Comparing Individual-Level Income vs. Regional-level Income's Association with Various Health Outcomes across the US

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8/22/19

AIM OF THE STUDY

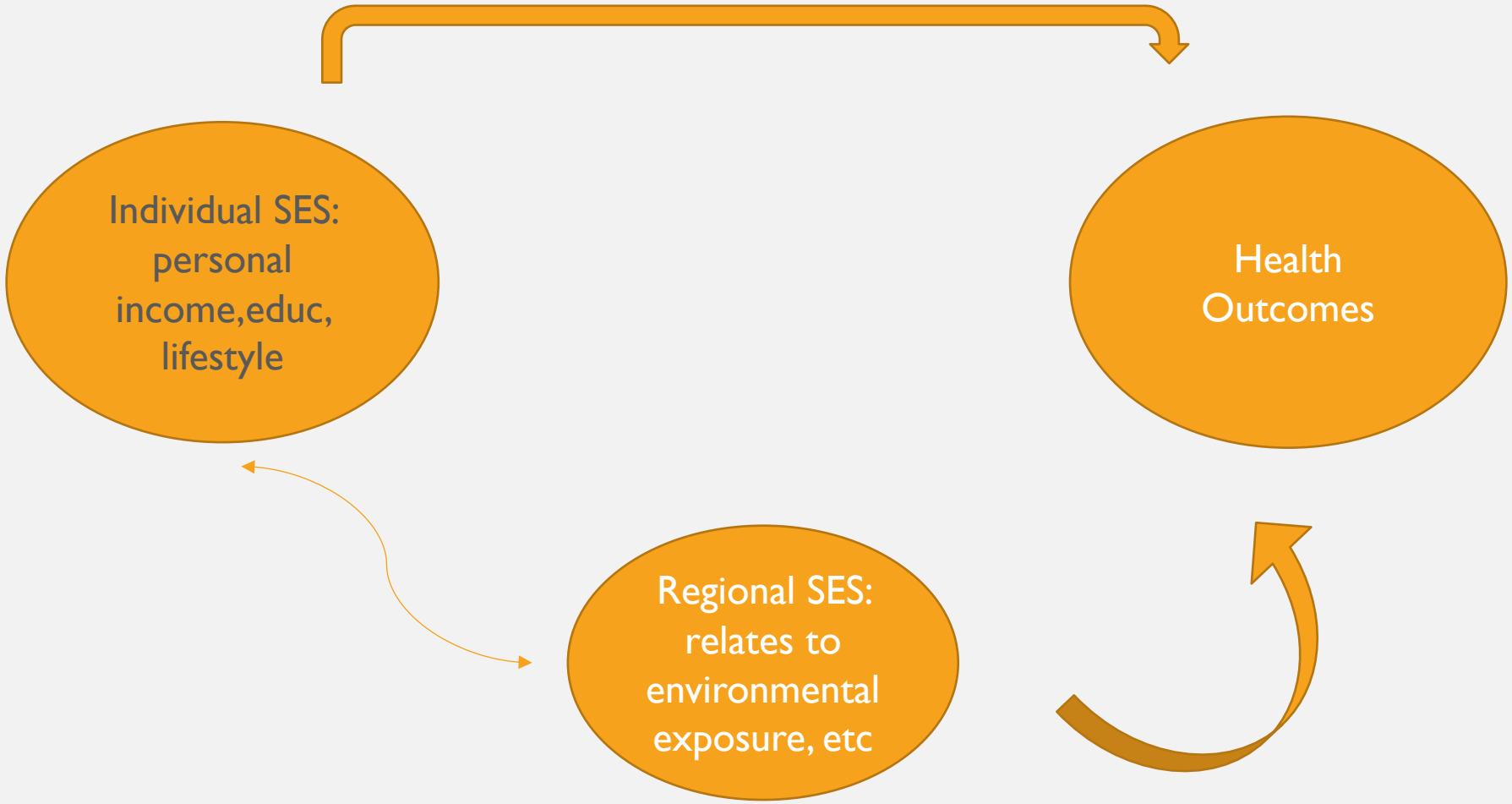
SES: SocialEconomic Status

Individual-level Data not disclosed for confidential security.

Many epidemiology studies use regional-level data to compensate for that. However, we don't know how much individual-level SES is correlated with regional-level social economic status.

Also, there might be confounding problems between Individual SES, regional SES, and final health outcomes.

Confounding Problems



GEOGRAPHICAL UNIT: MMSA

BRFSS DATA: INDIVIDUAL LEVEL

- Background The Behavioral Risk Factor Surveillance System (BRFSS) is a collaborative project between all of the states in the United States (US) and participating US territories and the Centers for Disease Control and Prevention (CDC). The BRFSS is administered and supported by CDC's Population Health Surveillance Branch, under the Division of Population Health at the National Center for Chronic Disease Prevention and Health Promotion. [1]
- BRFSS's objective is to collect uniform state-specific data on health risk behaviors and use of preventive health services , chronic diseases and conditions, access to health care, related to the leading causes of death and disability in the United States. Factors assessed by the BRFSS in 2017 included health status, healthy days/health-related quality of life, health care access, exercise, inadequate sleep, chronic health conditions, oral health, tobacco use, e-cigarettes, alcohol consumption, immunization, falls, seat belt use, drinking and driving, breast- and cervical cancer screening, prostate cancer screening, colorectal cancer screening, and HIV/AIDS knowledge.[1]

BRFSS 2017 SMART DATA:

- CDC analyzes BRFSS data for metropolitan and micropolitan statistical areas (MMSAs), to provide localized health information that can help public health practitioners identify local emerging health problems, plan and evaluate local responses, and efficiently allocate resources to specific needs.[1]
- The Selected Metropolitan/Micropolitan Area Risk Trends of BRFSS SMART BRFSS) uses BRFSS data to provide prevalence rates for selected conditions and behaviors for cities and their surrounding counties.[1]

ACS CENSUS DATA 2013-2017 5-YEAR ESTIMATES : MEDIAN INCOME&&EDUCATIONAL ATTAINMENT

- The Census Bureau aggregates 1, 2013 to December 31, 2017.

The American Community Survey (ACS) is a nationwide survey designed to provide communities a fresh look at how they are changing. It is a critical element in the Census Bureau's decennial census program. The ACS collects information such as age, race, income, commute time to work, home value, veteran status, and other important data. As with the 2010 decennial census, information about individuals remains confidential.

- About 3.5 million housing school graduate (includes equivalency) unit addresses are selected annually, across every county in the nation.[2]
- The 2013-2017 American Community Survey 5-year estimates include results from both the American Community Survey and the Puerto Rico Community Survey. The statistics presented describe the entire data collection period, from January chool graduate (includes equivalency)[2]
- Percent; Estimate; Population 25 years and over - Bachelor's degree
- Percent; Estimate; Population 25 years and over –High School Graduates
- MSA MedianIncome; MSA MedianIncome for Whites, Blacks, and Hispanic

1. 12 July 2019. *Wikipedia*. American Community Survey. https://en.wikipedia.org/wiki/American_Community_Survey
2. 5 Oct. 2010. *American FactFinder*. American Community Survey. https://factfinder.census.gov/faces/nav/jsf/pages/programs.xhtml?program=acs

BASIC DEMOGRAPHICS: POPULATION

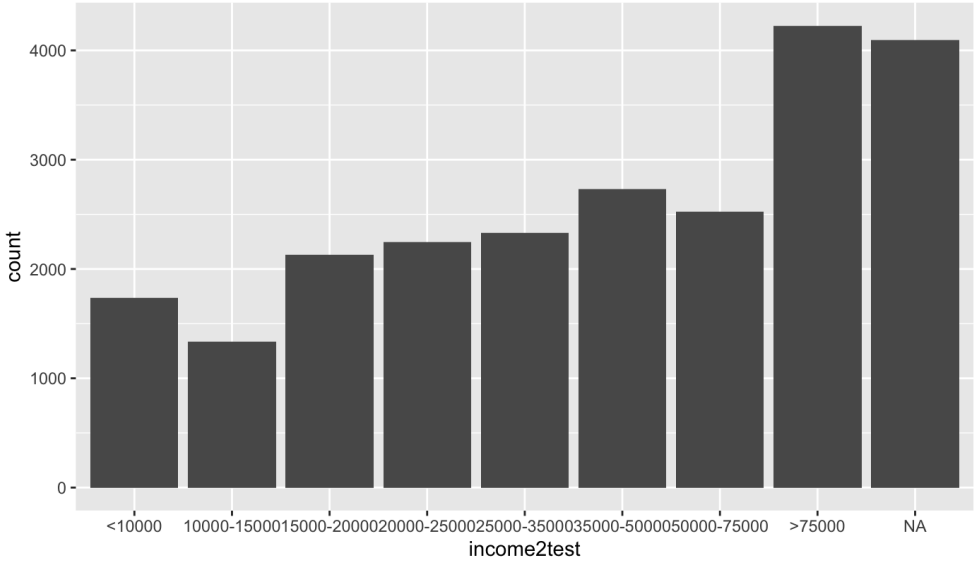
Population Analysis					
Race	White	BLACK	Other Race	Multiracial	Hispanic
Population	166,936	23,475	9,435	4,097	22,015

Stratified Analysis	**Race**	**Population**
	White	166,906
	Black	23,354
	Hispanic	21,832

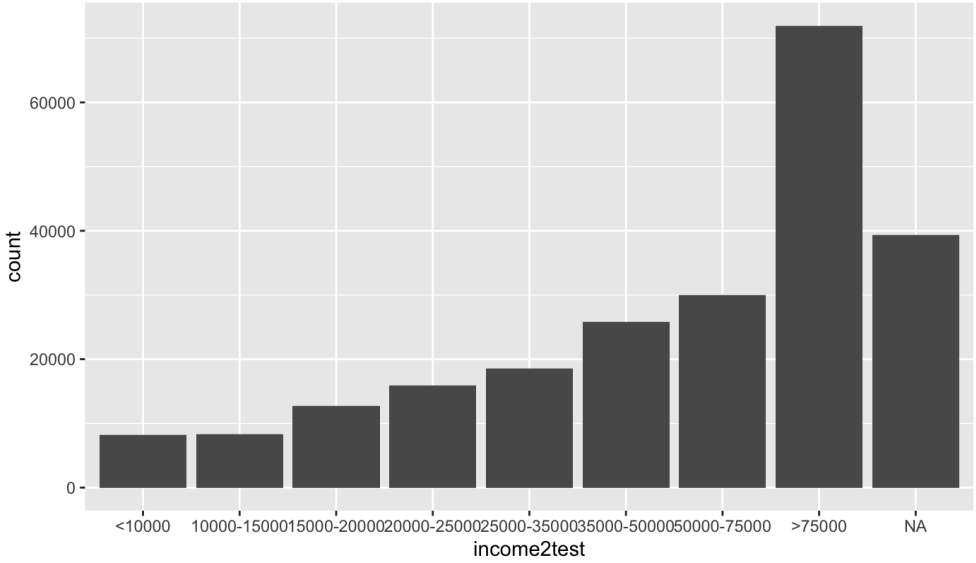
INDIVIDUAL INCOME DISTRIBUTION IN BRFSS SMART 2017

Category	<10000	10000-15000	15000-20000	20000-25000	25000-35000	35000-50000	50000-75000	>75000

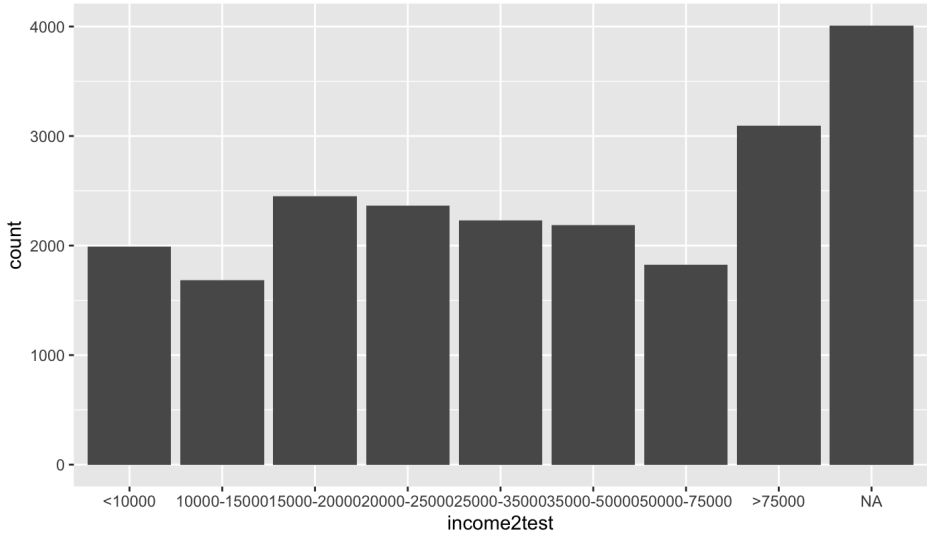
Black Individual Data: Income Distribution



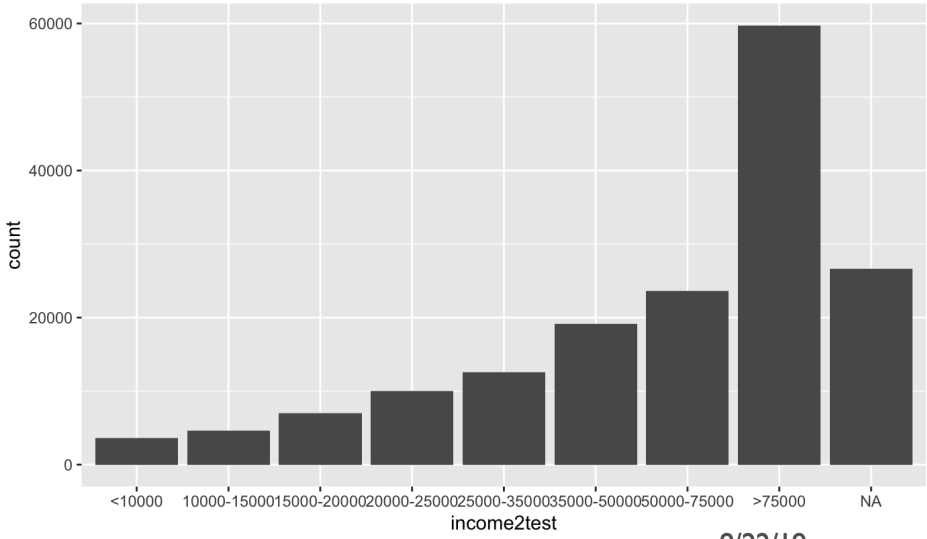
Whole Individual Data: Income Distribution



