



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

**Ibrahim G. Alghamdi<sup>1\*</sup> and Ghanem M. Al-Ghamdi<sup>2</sup>**

<sup>1</sup>University of Al-Baha, College of Applied Medical Sciences, Saudi Arabia

<sup>2</sup>University of Al-Baha, College of Science, Saudi Arabia

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Cancer epidemiology; Invasive breast cancer; United States of America; Age adjusted Incidence rate.

**ABSTRACT**

**Background:** This study provides descriptive epidemiological data of invasive breast cancer cases diagnosed from 1999 to 2014 in the United States of America.

**Methods:** This is a retrospective descriptive epidemiological analysis of invasive breast cancer cases recorded in the Centres for Disease Control and Prevention from 1999 to 2014.

**Results:** The State of Seattle and Detroit had the highest overall age-adjusted incidence rate (142.5 and 132.0 per 100,000 persons) of invasive breast cancer among women across all races (white, black, and Hispanic). The state of Connecticut had the highest overall age-adjusted incidence rate (139.5 per 100,000 persons) of invasive breast cancer among white and Hispanic women, compared to other states located in the northeast. The state of District of Columbia had the highest overall age-adjusted incidence rate (143.9 per 100,000 persons) of invasive breast cancer among white and black women. The state of Hawaii had the highest overall age-adjusted incidence rate (147.4 per 100,000 persons) of invasive breast cancer among Hispanic women compared to other states of America.

**Conclusion:** This study revealed that the best geographic areas in the United States of America for studying the most important risk factors of invasive breast cancer among women across all races are the state of Seattle, Detroit, Connecticut, Hawaii, and the District of Columbia. Multiple case control studies should be conducted separately in these states across all races to determine the similarities and differences of risk factors that every woman shares.

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**INTRODUCTION**

Breast cancer is considered a worldwide health problem among women in developed and developing countries. It affects hundreds of thousands of women in the world, with high mortality rate every year.<sup>1-3</sup> The incidence rates of breast cancer throughout the world will continue to increase.<sup>4-6</sup>

The burden of female breast cancer has increased in the world, it is estimated that nearly 1.7 million new breast cancer cases were detected in 2012, amounting to approximately 25% of all incident cases among women. The number of deaths from breast cancer has also increased globally with an estimated 521,900 in 2012. In Europe, it is estimated that the number of new breast cancer cases was 458,337, and 131,259 deaths registered in 2012.<sup>7</sup> In the United States of America, the International Agency for Research on Cancer estimated that the age-adjusted incidence rate for female breast cancer was 92.9 per 100,000 population

in 2012, and the age-adjusted mortality rate was 14.9 per 100,000 population.<sup>8-9</sup> The purpose of this study is to describe the pattern of invasive breast cancer in the United States of America from 1999 to 2014, while focusing on the age adjusted incidence rate, stratified by state and race.

**MATERIALS AND METHODS**

This is a retrospective descriptive epidemiological study of invasive breast cancer cases 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 race and state. For the data analysis, the Statistical Package for the Social Sciences version 20.0 (SPSS) was used. The descriptive statistics of the data were performed by calculating the mean age-adjusted incidence rate stratified by race, and state.

\*Corresponding author: **Ibrahim G. Alghamdi**

University of Al-Baha, College of Applied Medical Sciences, Saudi Arabia

**RESULTS**

***Invasive Breast Cancer in the North East of the United States of America***

The overall age-adjusted incidence rate of invasive breast cancer cases 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 breast cancer cases was documented in the state of Connecticut, with an estimated average of (139.5 per 100,000 persons). The estimated overall age-adjusted incidence rates in the state of Connecticut, from 1999 to 2014 were higher among white and Hispanic women compared to other races living in the North East and Middle Atlantic of the United States. (Table 1).

**Table 1** Overall age-adjusted incidence rate of invasive breast cancer in the North East of the United States from 1999 to 2014

Overall age-adjusted incidence rate of invasive breast cancer in the North East of the United States from 1999 to 2014				
Geographic Area	All Races	White	Black	Hispanic
United States	125.3	127.1	119.1	94.0
Northeast	131.4	135.1	113.0	101.0
New England	136.4	138.6	107.8	114.6
<b>Connecticut</b>	<b>139.5</b>	<b>142.2</b>	<b>115.2</b>	<b>129.3</b>
Maine	130.1	130.1	-	-
Massachusetts	136.9	140.0	103.6	-
New Hampshire	137.5	137.9	-	-
Rhode Island	132.3	135.2	103.2	73.5
Vermont	132.8	133.3	-	-
Middle Atlantic	129.7	133.7	113.7	98.9
New Jersey	132.8	137.5	118.3	101.6
New York	128.7	135.5	108.1	98.4
Pennsylvania	128.9	129.1	124.2	96.7

