Homework 1

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Number 1

probability: 400 / 50,001 = 0.0080 .8% probability of a MI in high risk men not on statins

odds: 400 / 49601 = 0.0081

Number 2

probability: 240 / 50,002 = 0.0048 .48% probability of a MI in high risk men on statins

odds: 240 / 49762 = 0.0048

Number 3

probability: 0.008 - 0.0048 = 0.0032

odds: 0.0081 - 0.0048 = 0.0033

Number 4

There is a higher chance of MI in high risk men not on statins than on statins, so it seems that statins do help.

Number 5

low risk, not on statins: probability: 360 / 180,002 = 0.002 odds: 360 / 179642 = 0.002

low risk, on statins: probability: 30 / 20,001 = 0.0015 odds: 30 / 19971 = 0.0015

Number 6

The difference for low risk men is only 0.0005, so it seems to help but only a small amount.

Number 7

probability: (400 + 360) / (50,001 + 180,002) = 0.0033 .33% probability of MI in men not on statins

odds: (400 + 360) / (49601 + 179642) = 0.0033

Number 8

probability: (240 + 30) / (50,002 + 20,001) = 0.0039 .39% probability of MI in men on statins

odds: (240 + 30) / (19971 + 49762) = 0.0039

Number 9

If we did not know about the risk status, we would probably conclude that statins have no effect on the chance of MI, or maybe that they have a negative effect because the difference here is -0.0006.

Number 10

It seems that statins have an effect only on high risk men, but if we don't know the risk status then statins do not appear to have an effect on the chance of MI. There is a casual effect when we separate by risk status because low risk men are less likely to be taking statins and less likely to have MI just in general, so it doesn't make sense to lump them together with the high risk men.

Number 11

We could expect a similar phenomenon with allergy medication, as we discussed in class. If people don't already have allergies, they will likely not need to take allergy medication and they will be less likely to experience allergy symptoms regardless of whether they take medication or not.

Number 12

(see end of document)

Number 13

The coefficient for the Statins variable is -0.4812, which is significant at alpha < 0.001. This means that patients taking statins are less likely to have an MI, and patients at high risk are more likely to have MI.

```
##
## Call:
## glm(formula = MI ~ factor(RiskScore) + Statins, family = binomial(link = "logit"),
##     data = MI, weights = N)
##
## Deviance Residuals:
##       1        2        3        4        5        6        7        8
##  62.230  -28.053   50.528  -22.106   66.819  -27.002   20.022   -7.079
##
## Coefficients:
##                     Estimate Std. Error  z value Pr(>|z|)
## (Intercept)        -6.19902    0.05092 -121.737  < 2e-16 ***
## factor(RiskScore)1  1.36624    0.06876   19.869  < 2e-16 ***
## Statins            -0.48120    0.07587   -6.342 2.26e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 13745  on 7  degrees of freedom
## Residual deviance: 13346  on 5  degrees of freedom
## AIC: 13352
##
## Number of Fisher Scoring iterations: 8
```

```
##        (Intercept) factor(RiskScore)1            Statins
##         -6.1990156          1.3662382         -0.4811988
```

Number 14

The coefficient for Statins is now -0.288, which is not significant (alpha > 1). The interaction term is also not significant (alpha > 1).

```r
fit2 <- glm(MI ~ RiskScore*Statins, weights = N, data = MI, family = binomial(link = "logit"))

summary(fit2)
```

```
##
## Call:
## glm(formula = MI ~ RiskScore * Statins, family = binomial(link = "logit"),
##     data = MI, weights = N)
##
## Deviance Residuals:
##       1        2        3        4        5        6        7        8
##  62.150  -28.227   50.624  -21.883   66.892  -26.819   19.752   -7.743
##
## Coefficients:
##                   Estimate Std. Error  z value Pr(>|z|)
## (Intercept)       -6.21262    0.05276 -117.759   <2e-16 ***
## RiskScore          1.39232    0.07282   19.119   <2e-16 ***
## Statins           -0.28822    0.19017   -1.516    0.130
## RiskScore:Statins -0.22584    0.20706   -1.091    0.275
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 13745  on 7  degrees of freedom
## Residual deviance: 13345  on 4  degrees of freedom
## AIC: 13353
##
## Number of Fisher Scoring iterations: 8
```

Number 15

Given the models above, I would say that statins do have an effect, but the risk score is a more prominent predictor of whether a patient will have MI or not.