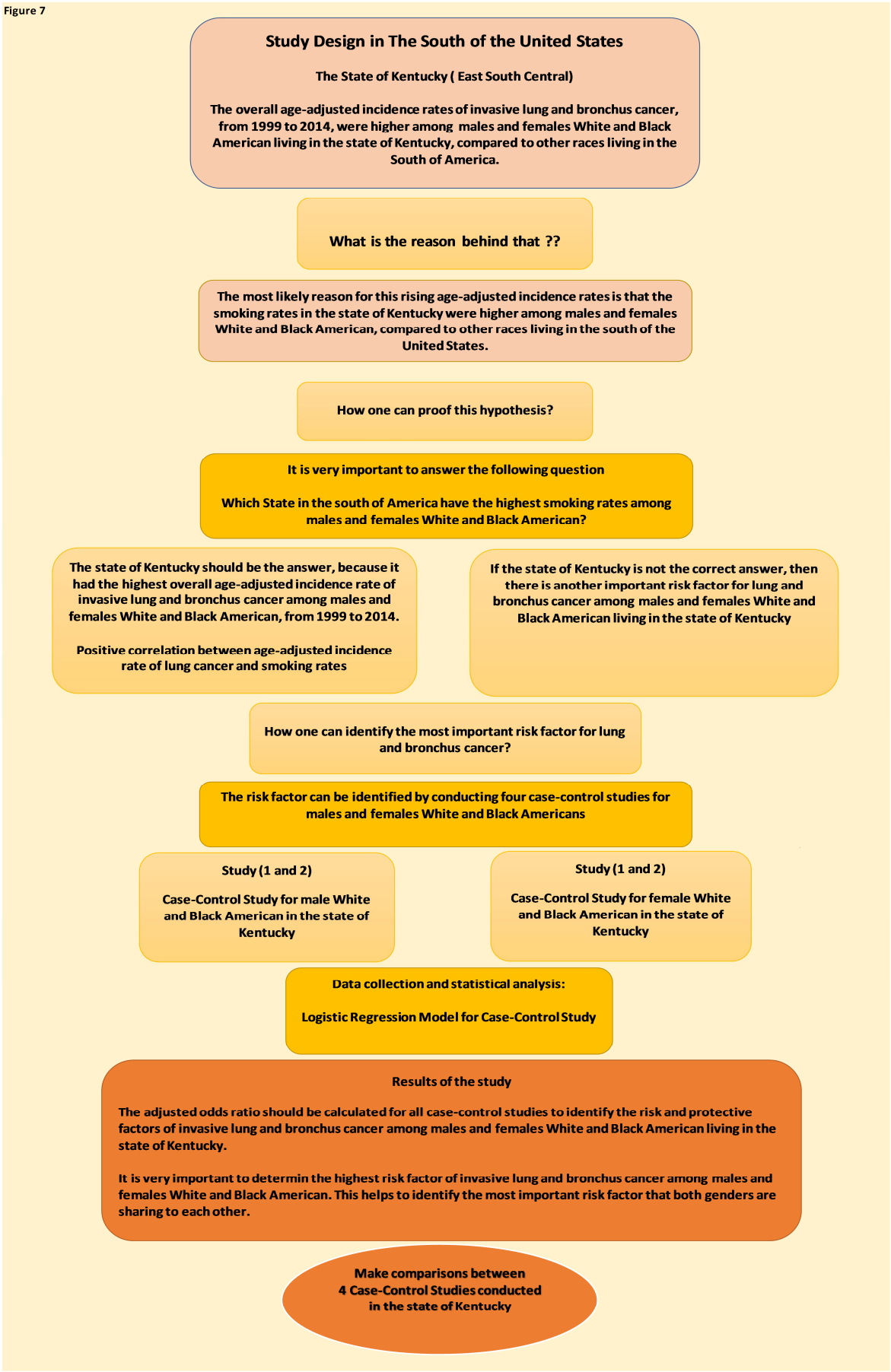

Figure 7 Study Design in The South of the United States (The state of Kentucky)