Hispanic Individual Data: Income Distribution



White Individual Data: Income Distribution



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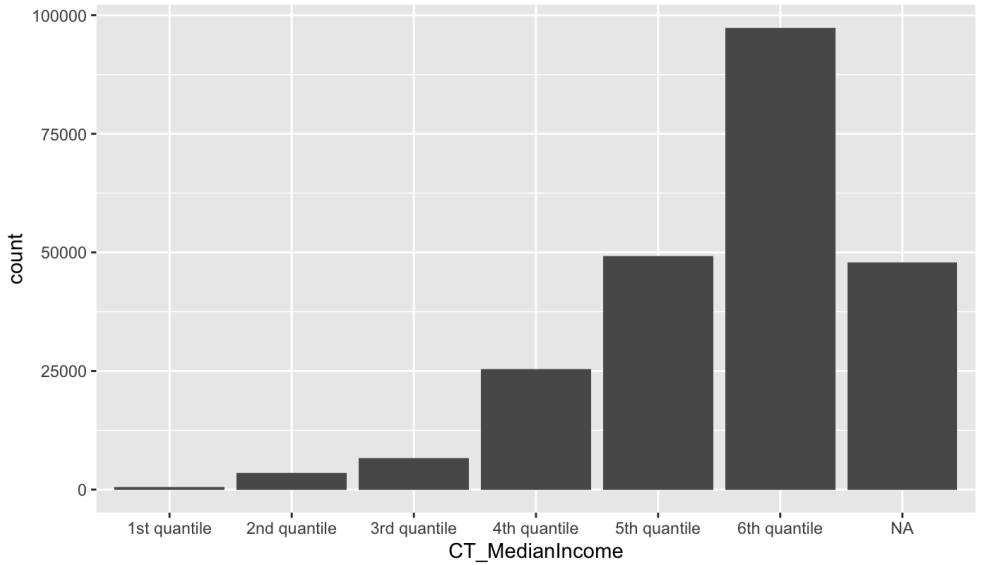
REGIONAL INCOME DISTRIBUTION

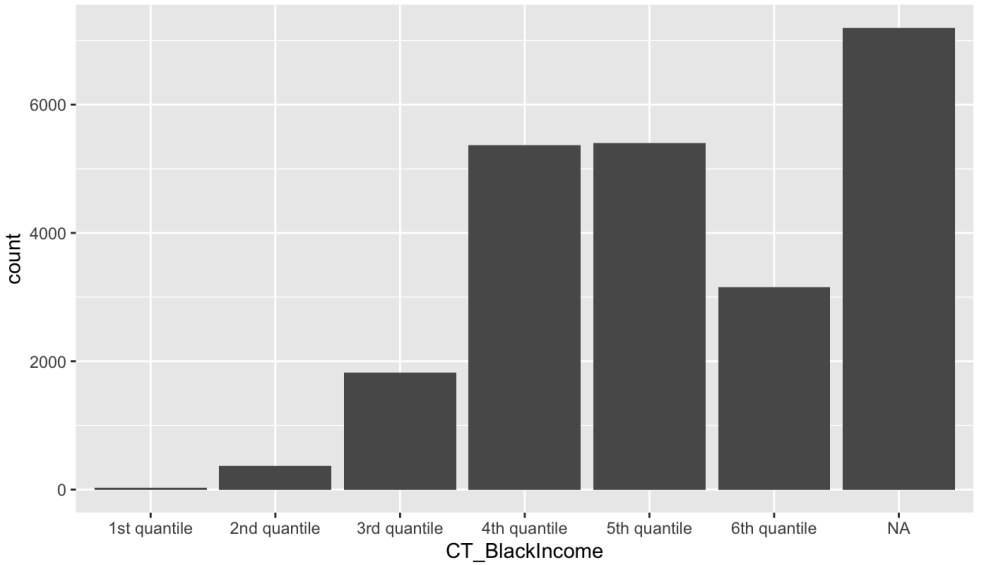
Categories: 1st to 6th Quantiles

	0%	16.66667%	33.33333%	50%	66.66667%	83.33333%	100%
Total:	23558.00,	41115.67,	45154.67,	49052.00,	52617.67,	58209.33,	110190.00,
White:	23966.00 ,	44729.67,	48907.67,	52535.50,	56412.67,	62749.50,	117009.00,
Black:	6903.00,	23960.33,	27948.67,	31152.00,	36033.00,	45102.67,	111696.00,
Hispanic:	9744,	31582,	36937,	41177,	45025,	50478,	123047

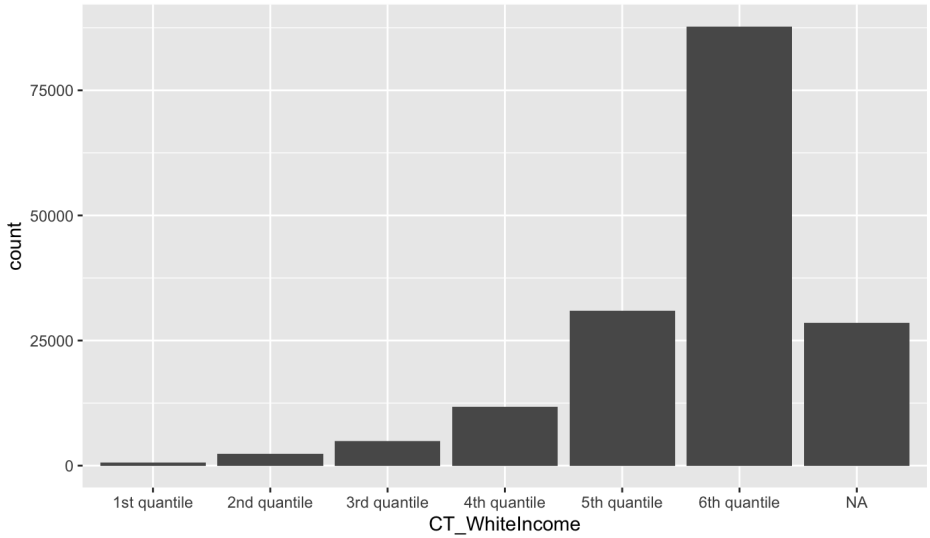
Total Regional Data: Income Distribution



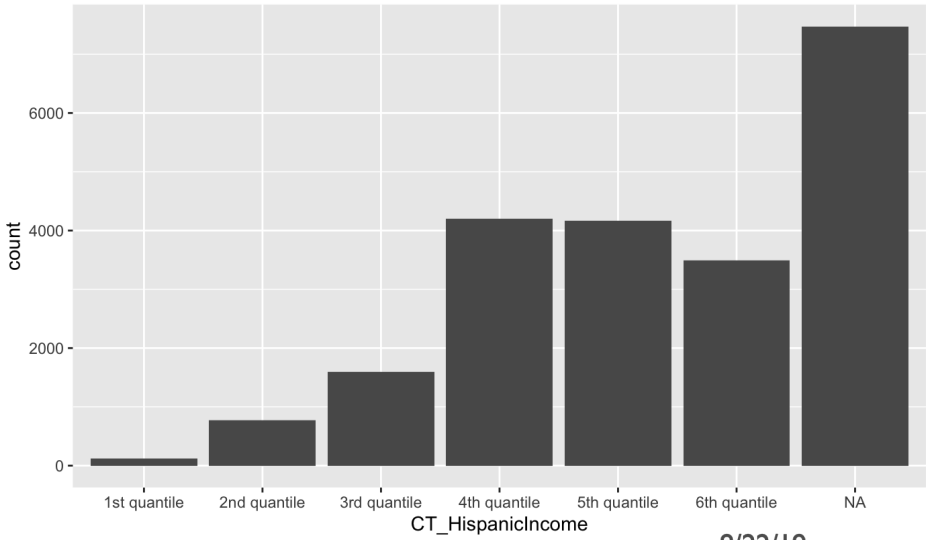
Black Regional Data: Income Distribution



White Regional Data: Income Distribution



Hispanic Regional Data: Income Distribution



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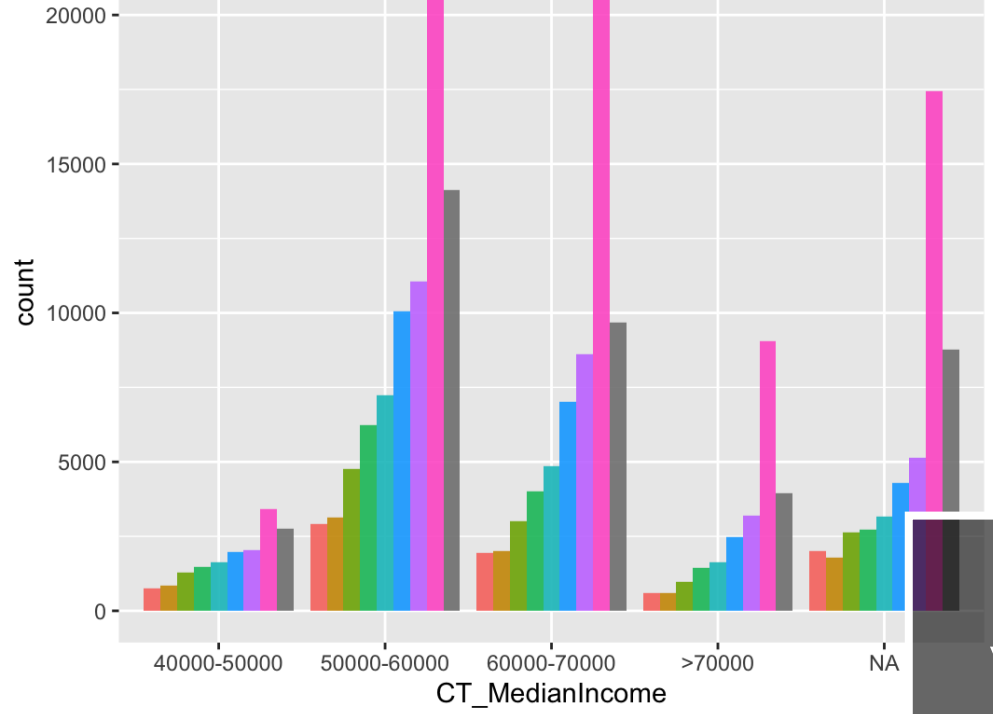
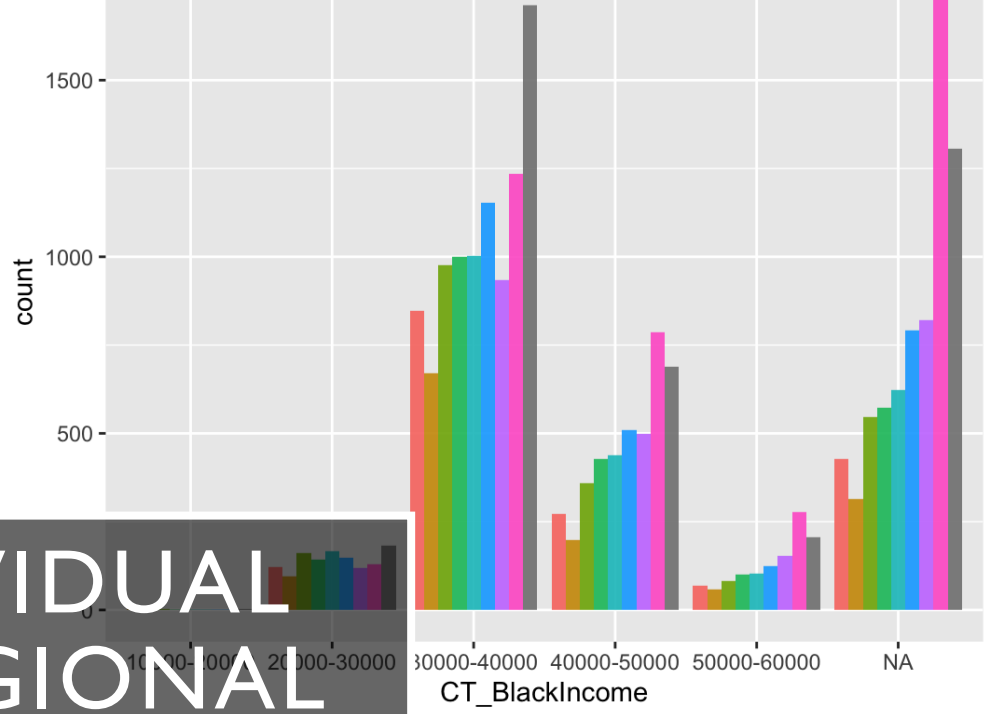
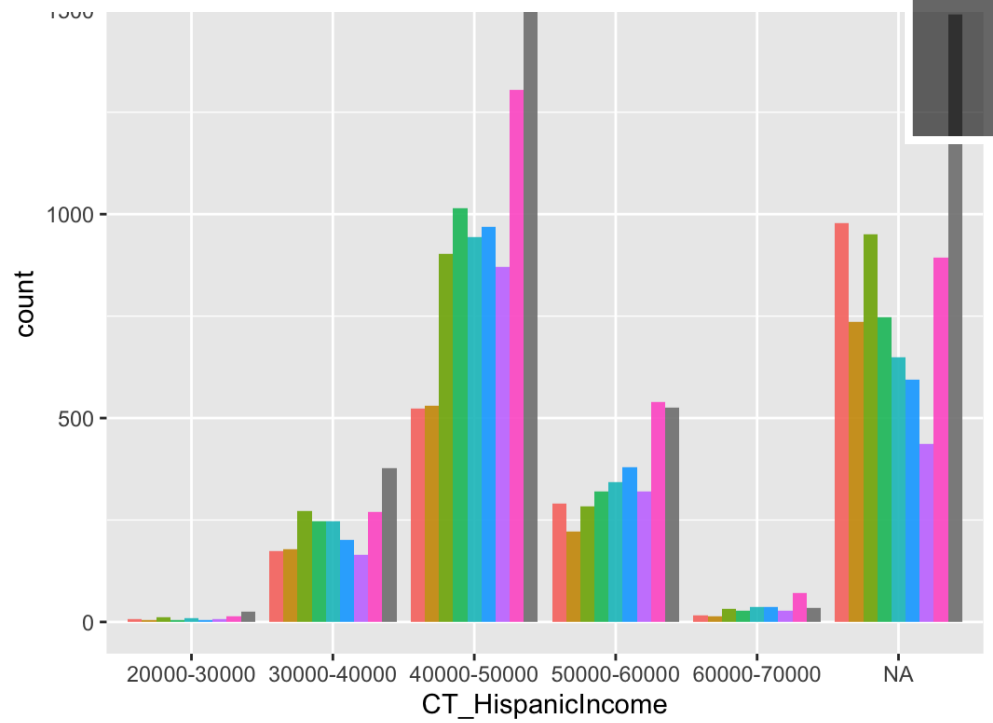
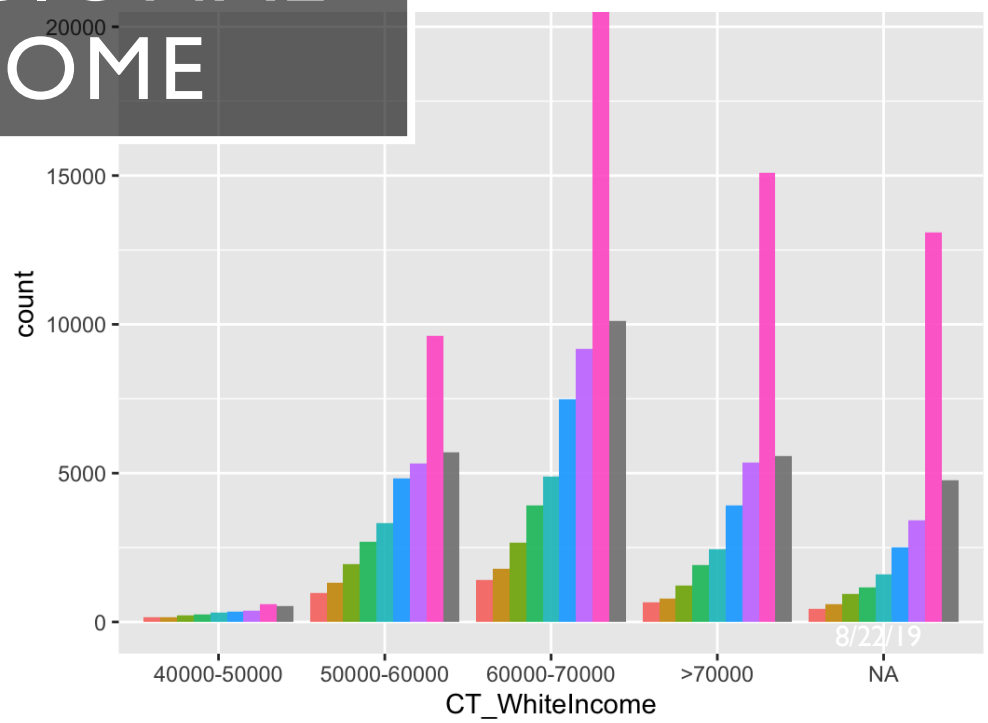
INDIVIDUAL VS REGIONAL INCOME