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

***Invasive Breast Cancer in the Midwest of the United States of America***

The highest overall age-adjusted incidence rate of invasive breast cancer cases was observed in the state of Detroit, with an estimated average of (132 per 100,000 persons). The estimated overall age-adjusted incidence rates of invasive

**Table 2** Overall age-adjusted incidence rate of invasive breast cancer in Midwest of the United States from 1999 to 2014

Overall age-adjusted incidence rate of invasive breast cancer in the Midwest of the United States from 1999 to 2014				
Geographic Area	All Races	White	Black	Hispanic
United States	125.3	127.1	119.1	94.0
Midwest	126.5	126.8	123.2	88.7
East North Central	126.2	126.5	123.3	88.7
Illinois	128.8	130.3	125.6	90.0
Indiana	121.9	122.0	121.5	84.9
Michigan	125.8	125.5	123.4	98.6
<b>Detroit</b>	<b>132.0</b>	<b>133.9</b>	<b>127.7</b>	<b>128.1</b>
Ohio	124.7	124.5	120.6	67.3
Wisconsin	129.2	129.7	123.0	95.5
West North Central	127.2	127.3	122.6	88.7
Iowa	125.2	125.9	111.0	77.2
Kansas	126.7	126.0	123.3	88.4
Minnesota	131.0	131.5	101.9	103.0
Missouri	125.6	125.3	126.9	86.8
Nebraska	126.5	127.2	117.4	102.7
North Dakota	124.4	123.7	-	-
South Dakota	127.3	127.6	-	-

breast cancer in the state of Detroit, from 1999 to 2014 were higher among white, black and Hispanic women compared to other races living in the Midwest of the United States. (Table2).

***Invasive Breast Cancer in the South of the United States of America***

The highest overall age-adjusted incidence rate of invasive breast cancer cases was observed in the state of District of Columbia, with an estimated average of (143.9 per 100,000 persons). The estimated overall age-adjusted incidence rates of invasive breast cancer in the state of District of Columbia, from 1999 to 2014 were higher among white and black women compared to other races living in the south of the United States. However, the state of South Carolina had the highest overall age-adjusted incidence rate (110.4 per 100,000 persons) of invasive breast cancer cases among Hispanic women from 1999 to 2014 (Table 3).

**Table 3** Overall age-adjusted incidence rate of invasive breast cancer in the South of United States from 1999 to 2014

Overall age-adjusted incidence rate of invasive breast cancer in the south of the United States from 1999 to 2014				
Geographic Area	All Races	White	Black	Hispanic
United States	125.3	127.1	119.1	94.0
South	119.7	119.6	121.1	93.0
South Atlantic	124.0	124.9	119.5	99.7
Delaware	130.4	130.9	127.2	-
<b>District of Columbia</b>	<b>143.9</b>	<b>156.9</b>	<b>134.2</b>	102.4
Florida	119.9	121.2	106.4	102.3
Georgia	123.6	125.7	119.6	93.7
Atlanta	132.6	139.5	126.4	101.4
Maryland	130.4	132.7	125.1	88.4
North Carolina	126.9	127.8	123.9	94.0
<b>South Carolina</b>	<b>125.5</b>	<b>127.2</b>	<b>119.4</b>	<b>110.4</b>
Virginia	125.9	126.9	126.2	85.3
West Virginia	116.2	116.2	112.1	-
East South Central	119.0	118.2	121.0	62.1
Alabama	118.6	118.1	116.7	77.6
Kentucky	123.4	123.1	129.5	-
Mississippi	114.1	111.8	117.9	79.1
Tennessee	119.3	119.2	118.5	73.5
West South Central	118.0	118.1	121.2	91.8
Arkansas	113.2	112.1	109.7	91.5
Louisiana	121.7	120.8	125.7	96.2
Oklahoma	124.8	122.6	127.0	108.9
Texas	117.4	118.4	119.9	91.6

***Invasive Breast Cancer in the West of the United States of America***

The highest overall age-adjusted incidence rate of invasive breast cancer cases was recorded in the state of Seattle, with an estimated average of (142.5 per 100,000 persons). The estimated overall age-adjusted incidence rates of invasive breast cancer in the state of Seattle, from 1999 to 2014 were higher among white, black, and Hispanic women compared to other races living in the west of the United States. However, the state of Hawaii was the highest area affected by invasive breast cancer among Hispanic women compared to other races living in all states of America (Table 4).

**DISCUSSION**

This descriptive epidemiological study of invasive breast cancer among women 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 invasive breast cancer stratified by state and race. The result of the study is based on the data recorded in the Centres for Disease Control and Prevention, from 1999 to 2014.