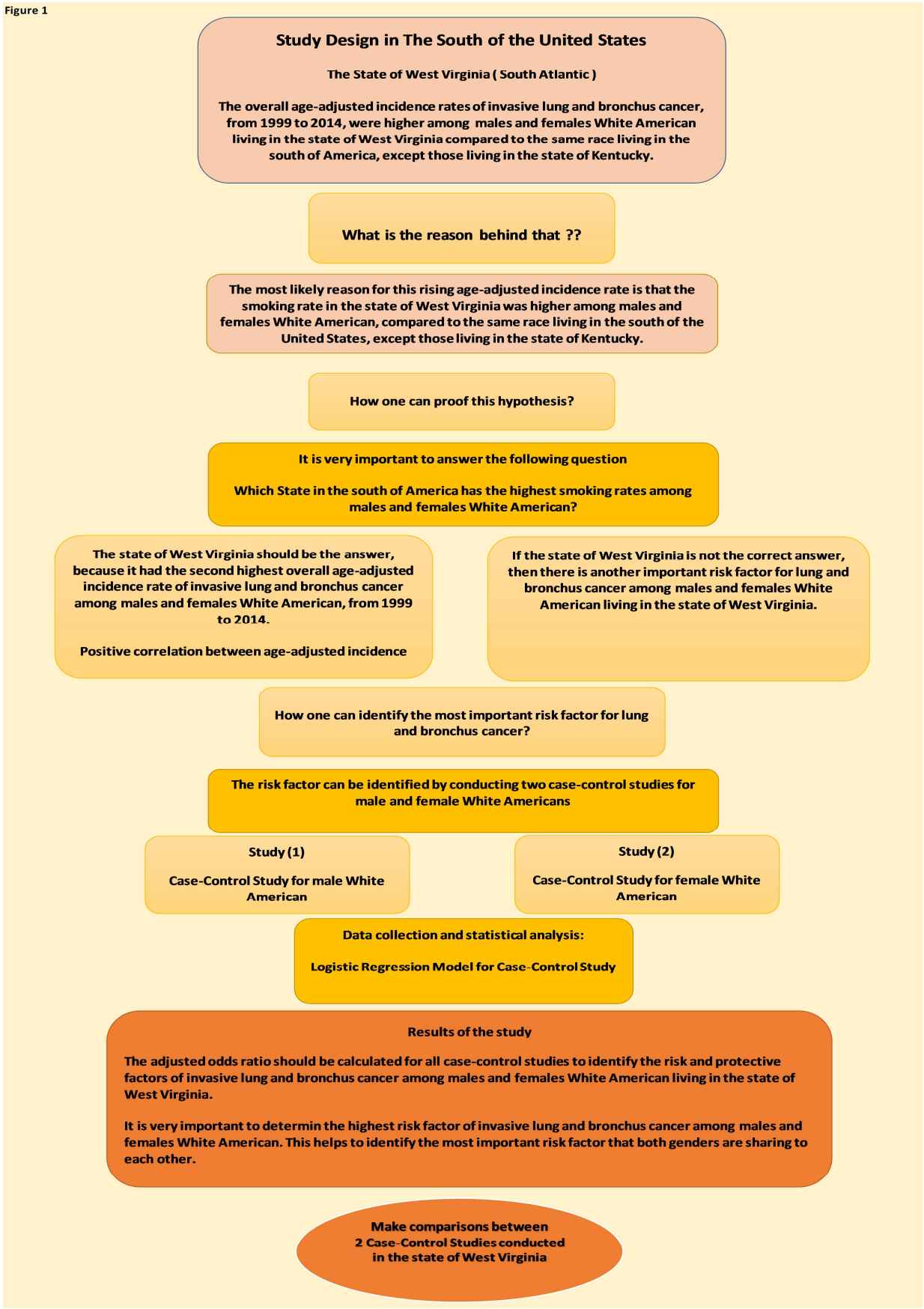

Figure 8 Study Design in The South of the United States (The state of West Virginia)