INDIVIDUAL EDUCATION VARS

Less than High School;

High School;

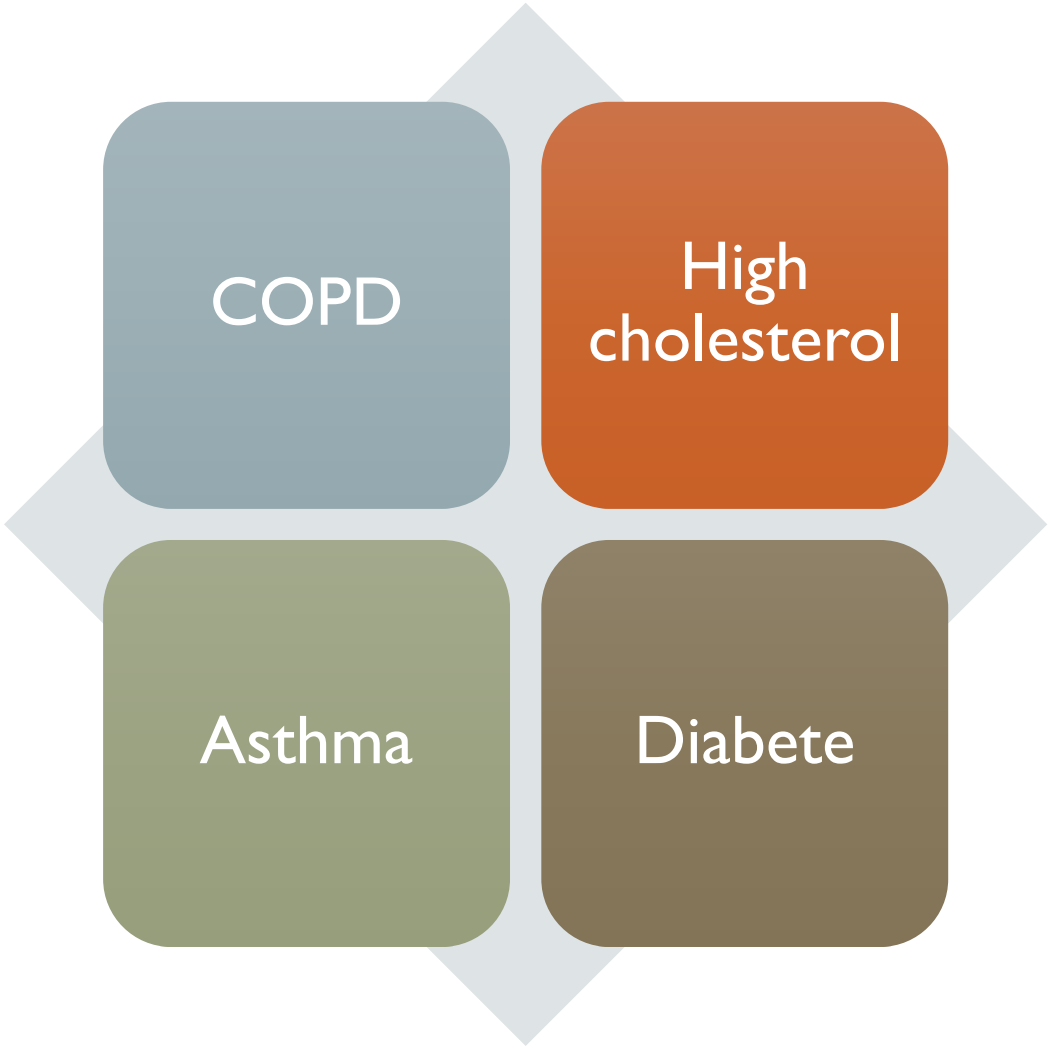
Some College;

College Graduated

REGIONAL EDUCATION VARS

Categories: 1st-5th quantile

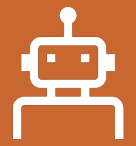
Percentile:	0%	20%	40%	60%	80%	100%
PctHighschool:	16.4,	23.4,	25.6,	27.2,	29.4,	39.5
PctBachelor:	11.4,	18.1,	19.5,	21.4,	22.9,	27.8



4 HEALTH OUTCOMES

THREE TREATMENTS

Full SES Model



Controlled for Individual SES Vars

Controlled for Regional Vars

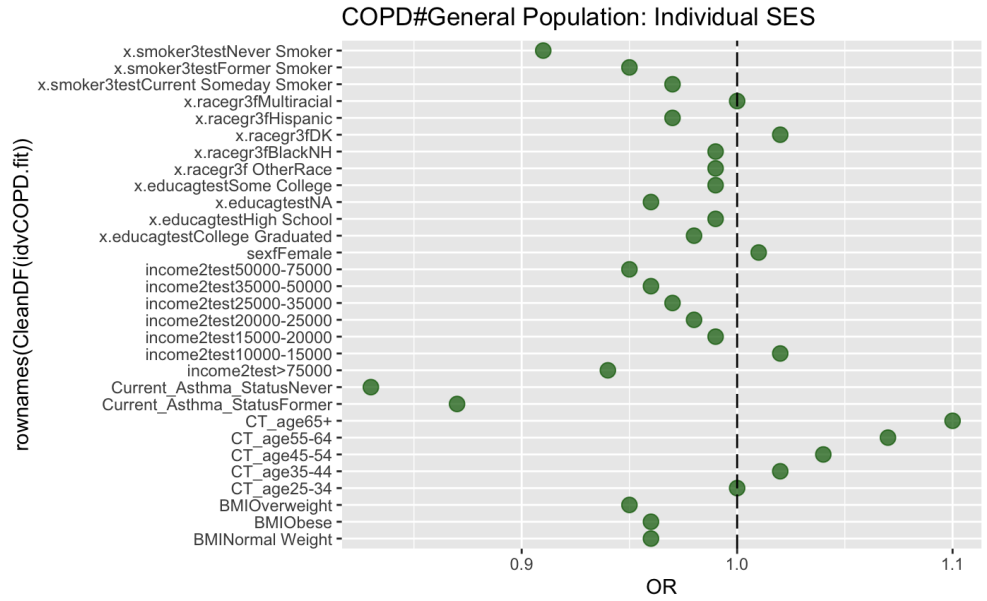
- svyglm(HealthOutcomes ~income2test+CT_MedianIncome+CT_age+x.educagtest+sexf+Current_Asthma_Status+x.racegr3f+CT_PctCollege+CT_PHSGrad+BMI,design=smart217dsgn)

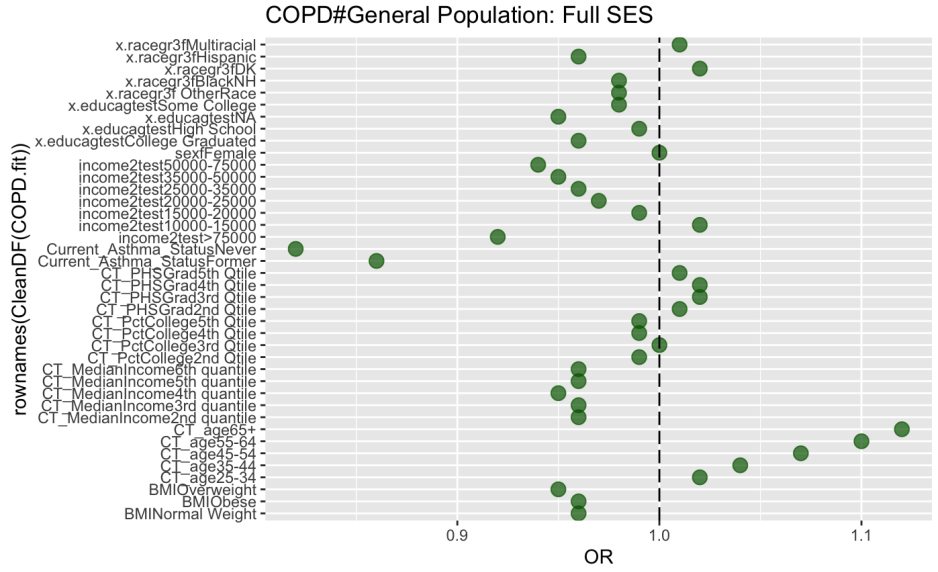
- svyglm(HealthOutcomes ~income2test+CT_age+x.educagtest+sexf+Current_Asthma_Status+x.smoker3test+BMI,design=Black217dsgn)

- svyglm(HealthOutcomes ~CT_HispanicIncome+CT_x.michd+CT_age+sexf+Current_Asthma_Status+CT_rfchol1+CT_diabetes+CT_PctCollege+CT_PHSGrad+x.smoker3test+BMI,design=Hispanic217dsgn)

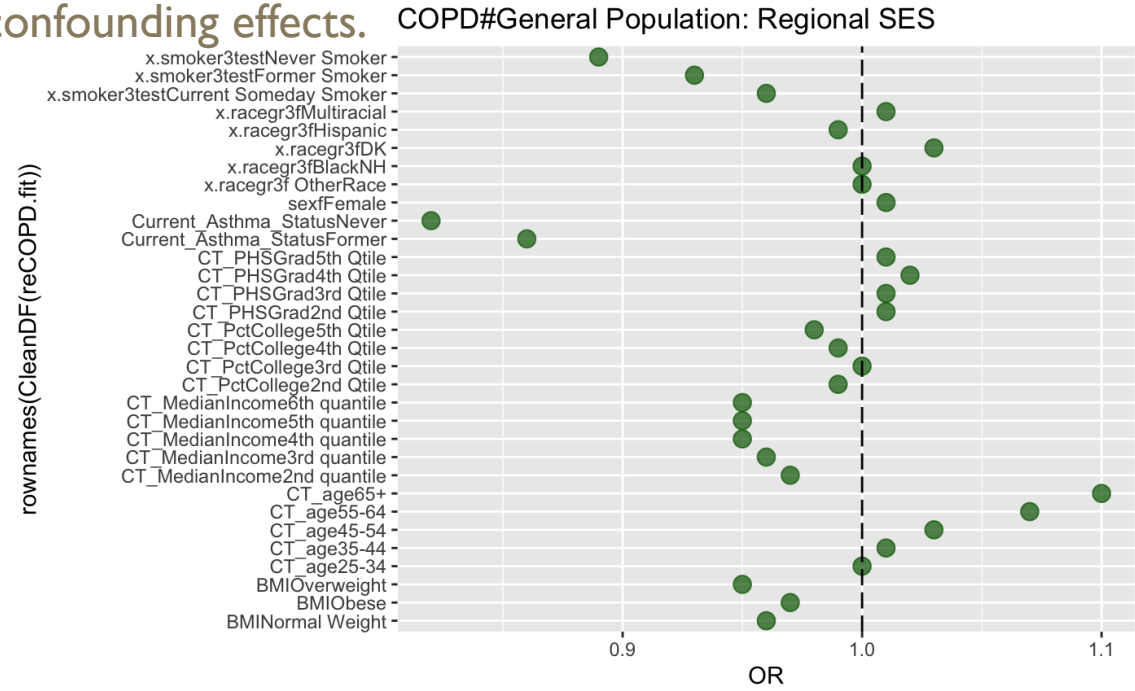
Three models: Full SES, individual SES, regional SES. If individual-level SES highly correlates with regional-level's, then coefficients of same SES Vars between Full vs idv model, or between Full vs regional, will varies a lot.

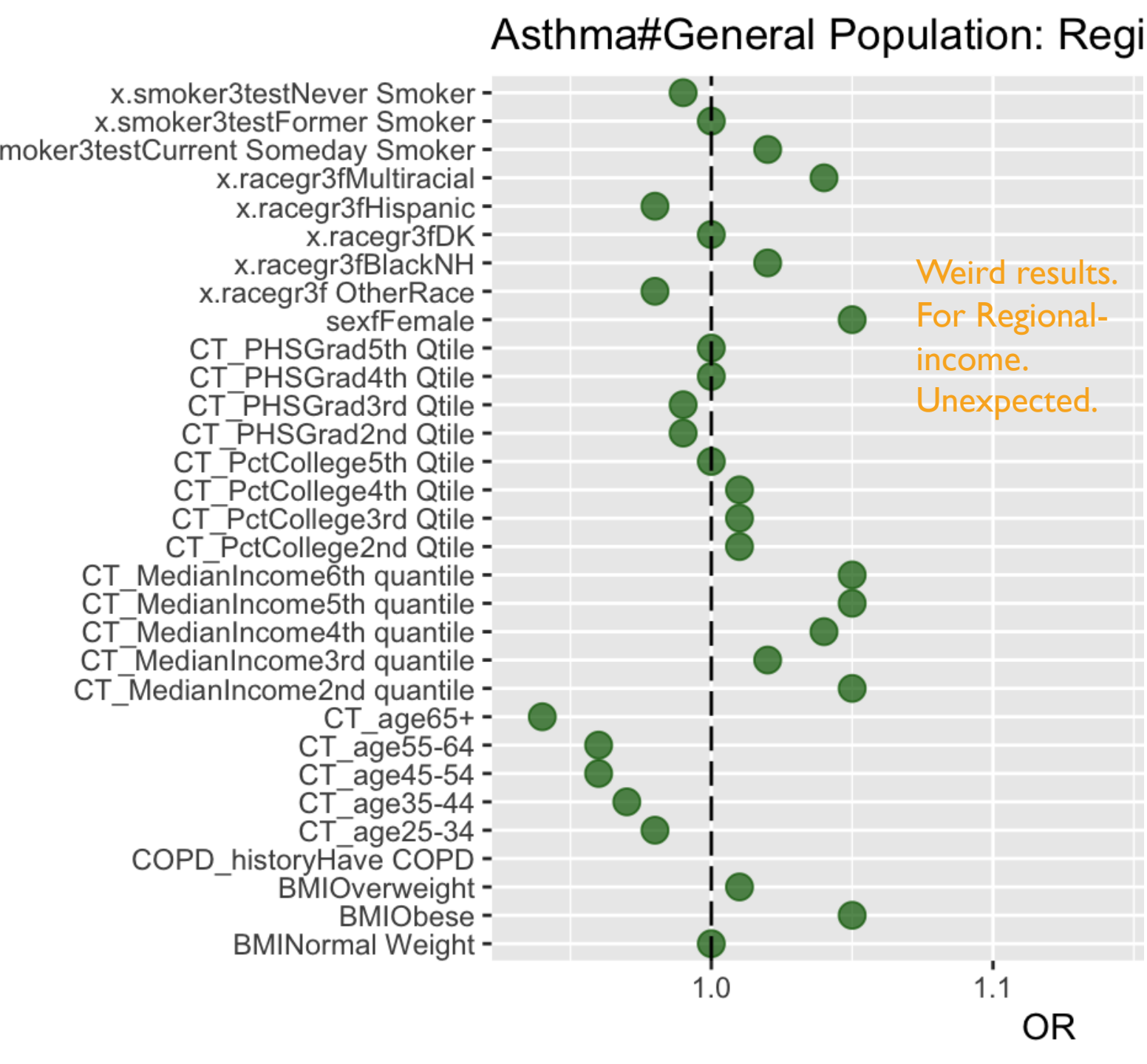
For different diseases, regional environment and individual life habits matter differently.

