

Homework 6

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We are interested in assessing associations among systolic blood pressure, age, sex, and race. The sample is of generally healthy elderly subjects from four U.S. communities.

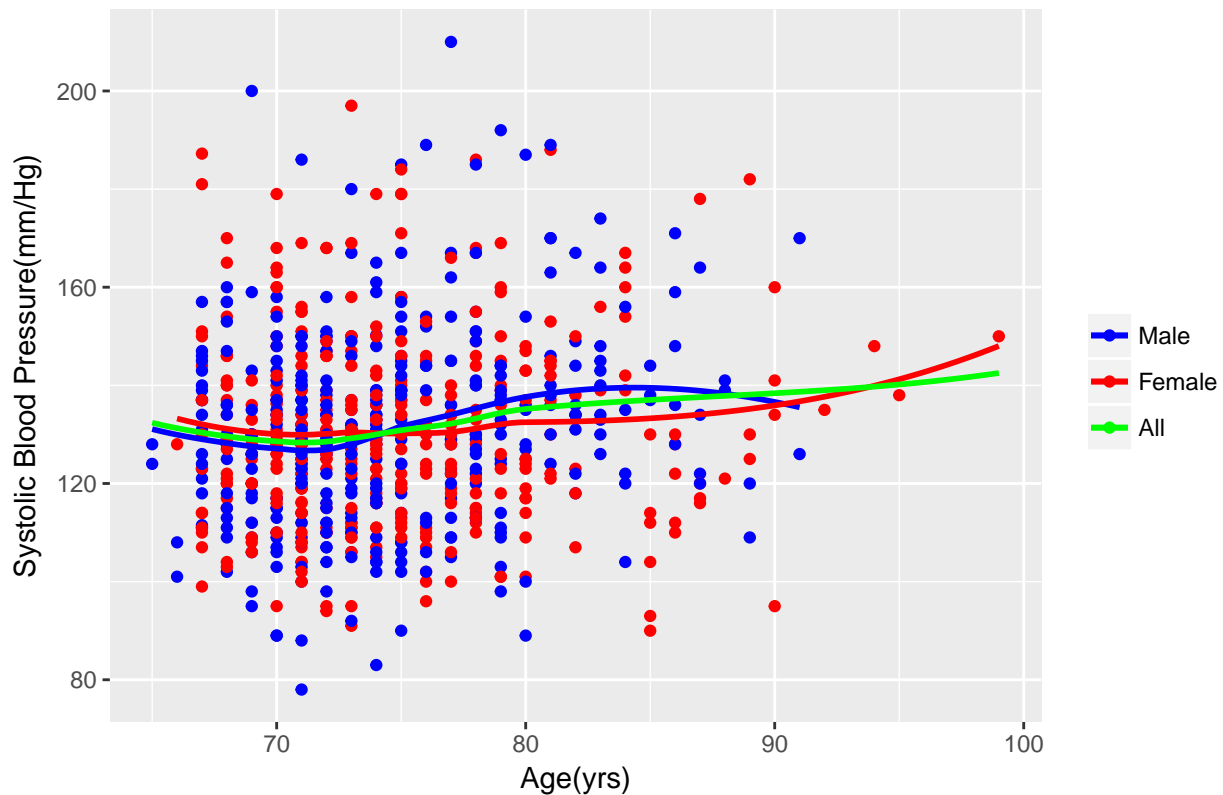
Question 1

We are interested in examining how mean systolic blood pressure varies by age and sex.

(a)

Create a scatterplot of systolic blood pressure versus age. Use different symbols and/or colors for each sex group, and include LOWESS (or LOESS) curves for each sex group.

Systolic blood pressure of MRI study Individuals



(b)

Is there evidence from the scatterplot of an association between systolic blood pressure and age after adjusting for sex? Explain your reasoning.

We don't see any association

- The marginal trend is same
- SBP is also hovering for both sexes in 1 SD of 10 mm/Hg

(c)

Is there evidence from the scatterplot that sex modifies the association between systolic blood pressure and age? Explain your reasoning.

Yes, We do see any evidence of sex modifying the association between SBP and age.

- Lines cross
- There maybe an effect modification, two slopes are not exactly same.

(d)

Perform a statistical analysis to determine if sex modifies the association between systolic blood pressure and age. Provide full statistical inference.

For each 1 year difference in age between two groups that have the same sex, the difference in mean SBP is 0.7372(95% CI: 0.373 to 1.101, with the older group with higher SBP. The results are highly atypical of what we might expect if there was no true difference in mean SBP levels between two age groups that have the same sex. (P-value is .0001 which is found to be significant at $\alpha = 0.05$).

