Task 1 Create Binary Response Variables

- Dichotomize the mental health variable such that the new binary response variable is coded as one (1 = having poor mental health) if the number of days for poor mental health is greater than zero, otherwize it's coded as zero (0 = having excellent mental health). Label this new variable as mntlhlthc2
- Create Dummy Variables from Binary Variables. Create a dummy variable for sex using male as the reference category (hint: for example the new indicator variable can be called female with female coded as one and male coded as zero). Note that you can create a dummy variable for sex using female as the reference category ((hint: for example the new indicator variable can be called male with male coded as one and female coded as zero). But when one enters the sex variable in a regression model, both dummy variables cannot be entered simultaneously, and one has to be dropped. Please think about why.

```
> #TASK 1: Create Binary Response Variables
> # 1 = poor mental health mntlhl > 0
> useddta$mntlhc2 <- ifelse(useddta$mntlhlth > 0, 1, 0)

> #Create dummy variables female (male = 0)
> useddta$female <- as.numeric(useddta$sex == "female")
```

Task 2 Create Binary Indicator Variables for Multi-Category Nomial Variables

- Create a set of dummy variables for the race variable. Note that the race variable has three categories, so one can create three dummy variables for race. Please be careful and clear about 1) how many of the three dummy variables, all measuring race, are usually used in a regression model and 2) how to interpret the results/corresponding coefficients (which group is the reference group?).

```
#Task 2: Create Binary Indicator Variables for Multi-Category Nomial
Variables
> #Create dummy variables for race
> useddta$raceF <- factor(useddta$race,
+                         levels = c(1,2,3,NA),
+                         labels = c("1white", "2black", "3other"))

> table(useddta$raceF,useddta$race, useNA = 'ifany')

         iap white black other
  1white   0     0     0     0
  2black   0     0     0     0
  3other   0     0     0     0
  <NA>     0  4644   770   292

> # In document discuss how many can be used in the regression model
> # In document discuss how to interpret the coefficient
>
```

1. Since there are 3 levels, we can use two of the variables in a regression model.
2. Whichever variable is omitted is the reference group.

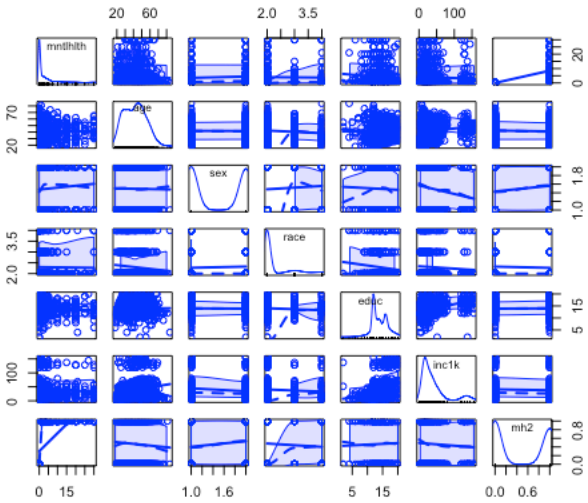
Task 3 Graph Bivariate Scatter Plot

- Drop missing cases

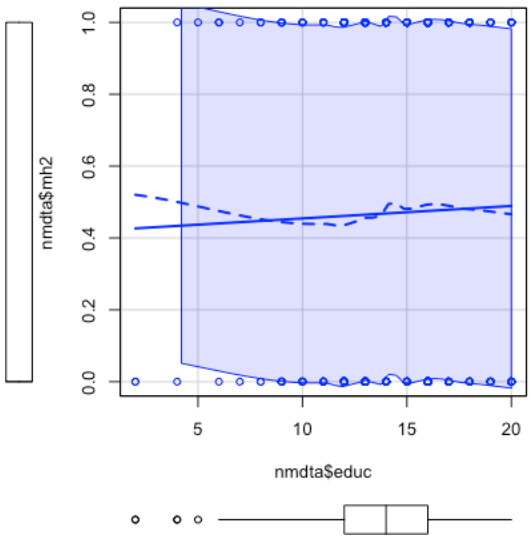
- Draw pairwise bivariate scatter plots (in one graph) and provide a brief description about the sub-graph plotting mntlhlthc2 against educ.

```
> #Task 3 Graph Bivariate Scatterplot
> #Drop Missing Cases
> nmdta <- useddta[complete.cases(useddta),]

> #Create Scatter plot matrix
> scatterplotMatrix(~ mntlhlth + age + sex + race +
+                       educ + inc1k + mntlhc2,
+                     smooth = list(span = 0.7), data = useddta)
```




```
> scatterplot(nmdta$educ,nmdta$mntlhc2)
```



From the scatterplot above, it appears that poor mental health occurs with the same frequency and distribution, regardless of education.