**Table 4** Overall age-adjusted incidence rate of invasive breast cancer in the West of United States from 1999 to 2014

Geographic Area	Overall age-adjusted incidence rate of invasive breast cancer in the west of the United States from 1999 to 2014			
	All Races	White	Black	Hispanic
United States	125.3	127.0	119.0	93.9
West	125.1	128.7	120.1	90.9
Mountain	118.9	121.1	102.1	93.5
Arizona	115.1	117.1	100.9	90.0
Colorado	127.3	128.7	110.7	100.1
Idaho	122.7	123.3	-	97.1
Montana	127.2	126.4	-	-
Nevada	115.0	118.8	103.8	84.1
New Mexico	113.5	118.8	100.5	97.8
Utah	113.8	115.3	-	96.5
Wyoming	117.1	118.1	-	106.4
Pacific	127.5	132.2	124.0	90.1
Alaska	130.8	131.5	-	-
California	124.9	130.2	124.7	89.3
San Francisco-Oakland	131.6	142.9	126.0	101.1
San Jose-Monterey	125.1	135.2	111.5	95.9
Los Angeles	118.9	122.8	127.8	83.1
<b>Hawaii</b>	128.0	139.9	-	<b>147.4</b>
Oregon	134.0	134.1	119.6	106.8
Washington	137.4	140.0	116.9	99.9
<b>Seattle-Puget Sound</b>	<b>142.5</b>	<b>147.6</b>	<b>126.2</b>	<b>137.3</b>

In the North East of the United States, we have observed that the highest overall age-adjusted incidence rates of invasive breast cancer cases among white and Hispanic women were documented in the state of Connecticut, from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that most white and Hispanic women were sharing the same risk factor that contribute in the increase of age-adjusted incidence rates of invasive breast cancer. Figure 1, shows how one can identify the most important risk factor for invasive breast cancer among white and Hispanic women living in the state of Connecticut. The risk factor can be identified by conducting three (3) case-control studies among women across all races (white, black, and Hispanic).

In the Midwest of the United States, the overall age-adjusted incidence rates of invasive breast cancer, from 1999 to 2014 were highest among white, black, and Hispanic women living in the state of Detroit compared to other parts of the Midwest of the United States. The most likely reason for this rising age-adjusted incidence rate is that most women across all races were sharing the same risk factor that contribute in the increase of age-adjusted incidence rates of invasive breast cancer. Figure 2, shows how one can identify the most important risk factor for invasive breast cancer among white, black, and Hispanic women living in the state of Detroit. The risk factor can be identified by conducting three (3) case-control studies among women across all races (white, black, and Hispanic).

In the South of the United States, the overall age-adjusted incidence rates of invasive breast cancer, from 1999 to 2014 were highest among white and black women living in the state of District of Columbia compared to other parts of the south of the United States. Figure 3, shows how one can identify the most important risk factor of invasive breast cancer among

white and black women living in the state of District of Columbia. In addition, the state of South Carolina had the highest overall age-adjusted incidence rate of invasive breast cancer cases among Hispanic women compared to the same races living in the south of the United States.

In the West of the United States, the overall age-adjusted incidence rates of invasive breast cancer, from 1999 to 2014 were highest among white, black, and Hispanic women living in the state of Seattle compared to other parts of the west of the United States. Figure 4, shows how one can identify the most important risk factor of invasive breast cancer among white, black, and Hispanic women living in the state of Seattle. In addition, the state of Hawaii was the highest area affected by invasive breast cancer among Hispanic women compared to other parts of the west, from 1999 to 2014. The most likely reason for this rising age-adjusted incidence rate is that most Hispanic women in the state of Hawaii were more exposed to a specific risk factor that may does not appear in white and black women. Figure 5, shows how one can identify the most important risk factor of invasive breast cancer among Hispanic women living in the state of Hawaii. However, we expect that Hispanic women living in the state of Hawaii may have different risk factors of invasive breast cancer.

Finally, it is very important to conduct multiple case-control studies in the highest area affected by invasive breast cancer adjusted by race. This procedure helps to make a good comparison between the risk factors of breast cancer across all races in the state of Connecticut, Detroit, Seattle, Hawaii, and the District of Columbia (Figure 6).

## CONCLUSION

Our study revealed that the State of Seattle and Detroit had the highest overall age-adjusted incidence rate of invasive breast cancer among white, black, and Hispanic women from 1999 to 2014, while the state of Connecticut had the highest overall age-adjusted incidence rate of invasive breast cancer among white and Hispanic women. Those women across all races living in the mentioned states were sharing the most important risk factor of invasive breast cancer that contribute to the increase of age-adjusted incidence rate, therefore, multiple case-control studies should be conducted to identify the major risk factors that can be controlled. The state of Hawaii was the highest area affected by invasive breast cancer among Hispanic women from 1999 to 2014, therefore, the majority of Hispanic women living in the state of Hawaii are more exposed to a specific risk factor that may does not appear in white and black women, however Hispanic women living in the state of Hawaii may have a different risk factors of invasive breast cancer.