Ask about how to decipher the category which is higher

Between two sex groups that have the same age, the difference in mean SBP is 42(95% CI: 3.445 to 80.55, with the males having a lower SBP. The results are highly atypical of what we might expect if there was no true difference in mean SBP levels between two sex groups that have the same Age (P-value is 0.03 which is found to be significant at $\alpha = 0.05$).

Additionally, we find that there is evidence of sex having an effect on the association between SBP and Age(P-value is found to be 0.03)

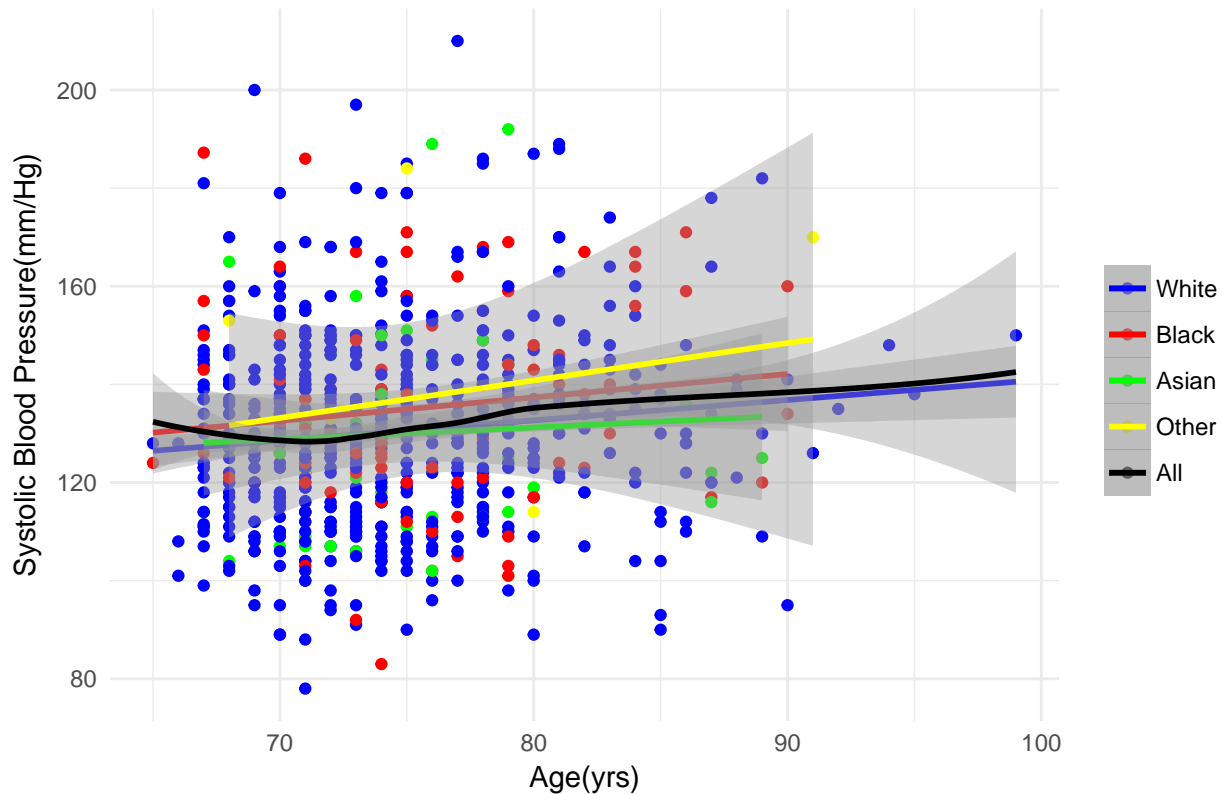
Question 2

Now suppose we are interested in examining how mean systolic blood pressure varies by race and age.

(a)

Create a scatterplot of systolic blood pressure versus age. Use different symbols and/or colors for each race group, and include LOWESS (or LOESS) curves for each race group.

Systolic blood pressure of MRI study Individuals



(b)

What observations do you make from the scatterplot regarding an association between systolic blood pressure and race.

- Whites inline with the marginal trend (intution says might be skewed on sample)
- 'Other' race having a non-linear trend
-

(c)

Perform a multivariate linear regression analysis with systolic blood pressure as the response and with race and age as predictors. What is the baseline group for race in your regression model. Provide an interpretation of the intercept in your regression model and include the numerical value of the intercept in your interpretation. Is the intercept scientifically useful? Briefly explain.