Task 4 Run Logit

- Run a logit model of mntlhlthc2 on age (age), sex (sex; male is used as the reference category), race (race; white is used as the reference category), education (educ), and income (inc1k)

```
> #Task 4 Run Logit
> logit.model <- glm(mntlhc2 ~ age + female + nonwhite + educ + inc1k, family = binomial(link =
'logit'),
+                    data = useddta)

> coef(logit.model)
 (Intercept)          age       female     nonwhite         educ        inc1k
-0.211867666 -0.007896290  0.532314849 -0.375736361  0.022785936 -0.002262255

> summary(logit.model)

Call:
glm(formula = mntlhc2 ~ age + female + nonwhite + educ + inc1k,
    family = binomial(link = "logit"), data = useddta)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.3750  -1.1019  -0.9097   1.1967   1.6133

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -0.211868   0.473886  -0.447 0.654813
age         -0.007896   0.005747  -1.374 0.169414
female       0.532315   0.150556   3.536 0.000407 ***
nonwhite    -0.375736   0.185659  -2.024 0.042991 *
educ         0.022786   0.029540   0.771 0.440492
inc1k       -0.002262   0.002280  -0.992 0.321134
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1036.6  on 749  degrees of freedom
Residual deviance: 1016.6  on 744  degrees of freedom
  (4956 observations deleted due to missingness)
AIC: 1028.6

Number of Fisher Scoring iterations: 4
```

Tasks 5 Produce and Interpret Odds Ratio (Coefficients)

- Produce odds ratio coefficients and provide substantive interpretation of the odds ratio coefficients and their precision estimates (i.e., confidence intervals) for sex, education, and race.

```
> #Task 5 Produce and Interpret Odds Ratio
> exp(logit.model$coefficients)
(Intercept)         age      female    nonwhite        educ       inc1k
  0.8090718   0.9921348   1.7028696   0.6867834   1.0230475   0.9977403

> #Create confidence intervals ... for fun
> exp(confint(logit.model))
                2.5 %   97.5 %
(Intercept) 0.3183974 2.046213
age         0.9809774 1.003349
female      1.2688314 2.290031
nonwhite    0.4757934 0.986059
educ        0.9656190 1.084432
inc1k       0.9932471 1.002187
```

Odds Ratio Interpretations:
Being nonwhite versus white decreases the odds of being mentally well by a factor of 0.6868, on average.

Being female versus males increases the odds of being mentally well by a factor of 1.7029, on average.

Holding all variables constant, for each additional year of education, we would expect the odds of being mentally well to increase by a factor or 1.02304.

Confidence Intervals
We are 95% confident that the odds ratio coefficient for education in the population to be between 0.9656 and 1.0844.

We are 95% confident that the odds ratio coefficient for nonwhite in the population to be between 0.47579 and 0.9861.

We are 95% confident that the odds ratio coefficient for female in the population to be between 1.269 and 2.29.