Figure 1

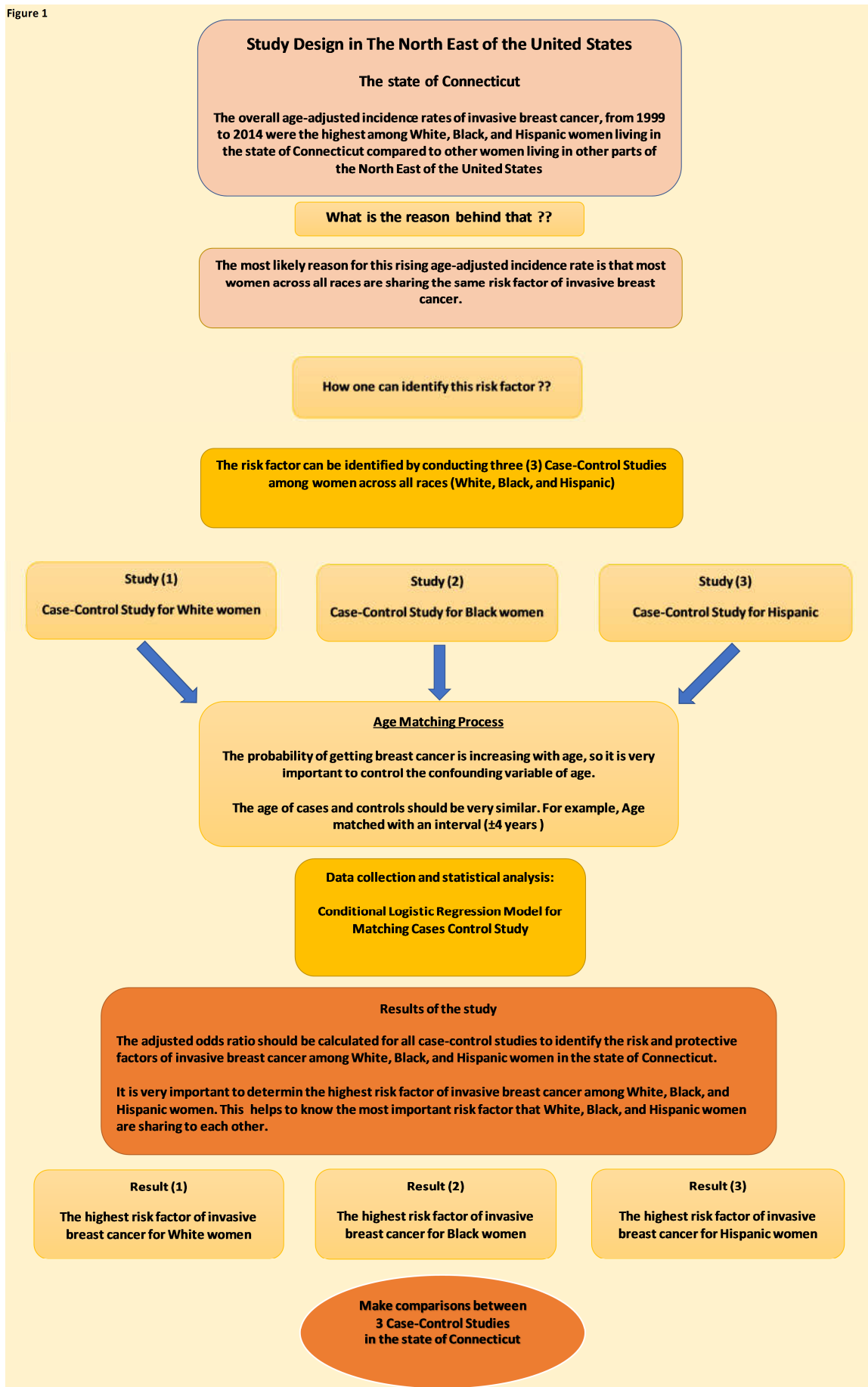


Figure 1 Study Design in the North East of the United States

Figure 2

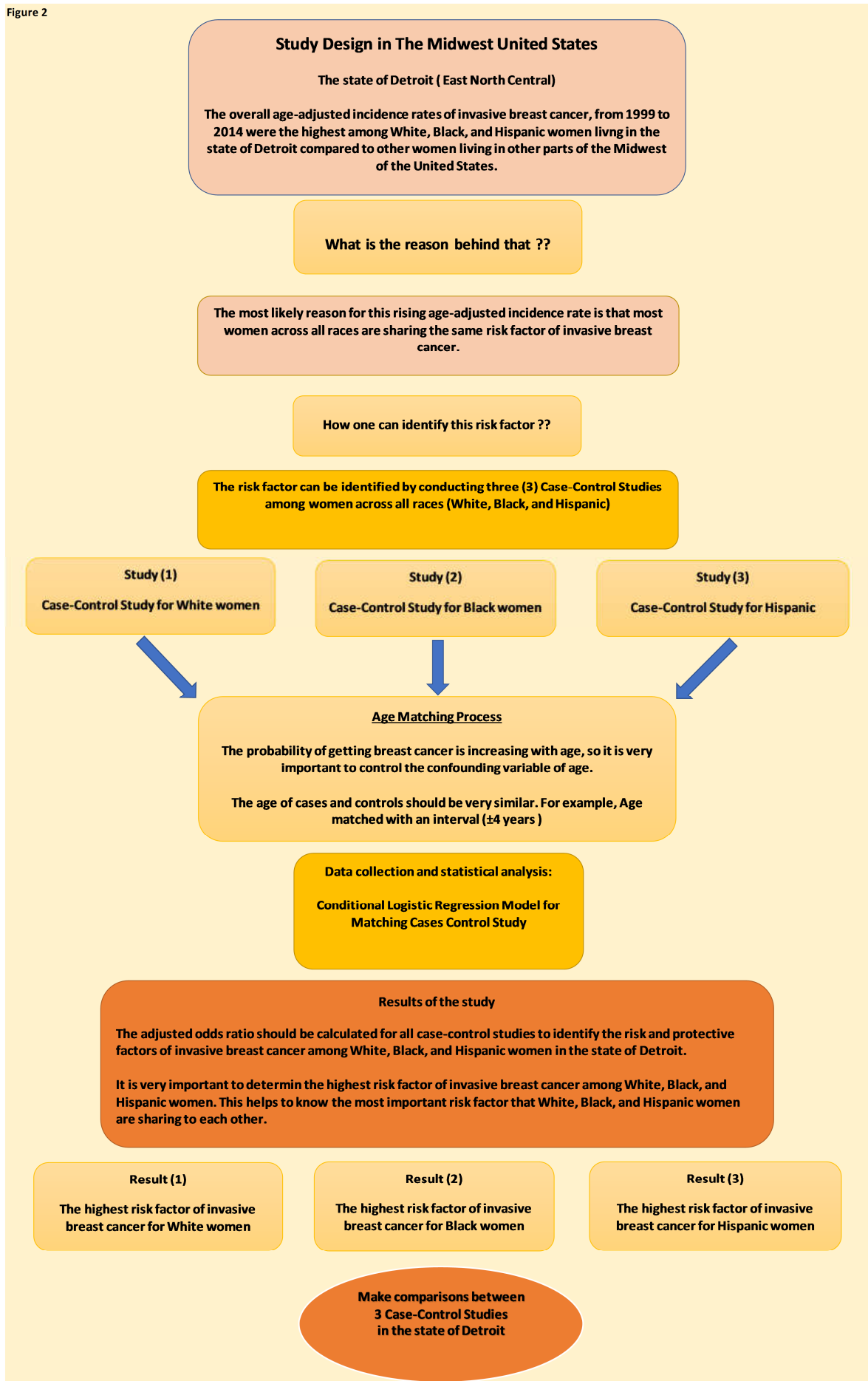