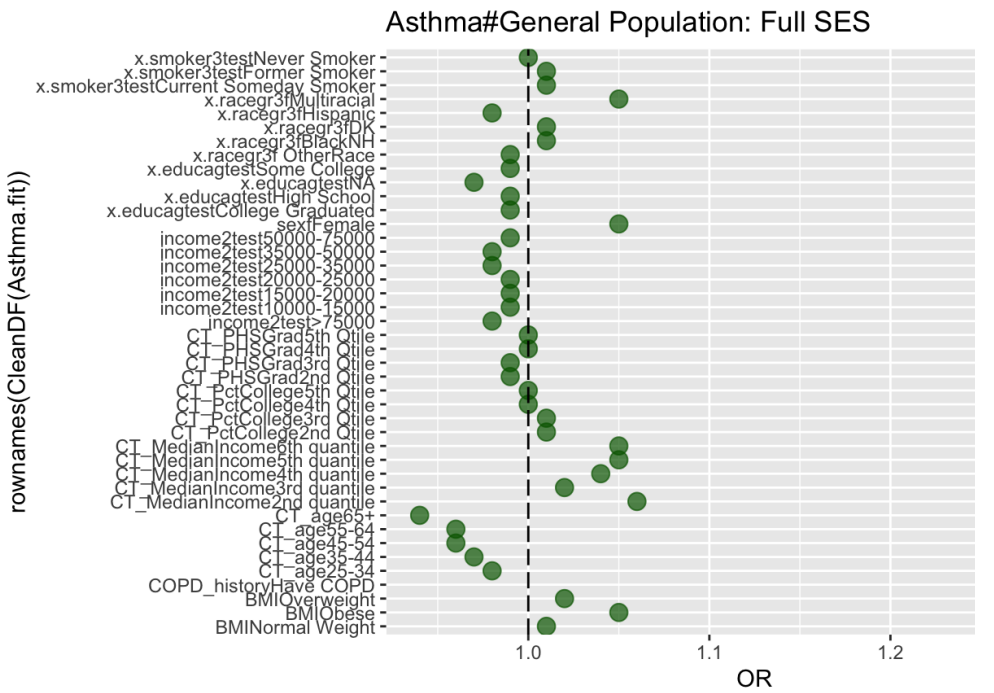


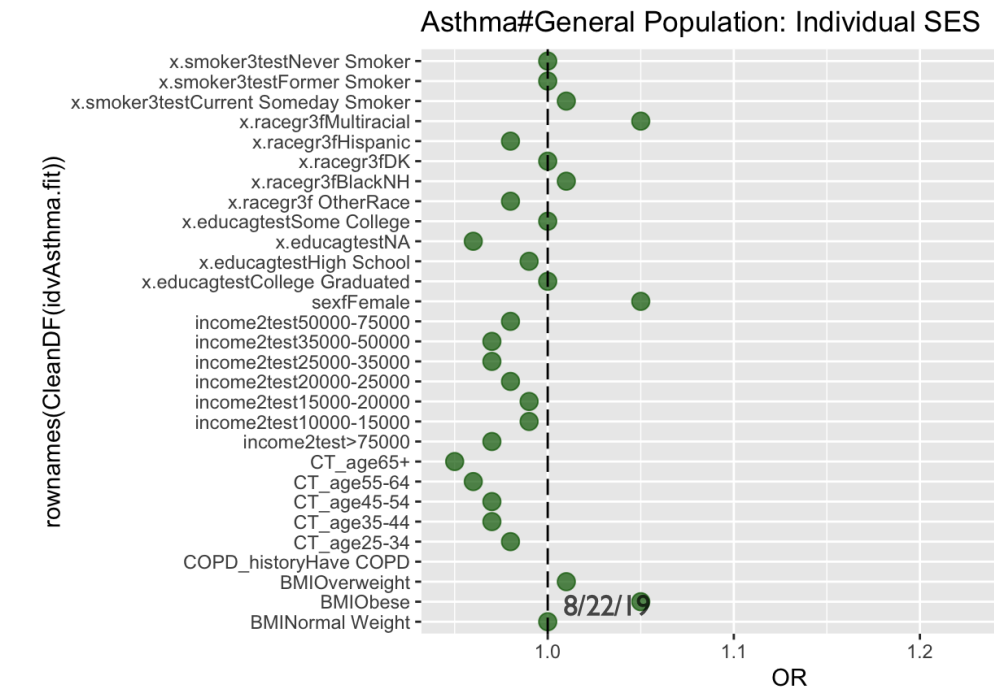


COPD for general Population: individual income impact more obvious effects. Regional income only matters from 1st to 2nd/3rd quantile. In general, income's effects more obvious than education's. seems no confounding effects.




Asthma#General Population: Regi
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
moker3testCurrent Someday Smoker
x.racegr3fMultiracial
x.racegr3fHispanic
x.racegr3fDK
x.racegr3fBlackNH
x.racegr3f OtherRace
sexfFemale
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_MedianIncome6th quantile
CT_MedianIncome5th quantile
CT_MedianIncome4th quantile
CT_MedianIncome3rd quantile
CT_MedianIncome2nd quantile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
1.0
1.1
OR
Weird results.
For Regional-
income.
Unexpected.


Asthma#General Population: Full SES
rownames(CleanDF(Asthma.fit))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.racegr3fMultiracial
x.racegr3fHispanic
x.racegr3fDK
x.racegr3fBlackNH
x.racegr3f OtherRace
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_MedianIncome6th quantile
CT_MedianIncome5th quantile
CT_MedianIncome4th quantile
CT_MedianIncome3rd quantile
CT_MedianIncome2nd quantile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
1.0
1.1
1.2
OR


Asthma#General Population: Individual SES
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x.smoker3testCurrent Someday Smoker
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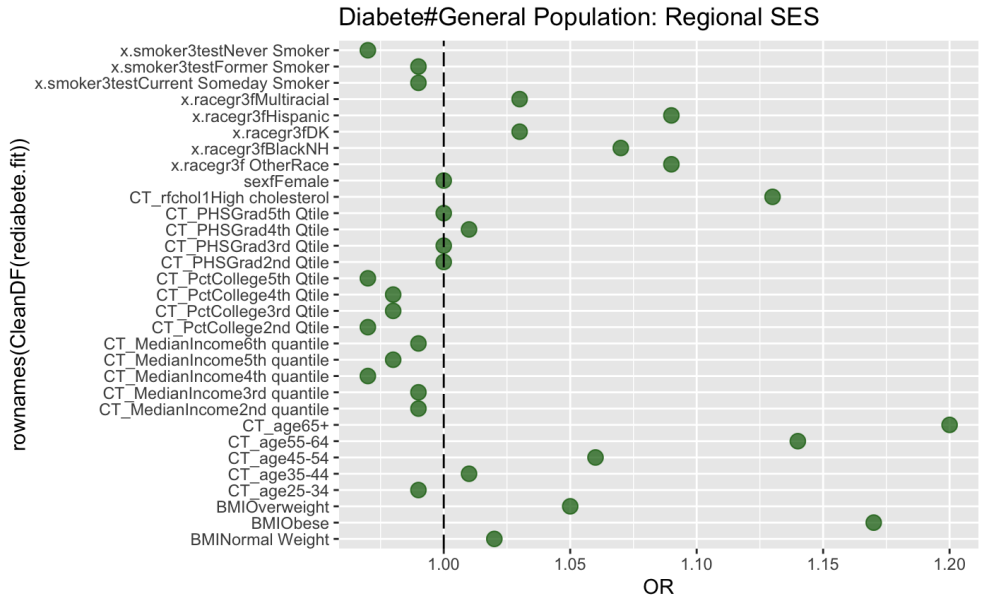
x.racegr3fHispanic
x.racegr3fDK
x.racegr3fBlackNH
x.racegr3f OtherRace
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
8/22/19
1.0
1.1
1.2
OR


Diabete#General Population: Regional SES
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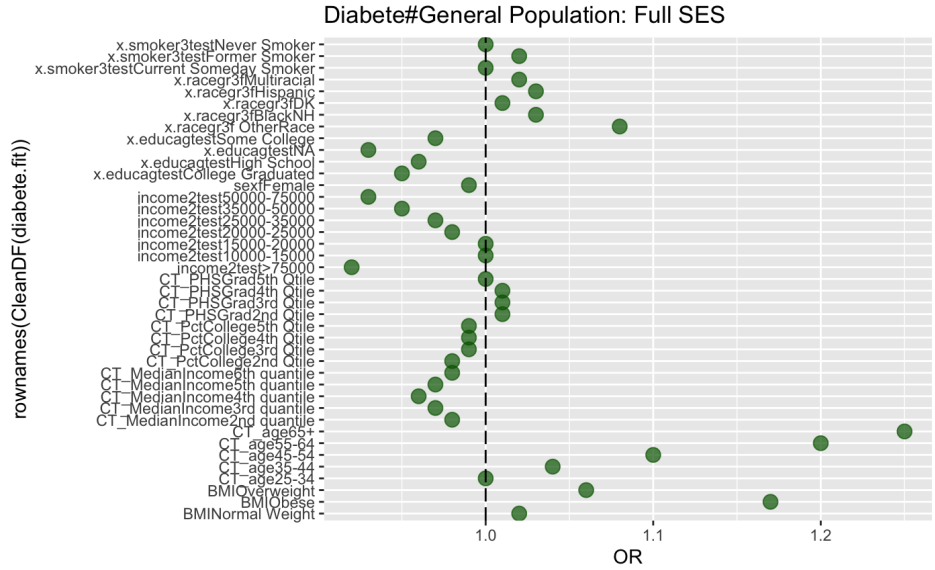
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.racegr3fMultiracial
x.racegr3fHispanic
x.racegr3fDK
x.racegr3fBlackNH
x.racegr3f OtherRace
sexfFemale
CT_rfchol1High cholesterol
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_MedianIncome6th quantile
CT_MedianIncome5th quantile
CT_MedianIncome4th quantile
CT_MedianIncome3rd quantile
CT_MedianIncome2nd quantile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
BMIOverweight
BMIObese
BMINormal Weight
1.00
1.05
1.10
1.15
1.20
OR


Diabete#General Population: Full SES
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x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.racegr3fMultiracial
x.racegr3fHispanic
x.racegr3fDK
x.racegr3fBlackNH
x.racegr3f OtherRace
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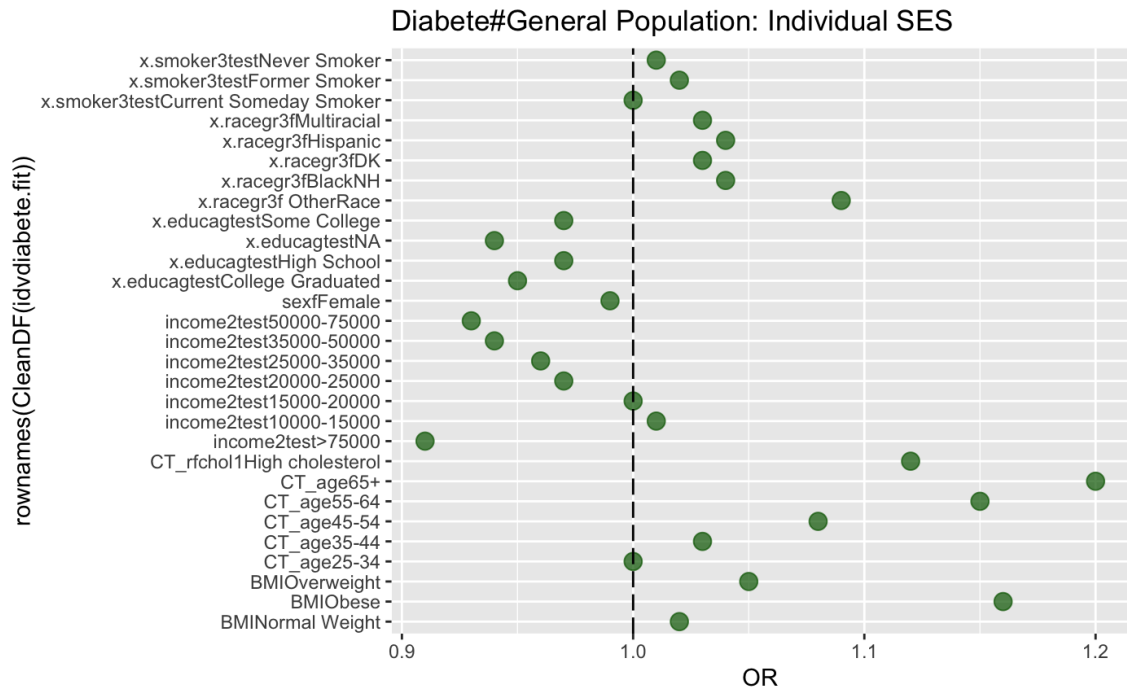
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_MedianIncome6th quantile
CT_MedianIncome5th quantile
CT_MedianIncome4th quantile
CT_MedianIncome3rd quantile
CT_MedianIncome2nd quantile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
BMIOverweight
BMIObese
BMINormal Weight
1.0
1.1
1.2
OR