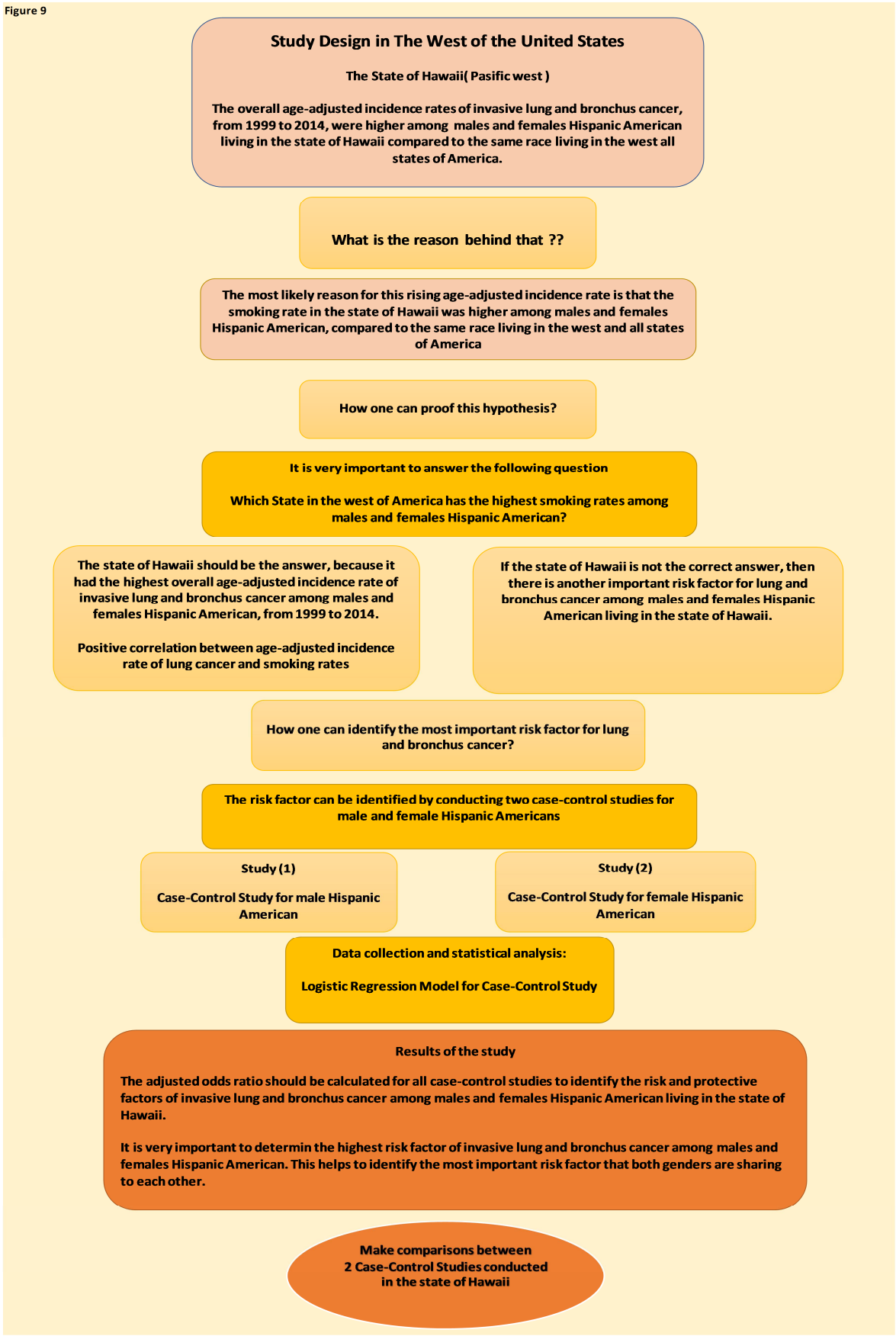

Figure 9 Study Design in The West of the United States (The state of Hawaii)

the smoking rates in the state of Missouri, Indiana, and Detroit were higher among males and females White American, compared to other males and females White American living in the Midwest of the United States. However, the smoking rates in the state of Missouri (22.3%, Rank = 47th), Indiana (20.6%, Rank = 40th), and Detroit (No Data), therefore, males and females White American should be the majority of smokers in the state of Missouri, Indiana, and Detroit, compared to other males and females White American living in other states in the Midwest of the United States, because they had the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer from 1999 to 2014. **Figure 4**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females White American living in the state of Missouri, Indiana, and Detroit. The risk factor can be identified by conducting eight case-control studies among males and females White American. It is very important to be sure that the smoking is the first risk factor in both genders across the state of Missouri, Indiana, and Detroit, otherwise, there is another risk factor contributing to the increase of overall age-adjusted incidence rates of invasive lung and bronchus cancer in these states.

The state of Wisconsin, Iowa, and Nebraska were the highest area affected in the Midwest of the United States, through invasive lung and bronchus cancer among males and females Black American, from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rates in the state of Wisconsin, Iowa, and Nebraska were higher among males and females Black American, compared to black males and other black females living in the Midwest of the United States. However, the smoking rates in the state of Wisconsin (17.3%, Rank = 24th), Iowa (18.1%, Rank = 30th), and Nebraska (17.1%, Rank = 22nd), therefore, males and females Black American should be the majority of smokers in the state of Wisconsin, Iowa, and Nebraska, compared to other males and females Black American living in other states of the Midwest of the United States, because they had the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer from 1999 to 2014. **Figure 5**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females Black American living in the state of Wisconsin, Iowa, and Nebraska. The risk factor can be identified by conducting eight case-control studies among males and females Black American. It is very important to be sure that the smoking is the first risk factor in both genders across the state of Wisconsin, Iowa, and Nebraska, otherwise, there is another risk factor contributing to the increase of overall age-adjusted incidence rates of invasive lung and bronchus cancer in these states.