Figure 2 Study Design in The Midwest of the United States

Figure 3

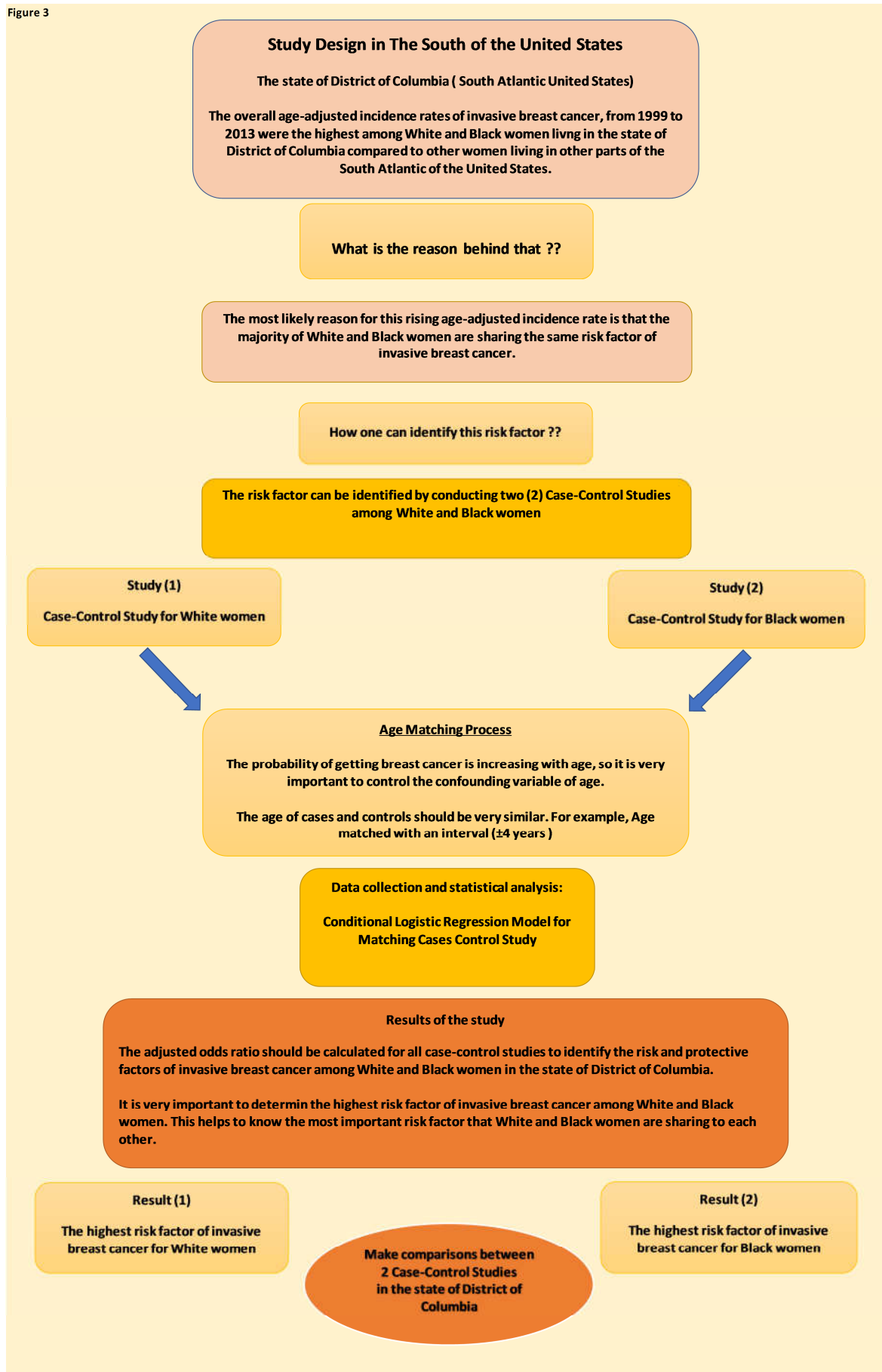


Figure 3 Study Design in The South