Diabete#General Population: Individual SES
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x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
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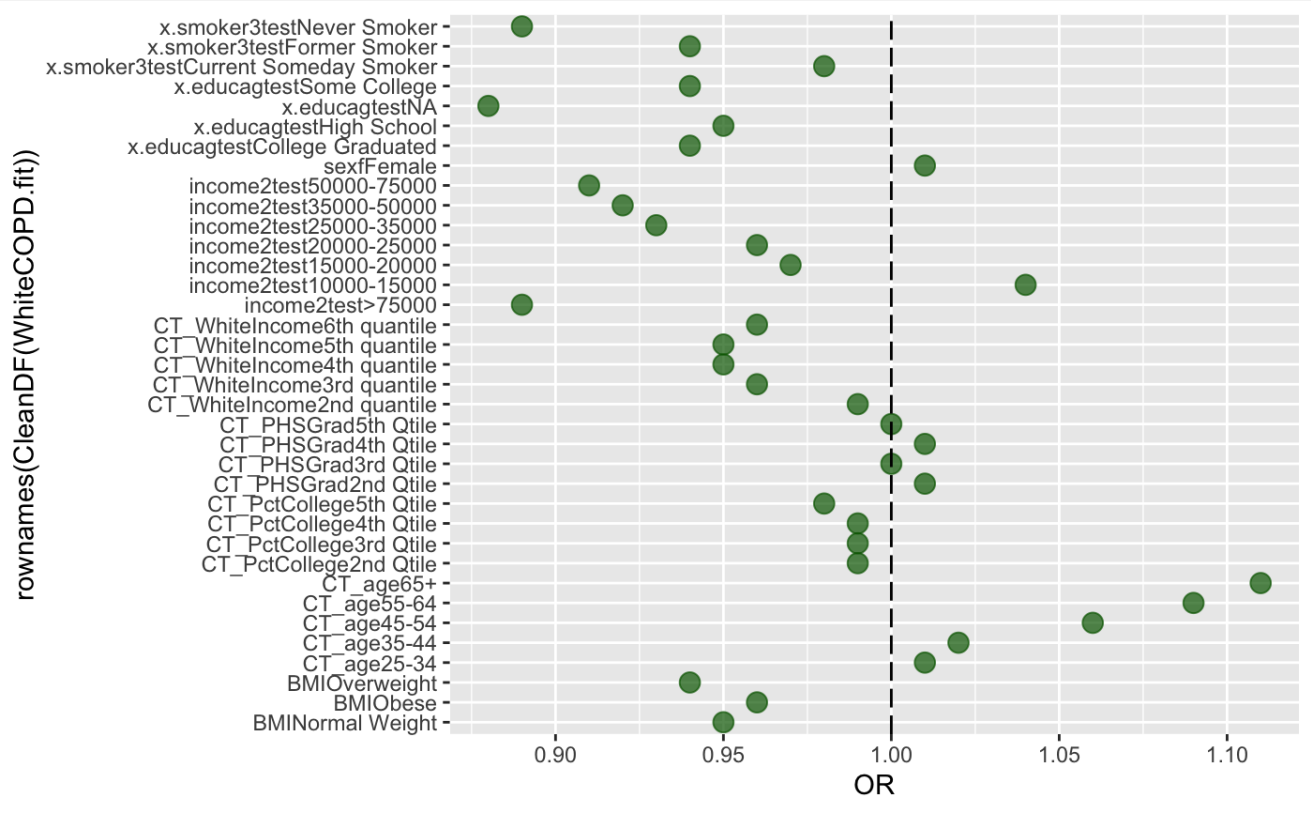
x.racegr3fDK
x.racegr3fBlackNH
x.racegr3f OtherRace
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_rfchol1High cholesterol
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
BMIOverweight
BMIObese
BMINormal Weight
0.9
1.0
1.1
1.2
OR

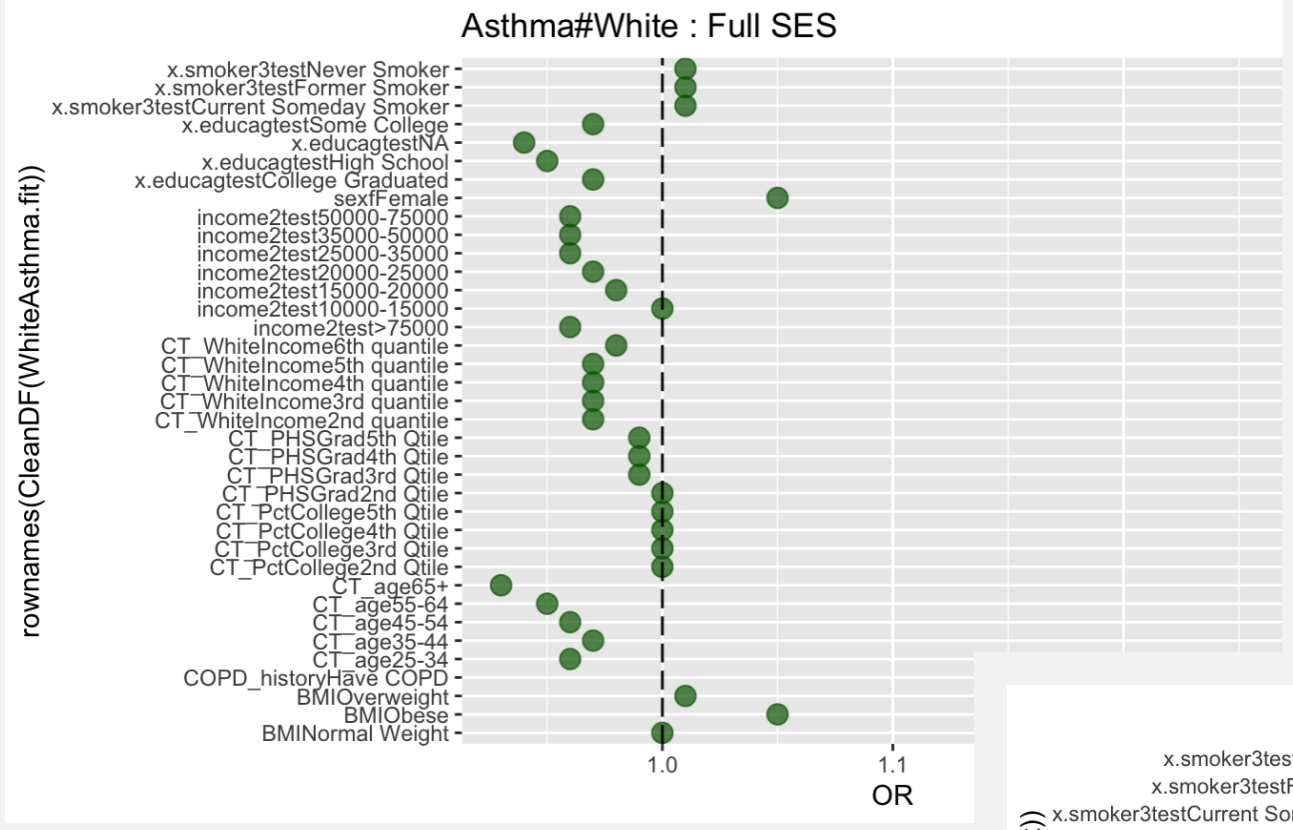
Regional Income more Obvious. Higherinc ome, more likely.

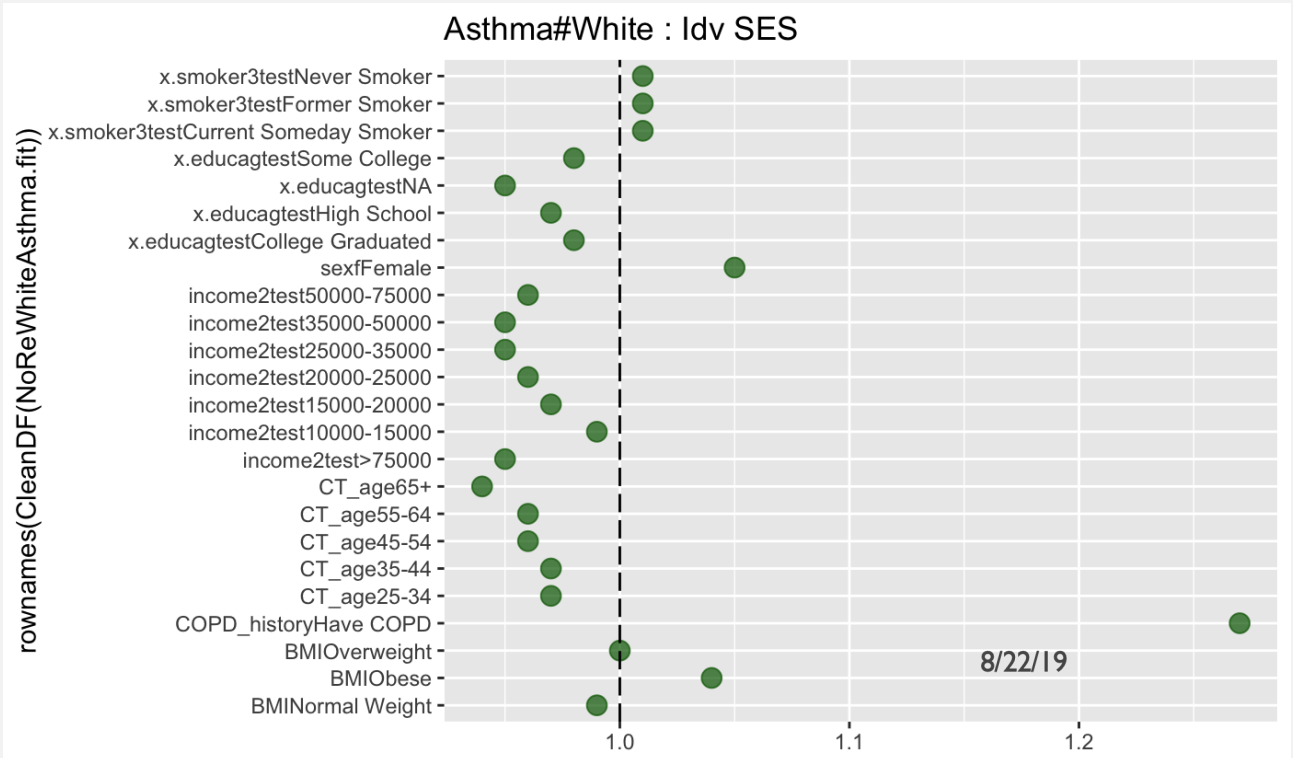
WHITE POPULATION

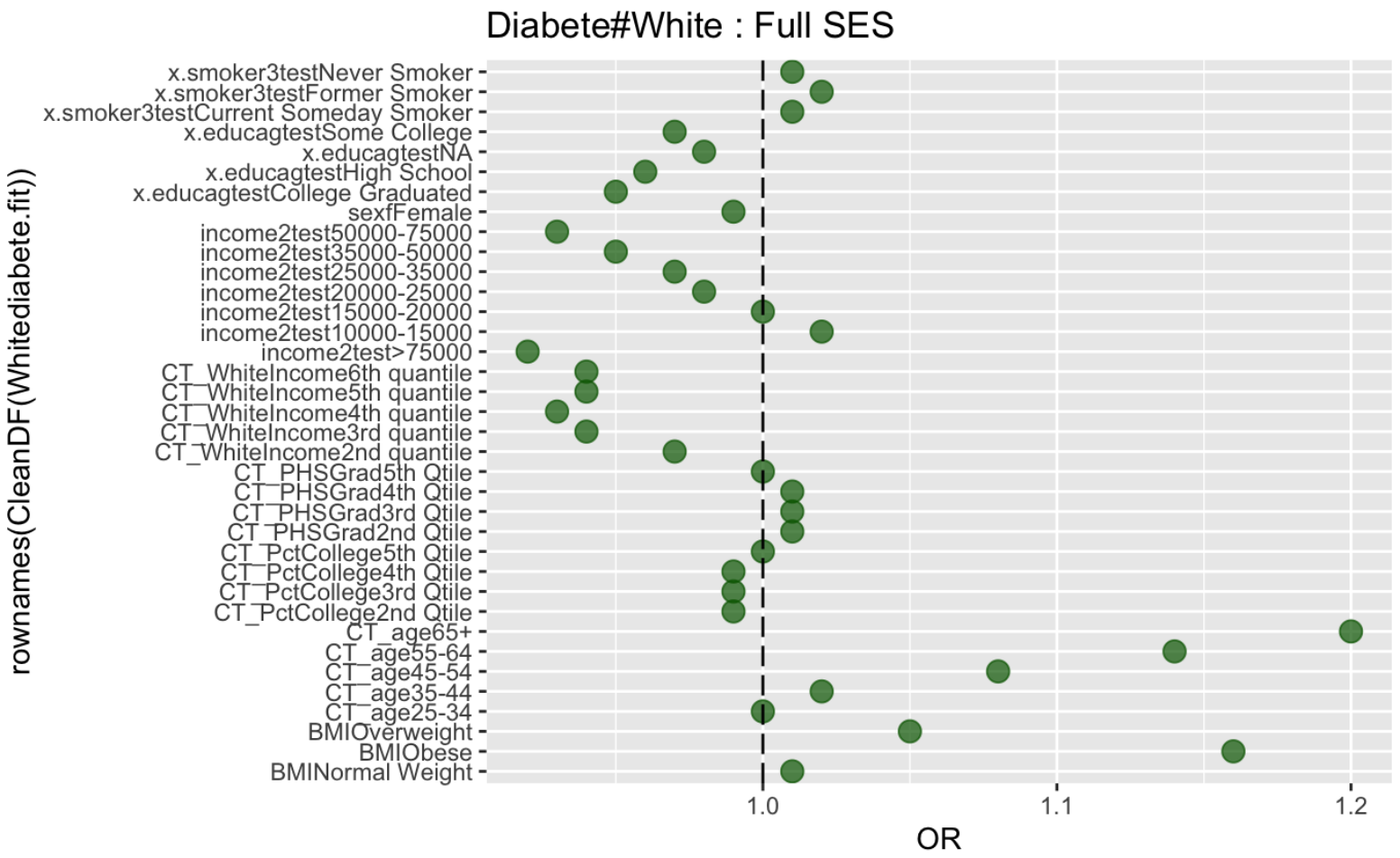
- Dependent Vars: Health Outcomes
- Independent Vars: Income, educ levels
- Other Controls: Demographics, smoking



- COPD effect: A little more obvious than the general population
- OR range from 1 to .9

