

Homework #6

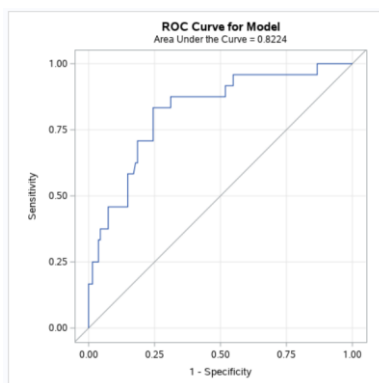
Exercise 1

a)

$$L_{FluShot} = b_o + b_{age}X_1 + b_{awareness}X_2 + b_{male}X_3$$

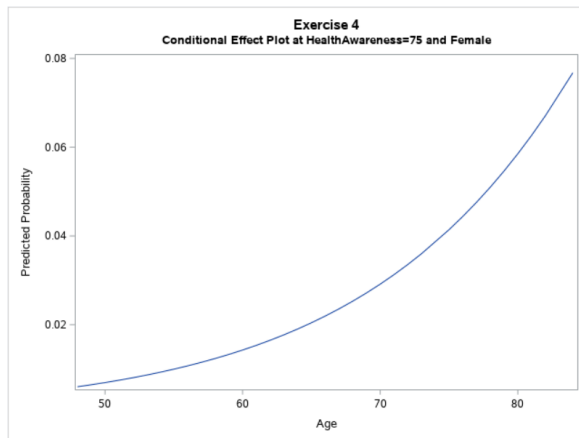
$$L = -1.1772 + 0.0728X_1 - 0.0990X_2 + 0.4339X_3$$

- b) The age parameter is positive (0.0728). This means that the older the individual is, the more likely they are to receive the flu shot. An increase of one unit of age is associated with an increase of 7.55% odds of receiving the flu shot.
- c) The male parameter is positive. This means that the response will be greater if X_3 is positive. Thus, being a male means an increased prediction of receiving a flu shot. Being a male increases the odds of receiving the flu shot by 54.3%
- d) The probability of receiving the flu shot given a 55 year old male with health awareness 60, is 6.42%.
- e)



The ROC curve plots false positive rates vs true positive rates. This gives an idea of the predictive success of the model. The gray line represents a 50% random guess. The ROC curve for this model does a better job than the gray line and has fairly good predictive success. A choice can be made whether to limit false positives or false negatives.

f)



The conditional effect plot for a female and health awareness score of 75. You can see that as age increases the probability increases. Notice that the percentage is always fairly low. Even at 80 years of age the predicted probability only reaches about 6%.

- g) The calculated probability, from the parameter estimates, of a 59 year old woman with health awareness score 75 of receiving the flu shot is 1.33%. This looks fairly consistent with the conditional effect plot above.
- h) The Hosmer-Lemeshow goodness of fit test. Ho: The logistic function is appropriate. Ha: The logistic function is not appropriate for the given data. The p-value is 0.1997. Given a significance level of $\alpha = 0.05$, the conclusion is to reject Ho and accept Ha. The logistic function is not appropriate.

Exercise 2

a) $L_{proficiency} = b_{lvl1} + b_{gender}X_1$

$$L = -2.4 + 0.4X_1$$

b) Odds for a boy to reach level 1 is equal to $1/(1+\exp(-(-2.4 + 0.4*1))) = 0.119$

Odds for a girl to reach level 1 is equal to $1/(1+\exp(-(-2.4 + 0.4*0))) = 0.083$

c) Cumulative probability for a boy to reach level 3 or less is

$$1/(1 + (\exp(-(0.8 + 1*0.4))) * 100\% = 76.9\%$$

d) Cumulative probability for a boy to reach level 2 or less is

$$1/(1 + (\exp(-(-1.1 + 1*0.4))) * 100\% = 33.2\%$$