of the United States

Figure 4

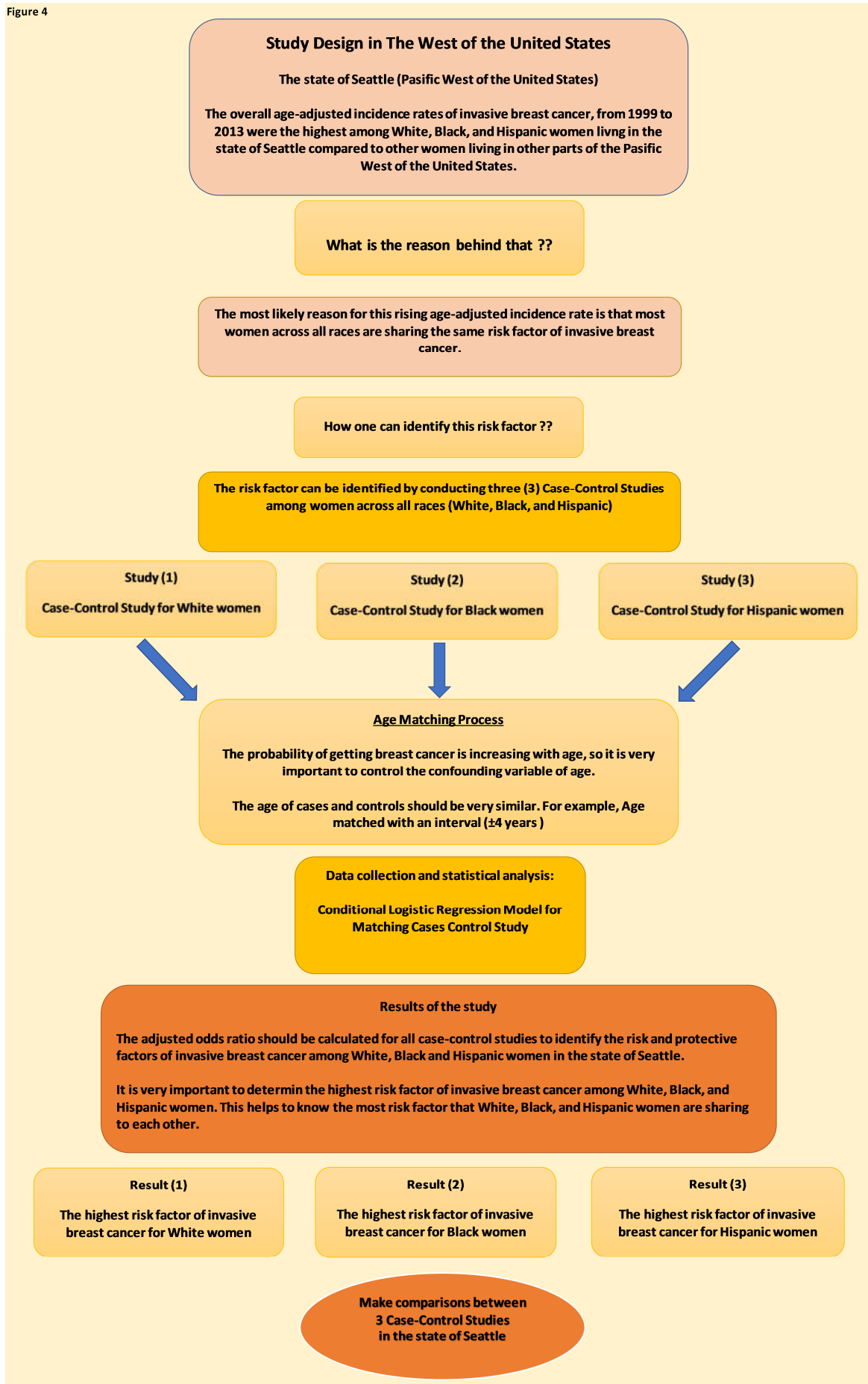


Figure 4 Study Design in the state of Seattle (The West of the United States)