1= white, 2= black, 3= Asian, 4= other

Baseline group for race is 'white'. The intercept is the estimated mean SBP for white, and the corresponding value is 99.01 mm/Hg. Yes ,it is scientifically relevant as it gives the default estimated mean SBP for one racial group.

(d)

Provide an interpretation of the age slope in your regression model in part c, and include the numerical value of the age slope in your interpretation. Is the age slope scientifically useful? Briefly explain.

Age slope is the mean estimated difference in SBP in one year change in age by keeping the race constant. Here the age slope is 0.4213, and it is relevant as it gives the estimated difference in SBP for different racial groups.

(e)

Is race a confounder, precision variable, or neither for the association between systolic blood pressure and age? Explain and provide evidence to support your reasoning.

Race looks to be a Precision variable

- As it reduces the variance when race is added, the Confidence Interval becomes tighter(evident in scatter plot)

(f)

Perform a statistical analysis using the multivariate regression model in part c to determine if race is associated with systolic blood pressure after adjusting for age. Provide full statistical inference.

For each 1 year difference in age between two groups that have the same race, the difference in mean SBP is 0.4213(95% CI:0.165 to 0.677, with the older group with higher SBP. The results are highly atypical of what we might expect if there was no true difference in mean SBP levels between two age groups that have the same race (P-value is .0013 which is found to be significant at $\alpha = 0.05$).

Is there a diff interpretation - race is associated with systolic blood pressure after adjusting for age?

Question 3

Perform a multivariate linear regression analysis with systolic blood pressure as the response and with race, sex, age, and an interaction for sex and age as predictors.

(a)

What is the baseline group for race in your regression model. Provide an interpretation of the intercept in your regression model and include the numerical value of the intercept in your interpretation. What, if any, scientific use would you make of the intercept?

Baseline group for race is 'white'. Intercept here is the estimated mean SBP for white newborn females. Scientifically not relevant as it is not what was collected or the subjects were.

(b)

Provide an interpretation of the sex slope in your regression model, and include the numerical value of the sex slope in your interpretation. Is the sex slope scientifically useful? Briefly explain.

Sex slope is the mean estimated difference in SBP between females and males by keeping the race, and age constant. Here the sex slope is 42.29, and it is relevant as it gives the estimated difference in SBP for two sex groups i.e. we can infer the estimated difference in mean SBP for males and females .

(c)

Provide an interpretation of the age slope in your regression model, and include the numerical value of the age slope in your interpretation. Is the age slope scientifically useful? Briefly explain.

Age slope is the mean estimated difference in SBP for each 1 yr difference in age by keeping the race, and sex constant. Here the age slope is .7302, and it is relevant as it gives the estimated difference in SBP for two age groups who differ by one year.

(d)

Perform a statistical analysis using the multivariate regression model to determine if age is associated with systolic blood pressure. Provide full statistical inference.

For each year difference in age between two groups that have the same sex and race, the difference in mean SBP is .7302(95% CI:.373 to 1.087), with the older group having a higher SBP. The results are highly atypical of what we might expect if there was no true difference in mean SBP levels between age groups that have the same sex and race.(P-value is 0.0001)

Talk about

(e)

Perform a statistical analysis using the multivariate regression model to determine if sex is associated with systolic blood pressure. Provide full statistical inference.

Between two sex groups that have the same age and race, the difference in mean SBP is 42.29(95% CI:4.284 to 80.29), with the males having a higher SBP The results are highly atypical of what we might expect if there was no true difference in mean SBP levels between two sex groups that have the same age and race(P-value is .02)

check the statement on who has higher

(f)

Perform a statistical analysis using the multivariate regression model to determine if race is associated with systolic blood pressure. Provide full statistical inference.

Doing ANOVA, we find that race is not associated with SBP (P-value is 0.1289), but checking the races individually, we find that the race 'black' has significant effect(P-value is 0.0483).

Between the racial groups 'white' and 'black' that have the same age and sex, the difference in mean SBP is 4.29(95% CI:0.03 to 8.55), with the 'black' group having a higher SBP. The results are highly atypical of what we might expect if there was no true difference in mean SBP levels between two racial groups('white' and 'black') that have the same age and sex (P-value is .04).

for all the racial groups

(g)

Perform a statistical analysis using the multivariate regression model for testing the null hypothesis that both age and sex are not associated with systolic blood pressure. Provide full statistical inference.

Doing ANOVA by excluding the sex and age interaction, we see that both age and sex are associated with systolic blood pressure (P-value is found to be 0.029) i.e. we reject the null hypothesis. Furthermore, based on our multivariate regression analysis, we reject the null hypothesis that age/sex are associated with SBP (P-value is 0.0274).

more detail