The state of Detroit was the highest area affected in the Midwest of the United States, through invasive lung and bronchus cancer among males and females Hispanic American, from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rate in the state of Detroit was higher among males and females Hispanic American, compared to Hispanic males and other Hispanic females living in the Midwest of the United States. However, it is very important to check the smoking rates in males and females Hispanic across all states in the Midwest of the United States of America. If the smoking rates are higher among males and females American Hispanic, in the state of Detroit, compared to the same race living in other states of the Midwest, this will give a good evidence that the smoking is the real risk factor for lung and bronchus cancer in the state of Detroit, but if not, this means there is another risk factor contributing to the increase of overall age-adjusted incidence rates of invasive lung and bronchus cancer in the state of Detroit. **Figure 6**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females Hispanic American living in the state of Detroit. The risk factor can be identified by conducting two case-control studies among males and females Hispanic American.

In the South of the United States, we have observed that the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer among males and females White and Black Americans were documented in the state of Kentucky from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rates in the state of Kentucky were higher among males and females White and Black Americans, compared to other races living in the south of the United States. However, the smoking rates in the state of Kentucky looks like very high (25.9%, Rank = 51th), therefore, males and females White and Black Americans should be the majority of smokers in the state of Kentucky, compared to other males and females White and Black Americans living in other states in the south of the United States, because they had the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer from 1999 to 2014. **Figure 7**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females White and Black Americans living in the state of Kentucky. The risk factor can be identified by conducting four case-control studies among males and females White and Black Americans. It is very important to be sure that the smoking is the first risk factor in both genders in the state of Kentucky, otherwise, there is another risk factor contributing to the increase of overall age-adjusted incidence rates of invasive lung and bronchus cancer.

The state of West Virginia was the second highest area in the south of the United States, affected by invasive lung and bronchus cancer from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rates in the state of West Virginia were higher among males and females White Americans, compared to other races living in the south of the United States, except the state of Kentucky. However, the smoking rates in the state of West Virginia looks like very high (25.7%, Rank = 50th), therefore, males and females White Americans should be the majority of smokers in the state of West Virginia, compared to other males and females White Americans living in other states in the south of the United States, except the state of Kentucky, because they had the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer from 1999 to 2014. **Figure 8**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females White Americans living in the state of West Virginia. The risk factor can be identified by conducting two case-control studies among males and females White Americans. It is very important to be sure that the smoking is the first risk factor in both genders in the state of West Virginia, otherwise, there is another risk factor

contributing to the increase of overall age-adjusted incidence rates of invasive lung and bronchus cancer. However, the south of the United States was the highest geographic area affected by invasive lung and bronchus cancer compared to Midwest, Northeast, and West of the United States, therefore, the smoking rates in the south of the United States should be the highest compared to Midwest, Northeast, and West of the United States.

In the West of the United States, we have observed that the highest overall age-adjusted incidence rates of invasive lung and bronchus cancer among males and females Hispanic Americans were documented in the state of Hawaii from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that the smoking rate in the state of Hawaii was higher among males and females Hispanic American, compared to Hispanic males and other Hispanic females living in the west of the United States. However, it is very important to check the smoking rates in males and females Hispanic across all states in the west of the United States of America. If the smoking rates are higher among males and females American Hispanic living in the state of Hawaii, compared to the same race in other states in the west, this will give a good evidence that the smoking is the real risk factor for lung and bronchus cancer in the state of Hawaii, but if it is not, this means there is another risk factor contributing to the increase of overall age-adjusted incidence rates of invasive lung and bronchus cancer in the state of Hawaii. **Figure 9**, shows how one can identify the most important risk factor for invasive lung and bronchus cancer among males and females Hispanic American living in the state of Hawaii. The risk factor can be identified by conducting two case-control studies among males and females Hispanic Americans. However, the west of the United States was the lowest geographic area affected by invasive lung and bronchus cancer compared to Midwest, Northeast, and South of the United States, therefore, the smoking rates in the west of the United States should be the lowest compared to Midwest, Northeast, and West of the United States.Finally, it is very important to conduct multiple case-control studies in the highest area affected by invasive lung and bronchus cancer adjusted by race and gender. This procedure helps to make a good comparison between the risk factors of lung and bronchus cancer across all races living in the United States of America.

CONCLUSION

Our study revealed that the states of Kentucky, West Virginia, Missouri, Indiana, Detroit, and Maine are the best geographic areas in the United States of America, for studying the most important risk factors for invasive lung and bronchus cancer among males and females White American. While, the states of Kentucky, Wisconsin, Iowa, Nebraska, and Pennsylvania are the best geographic areas for studying the most important risk factors of invasive lung and bronchus cancer among males and females Black American.

Furthermore, the states of Connecticut, Detroit, and Hawaii are the best geographic areas for studying the most important risk factors of invasive lung and bronchus cancer among males and females Hispanic American. The secret for confirming the real risk factor for lung and bronchus cancer can be found among males and females Hispanic American living in the state of Hawaii. Therefore, multiple case-control studies adjusted by race and gender should be conducted in the mentioned states to identify the major risk factors that can be controlled.

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