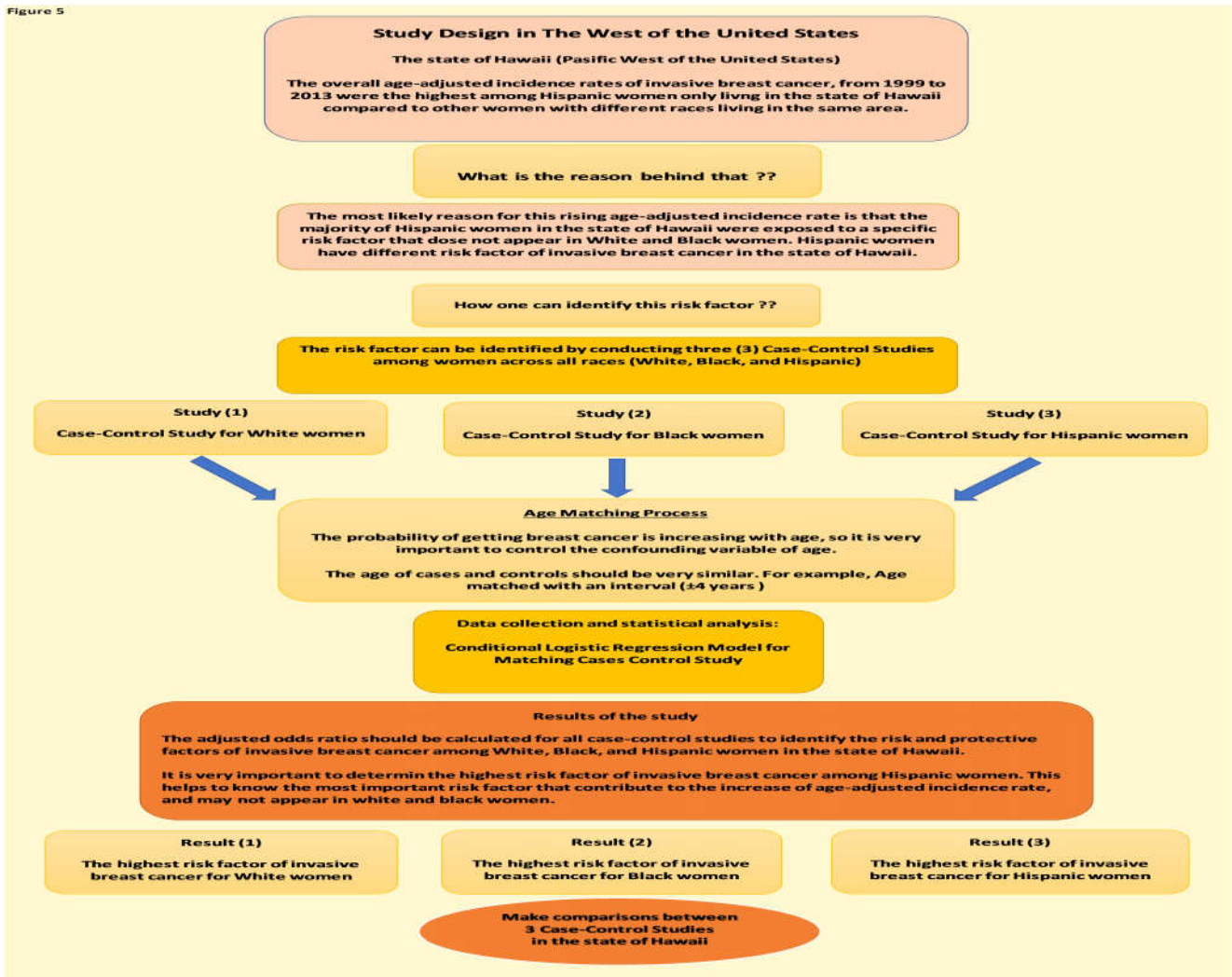


Figure 5 Study Design in the state of Hawaii (West of the United States)

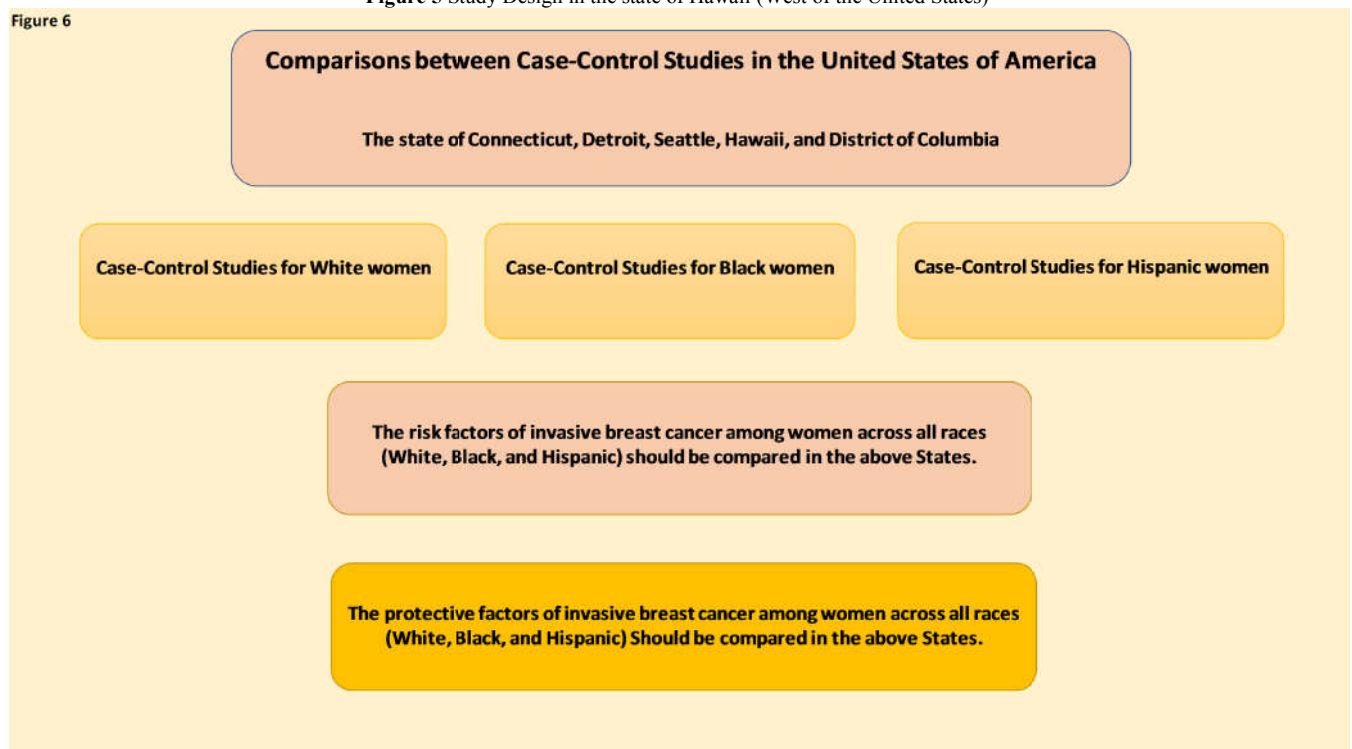


Figure 6 Comparisons between Case-Control Studies in the United States of America



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