R Script

```
#
source("/Users/burrisfaculty/Desktop/DSCode/SOC686/Shepherd_Lab0
3_SOC686.R", echo = TRUE, max.deparse.length = 1000)

#Open Log and Read in Data
sink("assign_03_shepherd.log")
rm(list=ls(all = TRUE))
setwd("/Users/burrisfaculty/Desktop/DSCode/SOC686")
library(foreign)
library(carData)
library(car)
mygss <- read.dta("gsscum7212teach.dta")

#Select, Tabulate and Summarize Variables for Analysis
usevar <- c("mntlhlth",'age','sex','race','educ','inc1k')
useddta <- mygss[usevar]

table(useddta$mntlhlth, useNA = c("ifany"))
summary(useddta$mntlhlth)
table(useddta$age, useNA = c("ifany"))
summary(useddta$age)
table(useddta$sex, useNA = c("ifany"))
summary(useddta$sex)
table(useddta$race, useNA = c("ifany"))
```

```
summary(useddta$race)
table(useddta$educ, useNA = c("ifany"))
summary(useddta$educ)
table(useddta$inc1k, useNA = c("ifany"))
summary(useddta$inc1k)

#TASK 1: Create Binary Response Variables
# 1 = poor mental health mntlhl > 0
useddta$mntlhc2 <- ifelse(useddta$mntlhlth > 0, 1, 0)

#Create dummy variables female (male = 0)
useddta$female <- as.numeric(useddta$sex == "female")



#Task 2: Create Binary Indicator Variables for Multi-Category
Nomial Variables
#Create dummy variables for race
useddta$raceF <- factor(useddta$race,
                        levels = c(1,2,3,NA),
                        labels = c("1white", "2black",
"3other"))
table(useddta$raceF,useddta$race, useNA = 'ifany')
useddta$nonwhite <- as.numeric(useddta$race != 'white')
# In document discuss how many can be used in the regression
model
# In document discuss how to interpret the coefficient

#Task 3 Graph Bivariate Scatterplot
#Drop Missing Cases
nmdta <- useddta[complete.cases(useddta),]

#Create Scatter plot matrix
scatterplotMatrix(~ mntlhlth + age + sex + race +
                   educ + inc1k + mntlhc2,
                  smooth = list(span = 0.7), data = useddta)
scatterplot(useddta$educ,useddta$mntlhc2)
#Describe scatterplot

#Task 4 Run Logit
logit.model <- glm(mntlhc2 ~ age + female + nonwhite + educ +
inc1k, family = binomial(link = 'logit'),
                   data = useddta)
coef(logit.model)
summary(logit.model)
#Task 5 Produce and Interpret Odds Ratio
exp(logit.model$coefficients)
```

```
#Create confidence intervals ... for fun
exp(confint(logit.model))

#Close Out
save(useddta, file = "Assignment_03.rdata")
sink()
```

Log

```
> rm(list=ls(all = TRUE))

> setwd("/Users/burrisfaculty/Desktop/DSCode/SOC686")

> library(foreign)

> library(carData)

> library(car)

> mygss <- read.dta("gsscum7212teach.dta")

> #Select, Tabulate and Summarize Variables for Analysis
> usevar <- c("mntlhlth",'age','sex','race','educ','inc1k')

> useddta <- mygss[usevar]

> table(useddta$mntlhlth, useNA = c("ifany"))

   0    1    2    3    4    5    6    7    8   10   12   14   15   16   18   20   21   25   27
30 <NA>
 401   34   62   37   29   39    6   19    2   35    3    4   22    1    2   21    2    9    1
23 4954

> summary(useddta$mntlhlth)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
   0.00    0.00    0.00    3.98    5.00   30.00    4954

> table(useddta$age, useNA = c("ifany"))

  18   19   20   21   22   23   24   25   26   27   28   29   30   31   32   33   34   35   36
37   38   39
  27   92   91   93   80  119  111  123  114  125  151  124  118  117  143  126  136  114  131
107  121   91
  40   41   42   43   44   45   46   47   48   49   50   51   52   53   54   55   56   57   58
59   60   61
 102  111   95  123  115   83  112   89   99  117   99   91   98   76   80   80   73   72   74
69   81   70
  62   63   64   65   66   67   68   69   70   71   72   73   74   75   76   77   78   79   80
81   82   83
  77   78   71   74   58   72   67   71   62   49   58   49   54   37   37   43   46   25   21
26    9   23
  84   85   86   87   88   89 <NA>
  22   21   16   14   10   35   18

> summary(useddta$age)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
  18.00   31.00   43.00   45.57   59.00   89.00      18

> table(useddta$sex, useNA = c("ifany"))

  male female
  2480   3226

> summary(useddta$sex)
  male female
  2480   3226
```

```
> table(useddta$race, useNA = c("ifany"))

  iap white black other
    0  4644   770   292

> summary(useddta$race)
  iap white black other
    0  4644   770   292

> table(useddta$educ, useNA = c("ifany"))

   0    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18
19   20 <NA>
  20    7   15   25   33   30   85   90  251  213  216  350 1817  479  580  249  679  167  189
91  102   18

> summary(useddta$educ)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
    0.0    12.0    12.0    12.7    15.0    20.0      18

> table(useddta$inc1k, useNA = c("ifany"))

0.245000049471855  0.25900000333786 0.267749965190887 0.284249991178513 0.301900029182434
0.312849968671799
                6                 3                 2                 7                 6
1
0.345000028610229 0.363000065088272 0.382000058889389 0.444000065326691 0.482999950647354
0.510000050067902
                1                 4                 1                 1                 2
1
0.550000071525574 0.602999866008759 0.904999792575836 0.962999880313873 0.980000197887421
1.03600001335144
                2                 5                 3                 2                 1
2
 1.07099986076355   1.1120001077652  1.13700008392334  1.20760011672974  1.23399996757507
1.25139987468719
                1                 2                 4                 4                 4
2
 1.31000018119812  1.32999980449677  1.37799978256226  1.45000004768372  1.52800023555756
1.57200014591217
                4                 3                 4                 3                 3
3
 1.67099976539612   1.7150000333786  1.81299960613251  1.92999982833862  1.98974978923798
2.00000023841858
                3                 2                 3                 2                 3
2
 2.11100053787231  2.11329984664917  2.18995046615601  2.20100021362305  2.20500040054321
2.27200055122375
                5                 3                 2                 4                 1
4
 2.32699966430664  2.40974974632263  2.41100025177002  2.53800058364868  2.55825018882751
2.67400002479553
                3                 3                 9                 4                 5
1
 2.69500041007996  2.70700025558472   2.7171003818512  2.75099968910217  2.81564974784851
2.84899997711182
                1                13                 3                 5                 1
3
 2.92499923706055   2.9452497959137  2.99200034141541  3.02099895477295  3.09999847412109
3.10499882698059
                3                 2                 1                 4                 1
4
 3.12675023078918  3.24699878692627  3.26300096511841  3.31584334373474  3.32883048057556
3.36700057983398
                8                 2                 3                 1                 1
4
 3.37264037132263  3.37800002098083  3.43799901008606  3.44135165214539  3.48074817657471
3.50000143051147
                1                 2                 5                 4                 3
3
```