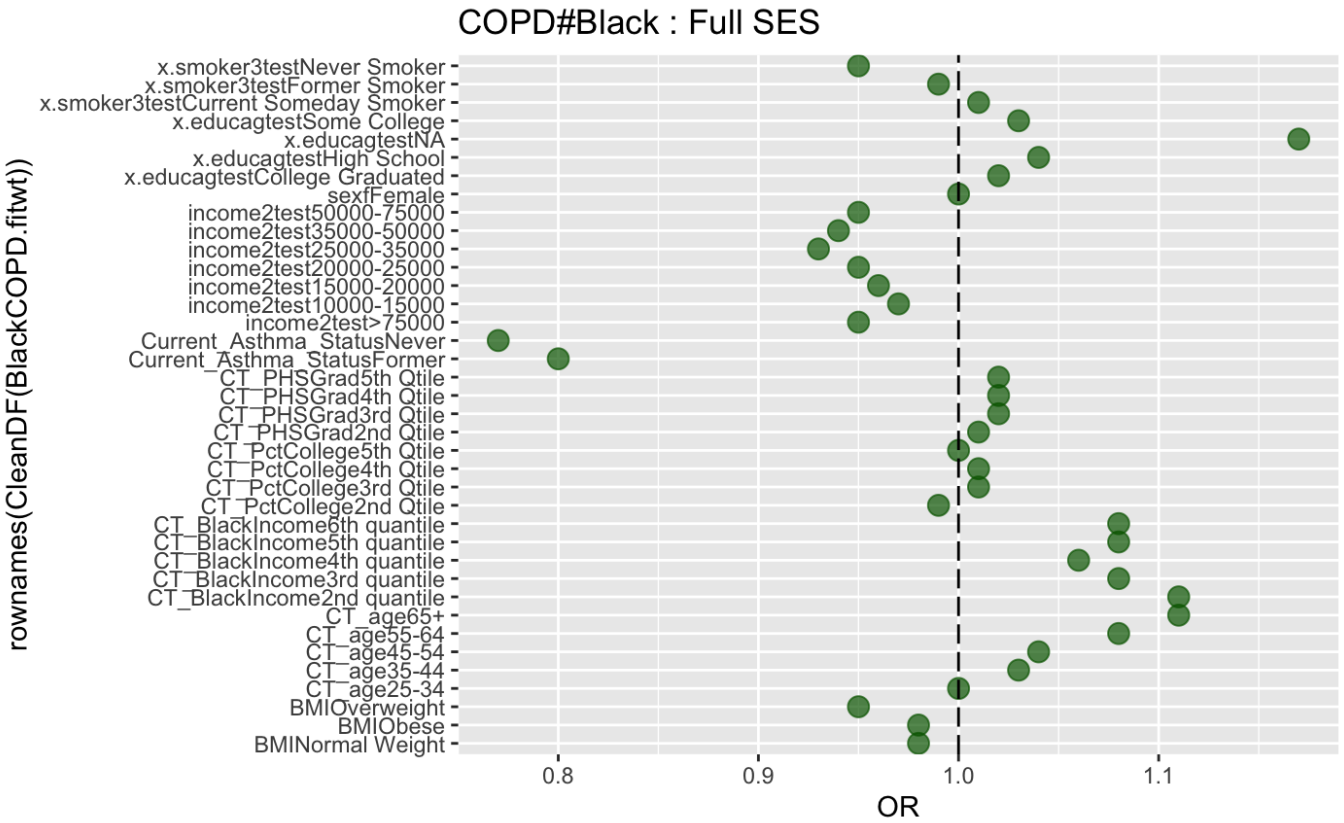

Asthma#White : Full SES
rownames(CleanDF(WhiteAsthma.fit))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_WhiteIncome6th quantile
CT_WhiteIncome5th quantile
CT_WhiteIncome4th quantile
CT_WhiteIncome3rd quantile
CT_WhiteIncome2nd quantile
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
1.0
1.1
OR

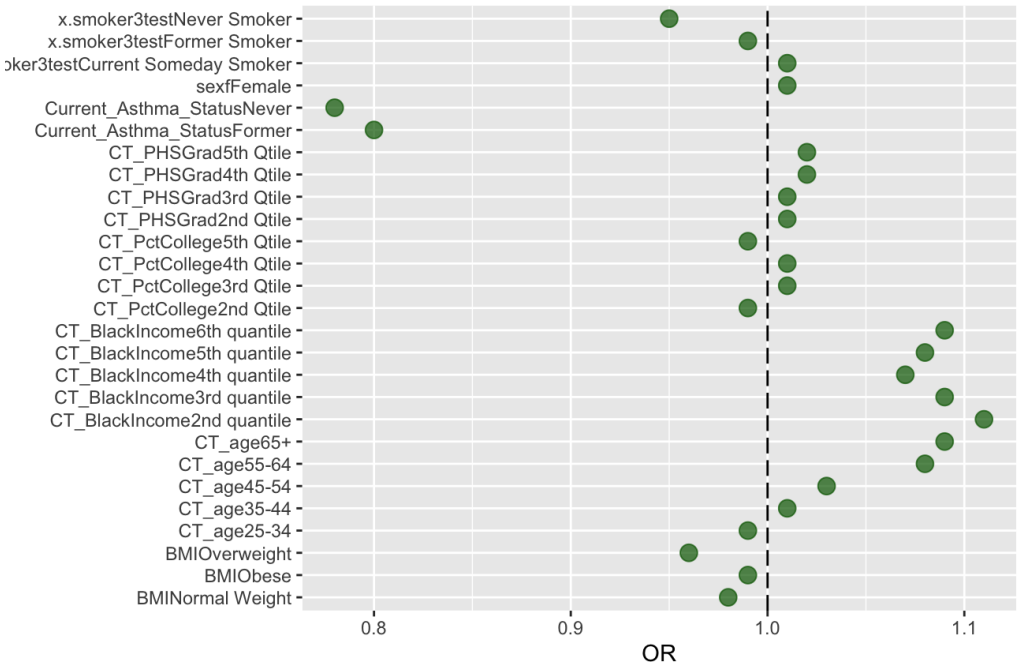

Asthma#White : Idv SES
rownames(CleanDF(NoReWhiteAsthma.fit))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
8/22/19
1.0
1.1
1.2


Diabete#White : Full SES
rownames(CleanDF(Whitediabete.fit))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_WhiteIncome6th quantile
CT_WhiteIncome5th quantile
CT_WhiteIncome4th quantile
CT_WhiteIncome3rd quantile
CT_WhiteIncome2nd quantile
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
BMIOverweight
BMIObese
BMINormal Weight
1.0
1.1
1.2
OR

Black Population Results

- Models:
- svyglm(Healthoutcomes ~CT_BlackIncome+CT_age+sexf+Current_Asthma_Status+CT_PctCollege+CT_PHSGrad+x.smoker3test+BMI,design=Black217dsgn)

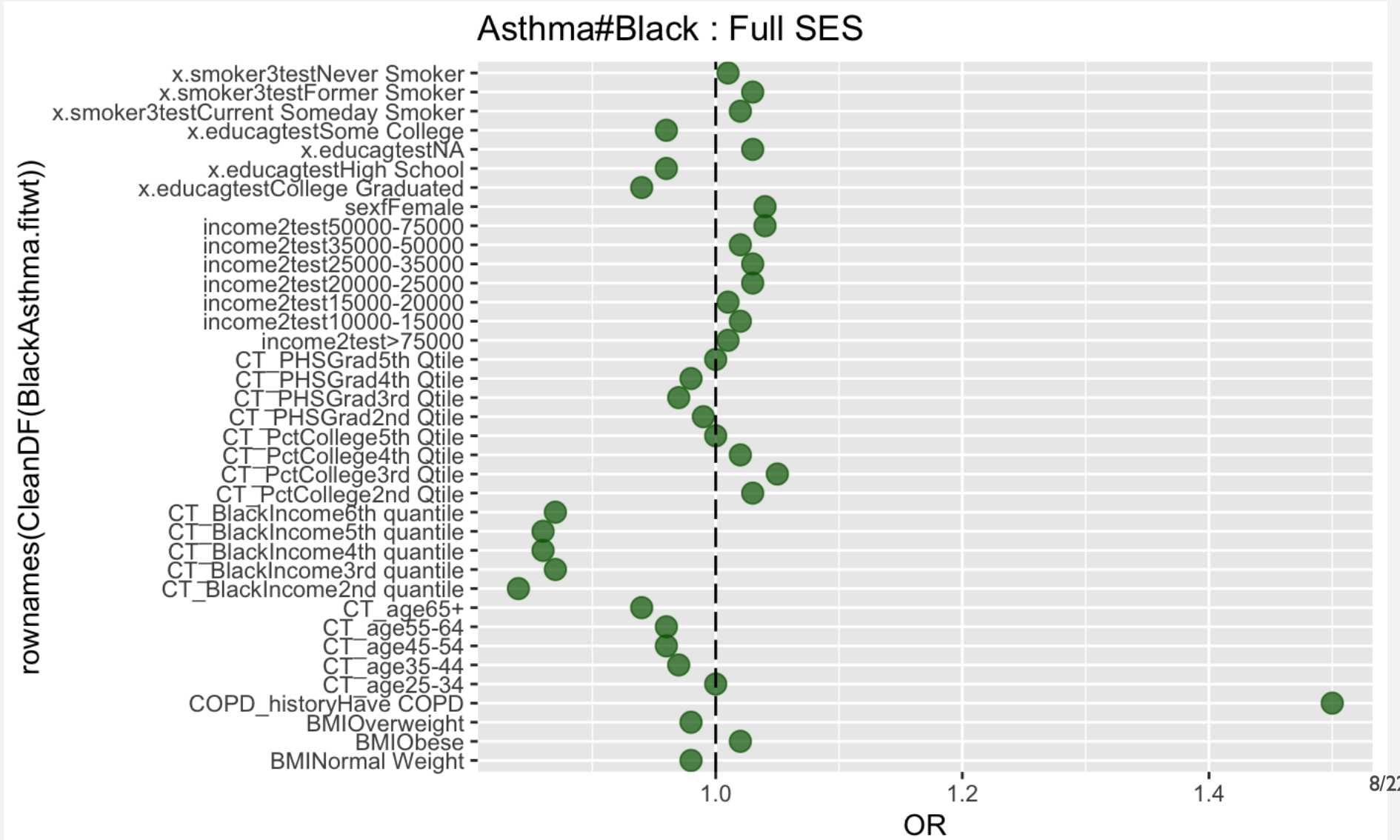


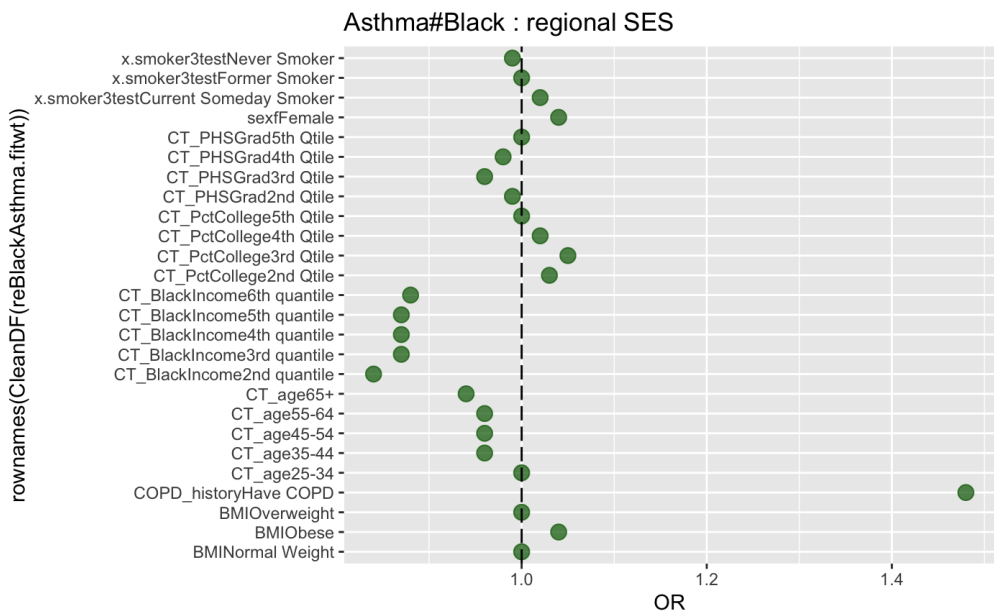


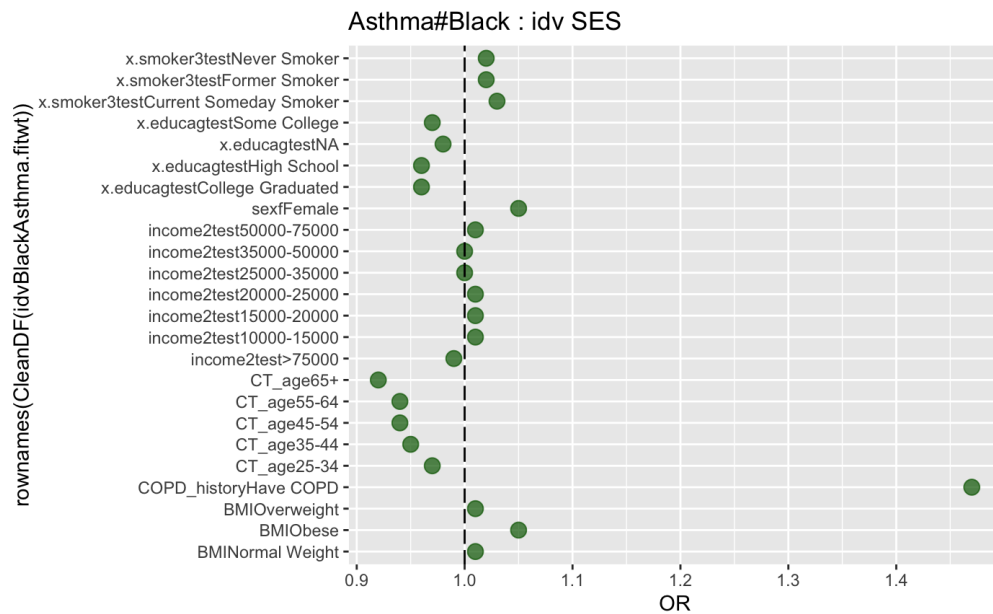
WEIRD RESULTS FOR REGIONAL LEVEL VARS;

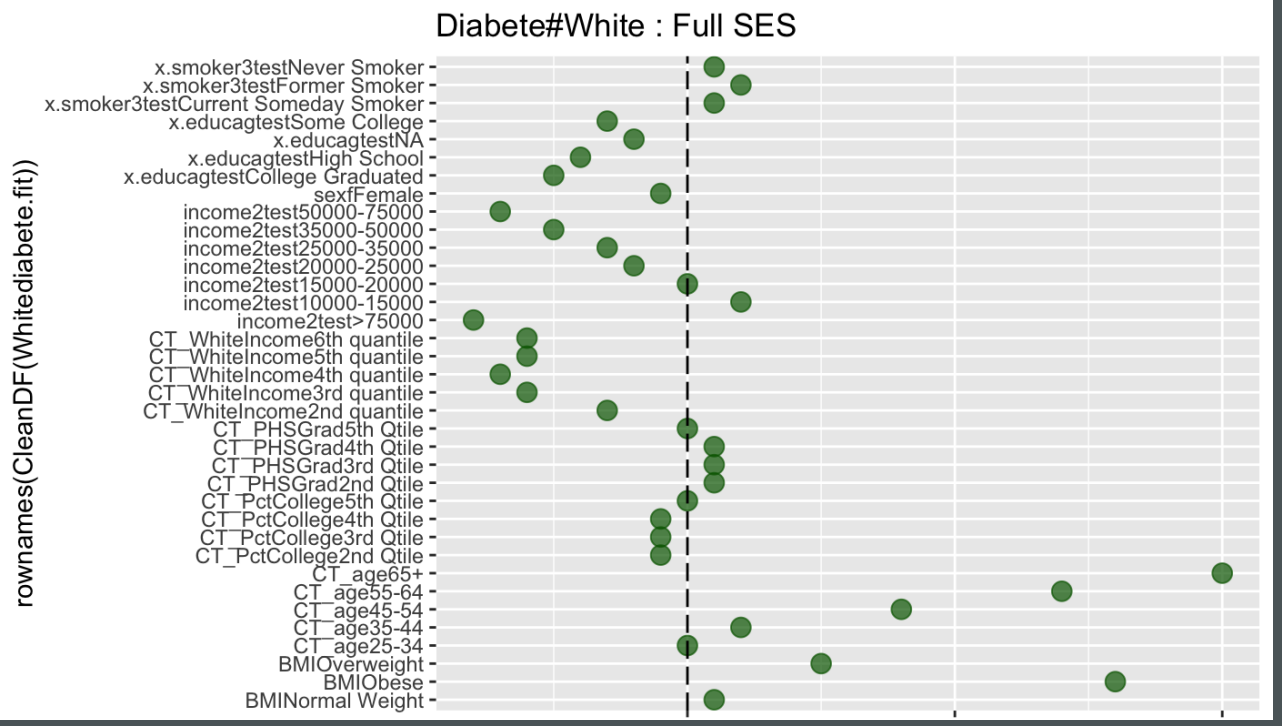
Income impacts not as obvious as that to White's population.