3.5369987487793	3.56700110435486	3.61899828910828	3.65699911117554	3.67500066757202
3.69500041007996				
2	5	9	3	2
5				
3.69525074958801	3.74912452697754	3.75999879837036	3.78900098800659	3.85199952125549
3.88499999046326				
8	1	5	3	13
3				
3.92470073699951	3.96213483810425	3.9760000705719	3.98800015449524	4.01625156402588
4.06704807281494				
4	1	2	4	3
3				
4.0740008354187	4.11047840118408	4.17499876022339	4.20200109481812	4.21999979019165
4.2637505531311				
10	1	4	8	12
6				
4.32199907302856	4.32300090789795	4.34300088882446	4.34620380401611	4.41000080108643
4.44700145721436				
5	2	3	1	4
14				
4.47800064086914	4.50000047683716	4.5285005569458	4.57300615310669	4.58700037002563
4.59599924087524				
3	9	1	1	6
3				
4.66200017929077	4.69275188446045	4.71300172805786	4.74999809265137	4.81950187683105
4.87900114059448				
4	4	6	6	5
3				
4.93499755859375	4.95199823379517	4.96600151062012	4.9870023727417	5.10199928283691
5.10900163650513				
15	7	1	8	4
2				
5.11199855804443	5.11650037765503	5.16700172424316	5.24200248718262	5.2870020866394
5.30799865722656				
6	7	5	6	5
6				
5.42499923706055	5.43199872970581	5.43420076370239	5.43800067901611	5.49999809265137
5.51250123977661				
10	2	6	3	5
7				
5.60599994659424	5.63130235671997	5.7300009727478	5.76599931716919	5.80599880218506
5.8274998664856				
2	8	4	1	3
7				
5.89500093460083	5.89644050598145	5.98500204086304	6.02437734603882	6.02999925613403
6.0529990196228				
4	1	9	10	4
5				
6.05927133560181	6.15190982818604	6.20099973678589	6.23559617996216	6.24800157546997
6.26700258255005				
1	1	7	1	3
3				
6.27299976348877	6.30417394638062	6.33300161361694	6.39562606811523	6.45313119888306
6.49999856948853				
3	1	6	19	1
4				
6.52499723434448	6.62500190734863	6.63100051879883	6.65299940109253	6.73749876022339
6.74100160598755				
9	1	9	6	8
10				
6.74680233001709	6.7927508354187	6.79427337646484	6.7979998588562	6.86100101470947
6.87600088119507				
1	3	1	4	3
6				
6.9580020904541	7.03912782669067	7.03949069976807	7.04162549972534	7.0740008354187
7.11407232284546				
2	6	1	1	3
1				
7.11829328536987	7.12249708175659	7.13000011444092	7.15299940109253	7.23799991607666
7.36312437057495				

```
                1                 6                10                 3                 4
6
 7.38400220870972  7.48100280761719  7.49999761581421  7.52099800109863  7.64399862289429
7.65081071853638
                3                14                 8                 2                 2
1
 7.71156692504883  7.75099802017212  7.78200244903564  7.81687259674072  7.83600234985352
7.83913421630859
                1                 8                11                17                 7
1
 7.86015462875366  7.88833808898926  7.91699934005737  7.96249914169312   7.9840030670166
8.12199974060059
                1                 1                 3                 8                 7
12
 8.14200115203857  8.15599727630615  8.25400257110596   8.2664966583252  8.29364585876465
8.30224704742432
                7                13                 8                 1                 1
9
 8.30799674987793  8.31664657592773  8.34899711608887  8.41749668121338  8.43902206420898
8.5200023651123
                4                 1                 5                 7                 1
3
 8.59500217437744  8.60337543487549  8.63600063323975  8.66699886322021  8.68500423431396
8.69449234008789
               15                 8                 7                 4                 5
1
 8.70187473297119  8.70726299285889  8.84299945831299  8.87659358978271  8.99999713897705
9.04199695587158
                5                 1                 8                 1                 6
7
 9.06238746643066  9.07034301757812  9.14223098754883  9.14299869537354  9.16699981689453
9.17300033569336
                1                 1                 1                 8                 3
17
 9.18749809265137  9.23812294006348  9.24072170257568   9.3040189743042  9.40099716186523
9.47300434112549
                6                11                 1                 1                10
12
              9.5   9.5033073425293  9.62625789642334  9.64777278900146  9.71249580383301
9.75203418731689
                4                 1                 1                 1                 3
1
 9.75462055206299  9.81174850463867  9.81900215148926  9.85030937194824  9.86153221130371
9.90500164031982
                1                 6                 7                 1                 1
5
 9.95200347900391  9.96899795532227  9.97226810455322  9.98000431060791  10.0050001144409
10.0112991333008
                3                10                 1                 7                 3
1
  10.040623664856  10.0774421691895  10.1676263809204  10.1768712997437  10.2203073501587
10.2229976654053
                5                 1                 8                 1                 1
8
 10.2312297821045  10.2455148696899  10.3233404159546   10.387354850769  10.3965711593628
10.4124975204468
                1                 1                 1                 1                 1
11
 10.4359979629517  10.4838199615479   10.504997253418  10.5187711715698  10.5940046310425
10.6593713760376
                6                 1                 9                 1                 6
13
 10.7324876785278  10.7467136383057  10.8060026168823  10.8069925308228  10.8080015182495
10.816065788269
                1                 1                15                 1                 6
1
 10.8183240890503  10.8472929000854  10.8500032424927  10.8570003509521    10.86243724823
10.892219543457
                1                 1                 7                11                 1
1
```