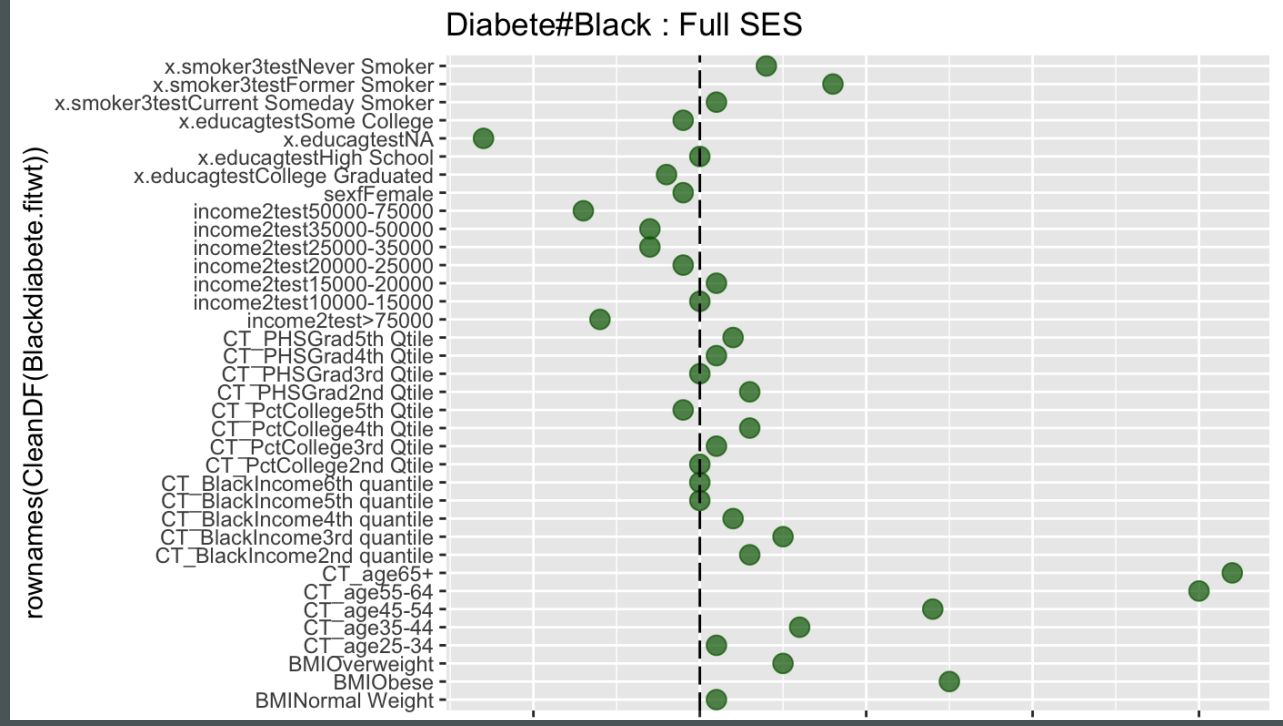
For Asthma: Only Regional Income Vars Matters




Asthma#Black : regional SES
rownames(CleanDF(reBlackAsthma.fitwt))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
sexfFemale
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_BlackIncome6th quantile
CT_BlackIncome5th quantile
CT_BlackIncome4th quantile
CT_BlackIncome3rd quantile
CT_BlackIncome2nd quantile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
1.0
1.2
1.4
OR


Asthma#Black : idv SES
rownames(CleanDF(idvBlackAsthma.fitwt))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
0.9
1.0
1.1
1.2
1.3
1.4
OR

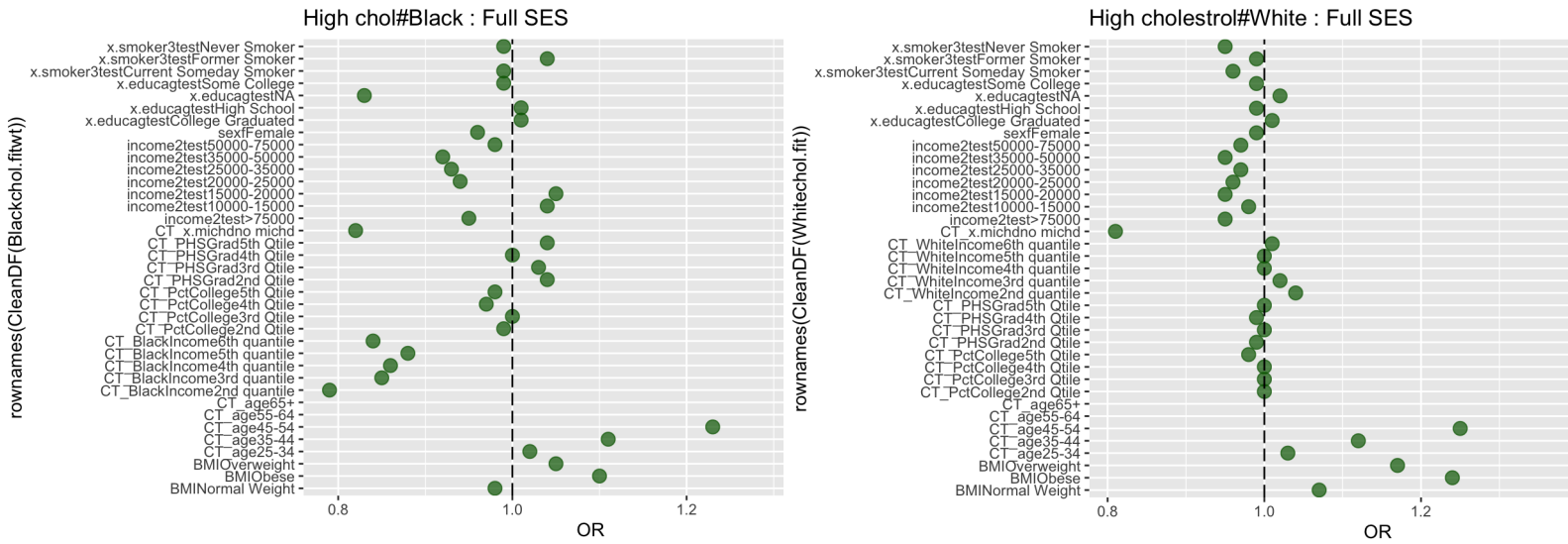


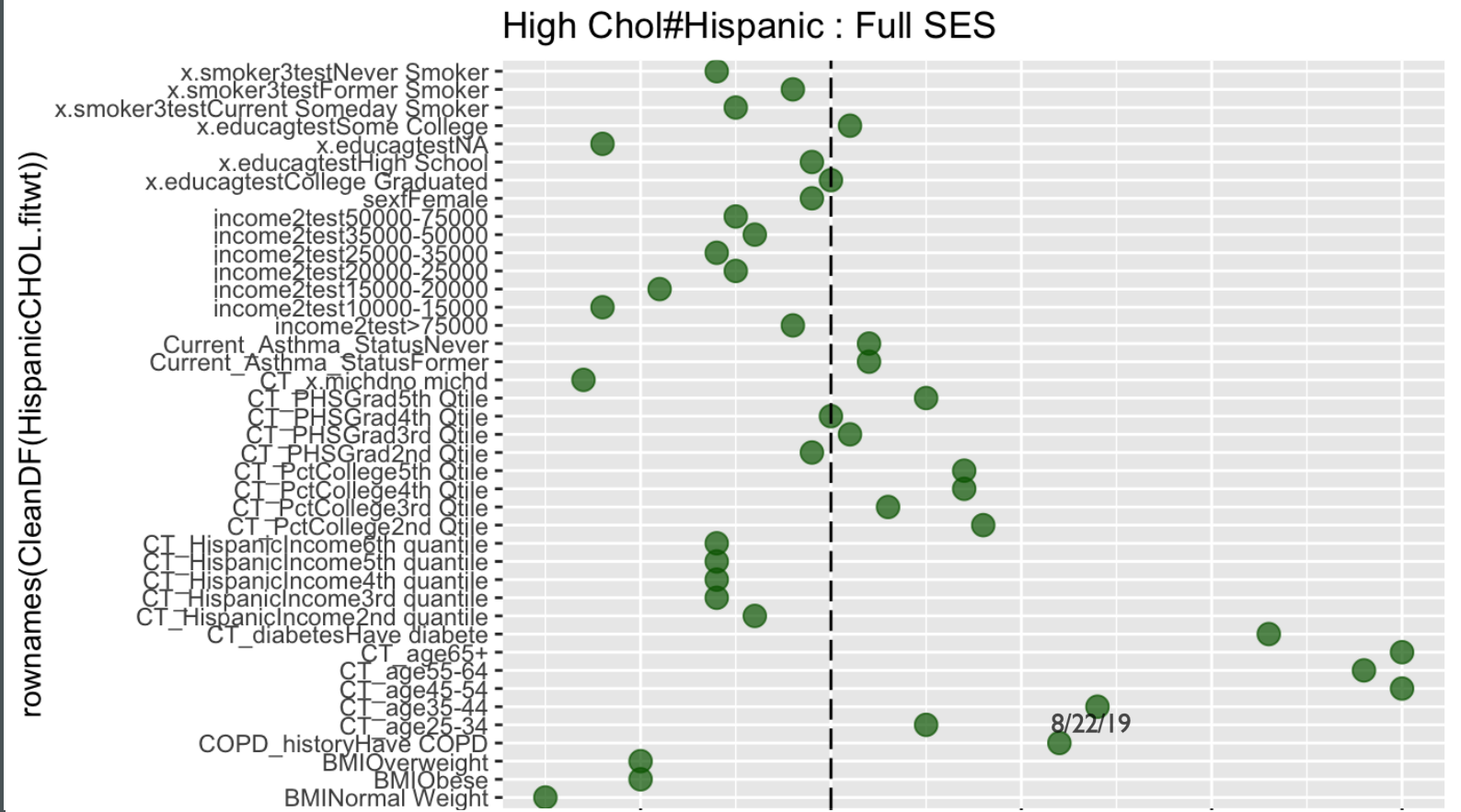


- Diabetes: Compare Whites vs Black Population

HIGH CHOLESTROL COMPARISON

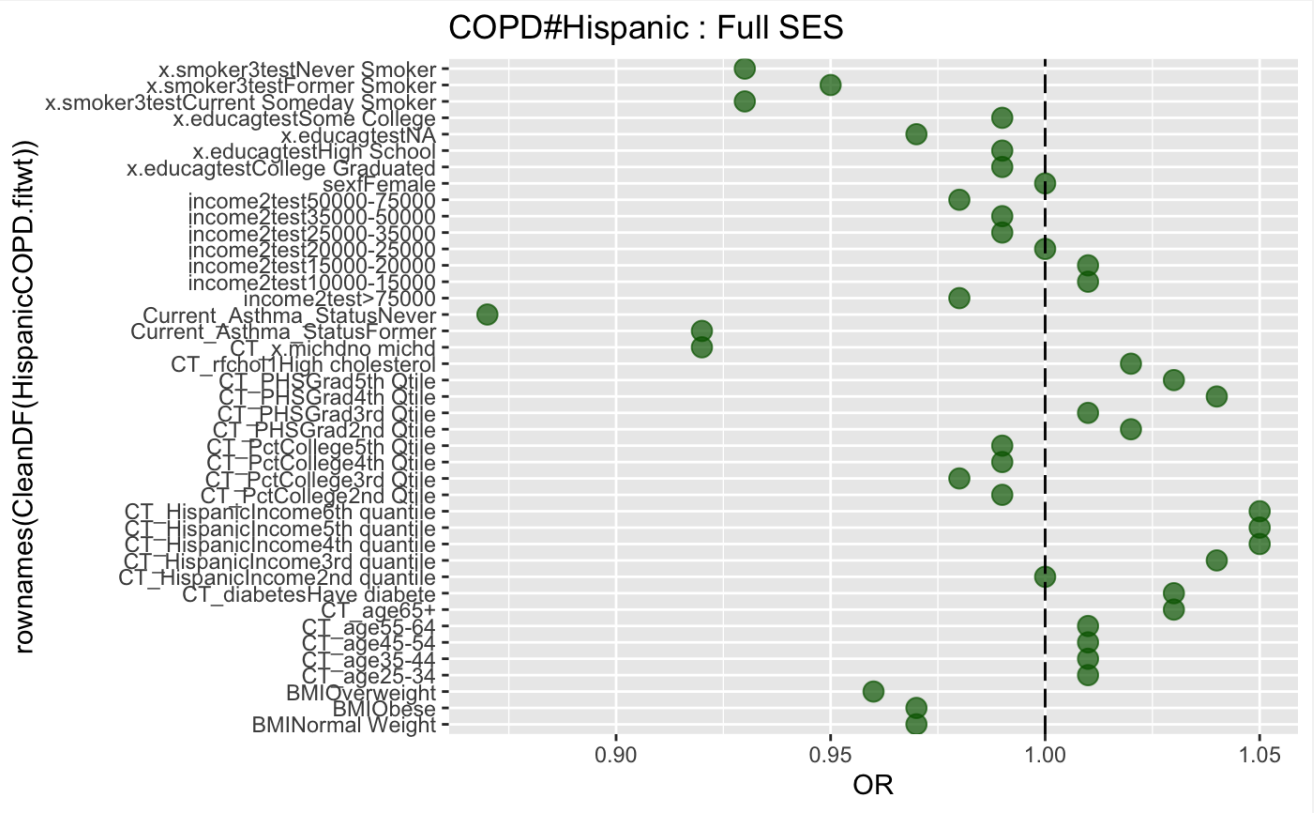
More Income, more likely
Effects on Whites not obvious

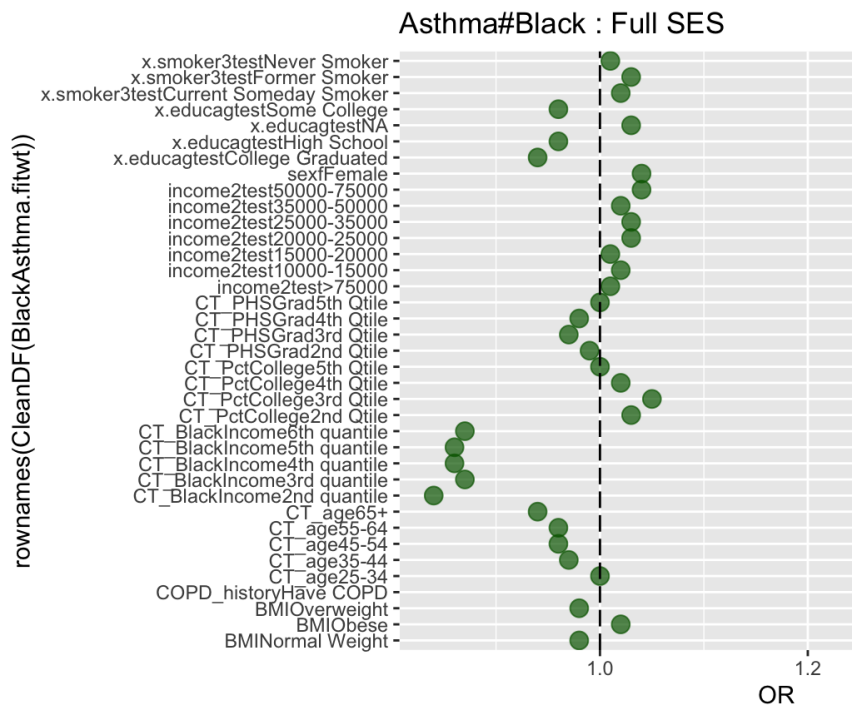


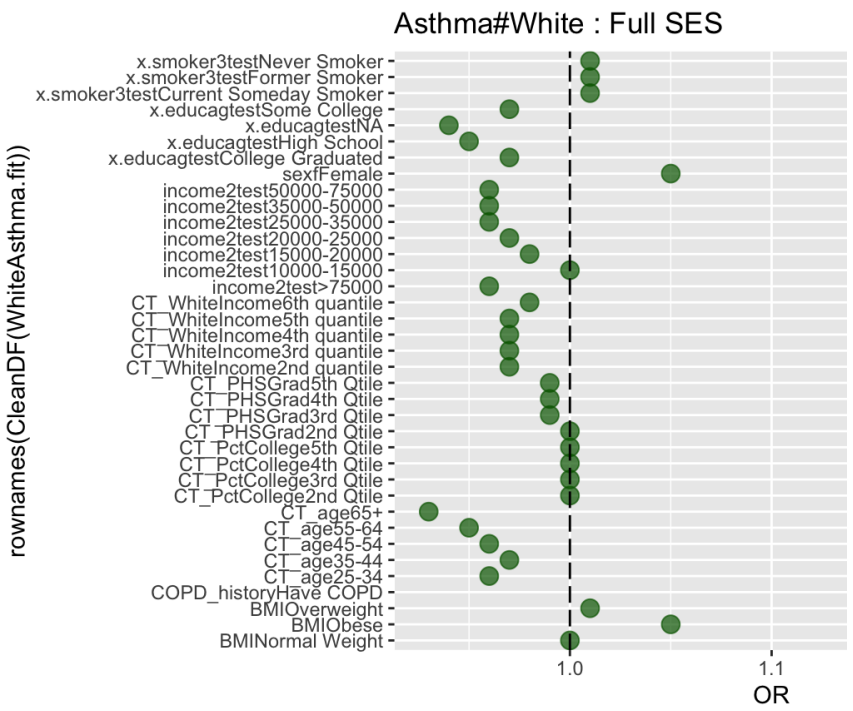


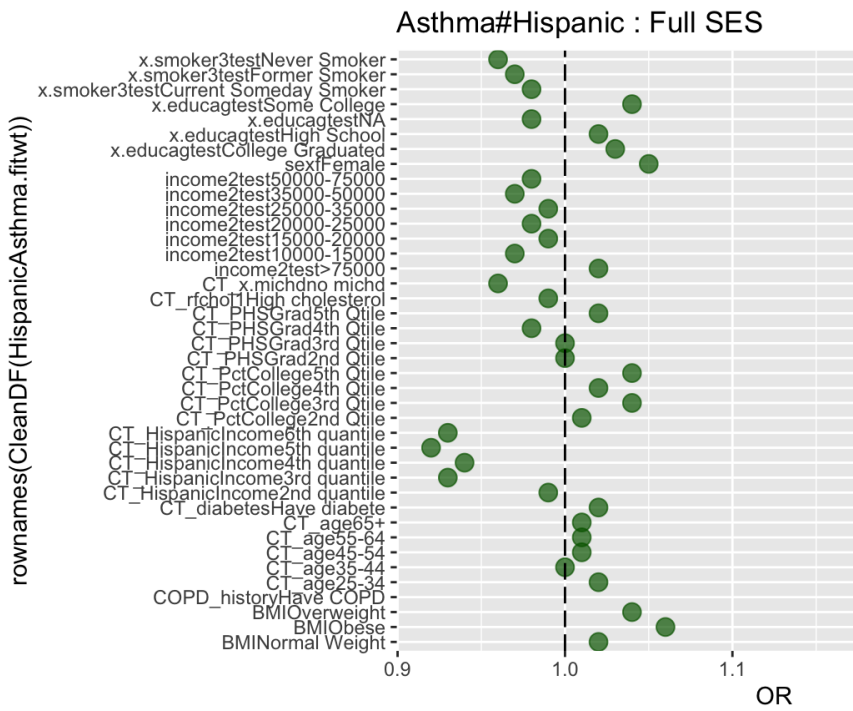
RESULTS FOR HISPANIC

- COPD: Weird results for Regional Vars

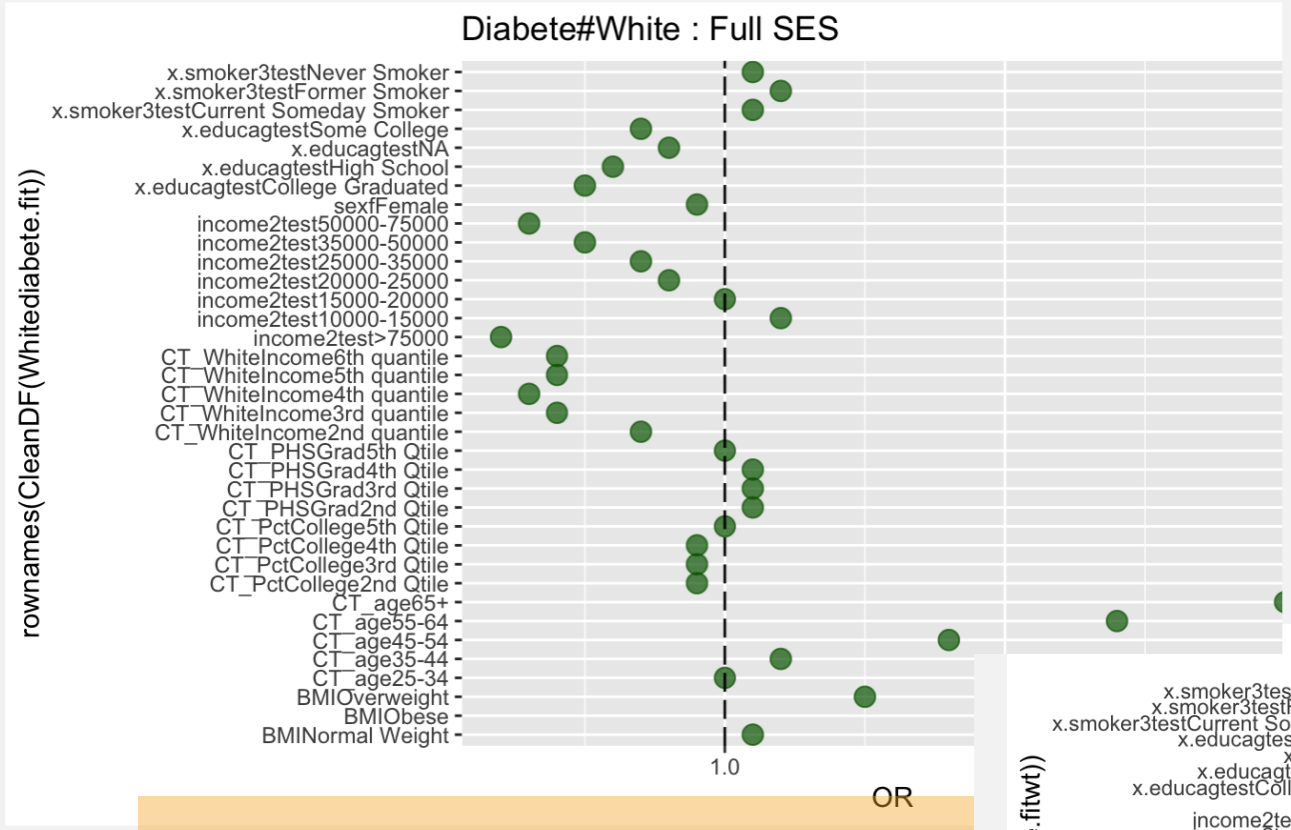


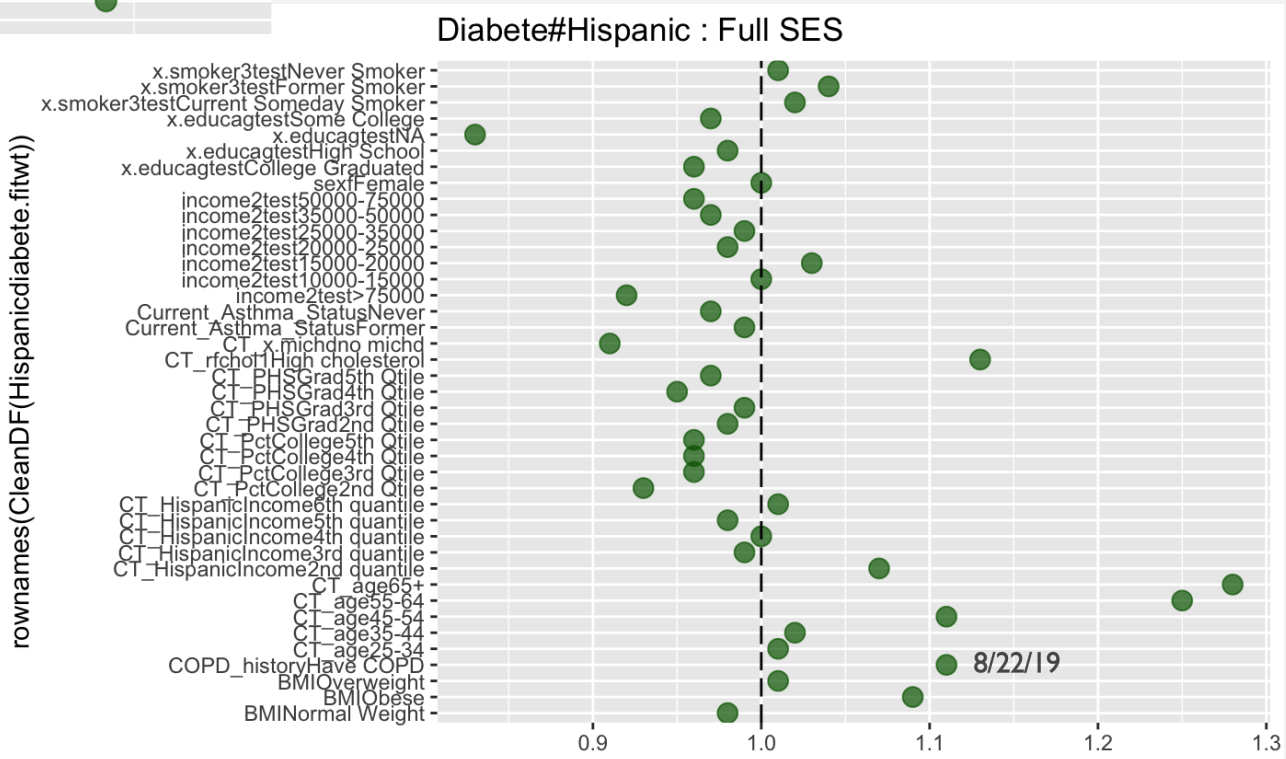






- Asthma Comparing Black vs Hispanic vs White


Diabete#White : Full SES
rownames(CleanDF(Whitediabete.fit))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
CT_WhiteIncome6th quantile
CT_WhiteIncome5th quantile
CT_WhiteIncome4th quantile
CT_WhiteIncome3rd quantile
CT_WhiteIncome2nd quantile
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
BMIOverweight
BMIObese
BMINormal Weight
1.0
OR

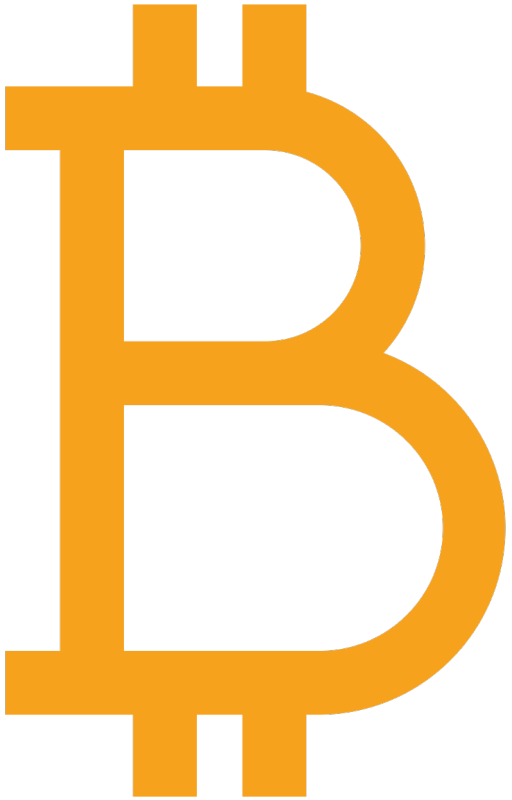

Diabete#Hispanic : Full SES
rownames(CleanDF(Hispanicdiabete.fitwt))
x.smoker3testNever Smoker
x.smoker3testFormer Smoker
x.smoker3testCurrent Someday Smoker
x.educagtestSome College
x.educagtestNA
x.educagtestHigh School
x.educagtestCollege Graduated
sexfFemale
income2test50000-75000
income2test35000-50000
income2test25000-35000
income2test20000-25000
income2test15000-20000
income2test10000-15000
income2test>75000
Current_Asthma_StatusNever
Current_Asthma_StatusFormer
CT_x.michdno michd
CT_rfchol1High cholesterol
CT_PHSGrad5th Qtile
CT_PHSGrad4th Qtile
CT_PHSGrad3rd Qtile
CT_PHSGrad2nd Qtile
CT_PctCollege5th Qtile
CT_PctCollege4th Qtile
CT_PctCollege3rd Qtile
CT_PctCollege2nd Qtile
CT_HispanicIncome6th quantile
CT_HispanicIncome5th quantile
CT_HispanicIncome4th quantile
CT_HispanicIncome3rd quantile
CT_HispanicIncome2nd quantile
CT_age65+
CT_age55-64
CT_age45-54
CT_age35-44
CT_age25-34
COPD_historyHave COPD
BMIOverweight
BMIObese
BMINormal Weight
0.9
1.0
1.1
1.2
1.3
8/22/19

What Happens to some weird results on Regional Vars?

1. Should understand the data structure better

2. the way I quantile regional income data might have some problems: 1st quantile almost no person. The reference group weird.

3. will OR=.95etc really matters?



ACKNOWLEDGEMENT AND THANKS

- Sherrie
- Blanca