10.9157829284668	10.9222602844238	10.9857225418091	11.0075044631958	11.0141201019287
11.0360431671143				
1	1	1	6	1
1				
11.0463190078735	11.0499439239502	11.0514621734619	11.1030035018921	11.111011505127
11.1368961334229				
1	1	1	1	1
1				
11.1959991455078	11.2050037384033	11.2282056808472	11.2499961853027	11.3173589706421
11.3212461471558				
4	7	1	12	1
7				
11.3290014266968	11.3793725967407	11.3844528198242	11.4659976959229	11.4900035858154
11.5382747650146				
4	9	1	9	9
1				
11.6375017166138	11.6599760055542	11.6940622329712	11.7184782028198	11.7318754196167
11.744647026062				
6	1	1	1	10
1				
11.7609996795654	11.7724018096924	11.7810049057007	11.793999671936	11.8189172744751
11.8489255905151				
9	1	6	4	1
1				
11.875997543335	11.9353685379028	12.063362121582	12.0806198120117	12.1227216720581
12.1687984466553				
8	1	1	14	1
1				
12.174464225769	12.1969966888428	12.22900390625	12.3024988174438	12.3177843093872
12.3274793624878				
1	4	5	9	1
1				
12.3418779373169	12.3565406799316	12.3810052871704	12.4090557098389	12.4149980545044
12.467999458313				
1	1	5	1	13
9				
12.5199966430664	12.5951814651489	12.71812915802	12.718165397644	12.7560033798218
12.7729969024658				
5	1	4	1	6
9				
12.7790040969849	12.8147125244141	12.8245306015015	12.8307447433472	12.8385782241821
12.8903274536133				
10	1	1	12	1
1				
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 [ reached getOption("max.print") -- omitted 135 entries ]

> summary(useddta$inc1k)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.245  12.481  22.605  30.279  37.226 162.607

> #TASK 1: Create Binary Response Variables
> # 1 = poor mental health mntlhl > 0
> useddta$mntlhc2 <- ifelse(useddta$mntlhlth > 0, 1, 0)

> #Create dummy variables female (male = 0)
> useddta$female <- as.numeric(useddta$sex == "female")
```

```
> #Task 2: Create Binary Indicator Variables for Multi-Category Nomial Variables
> #Create dummy variables for race
> useddta$raceF <- factor(useddta$race,
+                         levels = c(1,2,3,NA),
+                         labels = c("1white", "2black", "3other"))

> table(useddta$raceF,useddta$race, useNA = 'ifany')

          iap white black other
  1white    0     0     0     0
  2black    0     0     0     0
  3other    0     0     0     0
  <NA>      0  4644   770   292

> useddta$nonwhite <- as.numeric(useddta$race != 'white')

> # In document discuss how many can be used in the regression model
> # In document discuss how to interpret the coefficient
>
> #Task 3 Graph Bivariate Scatterplot
> #Drop Missing Cases
> nmdta <- useddta[complete.cases(useddta),]

> #Create Scatter plot matrix
> scatterplotMatrix(~ mntlhlth + age + sex + race +
+                     educ + inc1k + mntlhc2,
+                   smooth = list(span = 0.7), data = useddta)

> scatterplot(useddta$educ,useddta$mntlhc2)

> #Describe scatterplot
>
> #Task 4 Run Logit
> logit.model <- glm(mntlhc2 ~ age + female + nonwhite + educ + inc1k, family = binomial(link =
'logit'),
+                    data = useddta)

> coef(logit.model)
 (Intercept)          age       female     nonwhite         educ        inc1k
-0.211867666 -0.007896290  0.532314849 -0.375736361  0.022785936 -0.002262255

> summary(logit.model)

Call:
glm(formula = mntlhc2 ~ age + female + nonwhite + educ + inc1k,
    family = binomial(link = "logit"), data = useddta)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.3750  -1.1019  -0.9097   1.1967   1.6133

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -0.211868   0.473886  -0.447 0.654813
age         -0.007896   0.005747  -1.374 0.169414
female       0.532315   0.150556   3.536 0.000407 ***
nonwhite    -0.375736   0.185659  -2.024 0.042991 *
educ         0.022786   0.029540   0.771 0.440492
inc1k       -0.002262   0.002280  -0.992 0.321134
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1036.6  on 749  degrees of freedom
Residual deviance: 1016.6  on 744  degrees of freedom
  (4956 observations deleted due to missingness)
AIC: 1028.6

Number of Fisher Scoring iterations: 4
```

```
> #Task 5 Produce and Interpret Odds Ratio
> exp(logit.model$coefficients)
(Intercept)         age      female    nonwhite        educ       inc1k
  0.8090718   0.9921348   1.7028696   0.6867834   1.0230475   0.9977403

> #Create confidence intervals ... for fun
> exp(confint(logit.model))
                2.5 %   97.5 %
(Intercept) 0.3183974 2.046213
age         0.9809774 1.003349
female      1.2688314 2.290031
nonwhite    0.4757934 0.986059
educ        0.9656190 1.084432
inc1k       0.9932471 1.002187

> #Close Out
> save(useddta, file = "Assignment_03.rdata")

> sink()
```