Model 02

2024-06-17

#Importing the necessary libraries

```
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

library(tidyr)
library(prettyR)
library(dplyr)
library(caret)

## Warning: package 'caret' was built under R version 4.3.3

## Loading required package: ggplot2

## Warning: package 'ggplot2' was built under R version 4.3.3

## Loading required package: lattice

library(rpart)
library(partykit)

## Warning: package 'partykit' was built under R version 4.3.3

## Loading required package: grid

## Loading required package: libcoin

## Warning: package 'libcoin' was built under R version 4.3.3

## Loading required package: mvtnorm

## Warning: package 'mvtnorm' was built under R version 4.3.3

library(prettyR)
```

Loading the data file from Wave 2 interviews to calculate the BMI

```
load("34921-0001-Data.rda")

da34921.0001 <- da34921.0001 %>%
  mutate(
         OBESITY = case_when(
           ((WEIGHT)/(HEIGHT*HEIGHT) * 703) >= 30.000 ~ 1,
           ((WEIGHT)/(HEIGHT*HEIGHT) * 703) < 30.000 ~ 0
         ))

obesity <- da34921.0001 %>% select(ID, OBESITY)
head(obesity)

##       ID OBESITY
## 1 100005       0
## 2 100033       1
## 3 100067       0
## 4 100080       1
## 5 100149       1
## 6 100154       0
```

Loading and Processing the Independent Social Network Variables to calculate Bridge from WAVE 1.

```
load("20541-0001-Data.rda")
load("20541-0004-Data.rda")


da20541.0001 <- da20541.0001 %>%
  select (ID, HEARN_RECODE, GENDER, AGE, RACE_RECODE, ETHGRP, COMBUILD,
DEGREE_RECODE, HISPANIC, MARITLST,JOBSTAT_1, PHYSHLTH, MNTLHLTH, ATNDSERV )

da20541.0001 <- da20541.0001 %>%
  mutate(DEGREE_RECODE = if_else(DEGREE_RECODE == "(-2) don't know", NA,
DEGREE_RECODE),
         HEARN_RECODE = if_else(HEARN_RECODE == "(-2) don't know", NA,
HEARN_RECODE),
         RACE_RECODE = if_else(RACE_RECODE == "(-2) don't know", NA,
RACE_RECODE))

head(da20541.0001)

##       ID       HEARN_RECODE     GENDER AGE         RACE_RECODE
## 1 100005 (4) 100k or higher (2) female  62 (1) white/caucasian
## 2 100033  (2) 25,000-49,999 (2) female  79 (1) white/caucasian
## 3 100080  (3) 50,000-99,999   (1) male  60 (1) white/caucasian
## 4 100154  (2) 25,000-49,999 (2) female  78 (1) white/caucasian
## 5 100203               <NA> (2) female  61 (1) white/caucasian
## 6 100359  (3) 50,000-99,999   (1) male  75 (1) white/caucasian
##                    ETHGRP          COMBUILD
DEGREE_RECODE
## 1               (1) white       (3) average                         (5)
masters
## 2               (1) white (4) above average (2) high school
diploma/equivalency
## 3               (1) white       (3) average (2) high school
diploma/equivalency
## 4               (1) white       (3) average (2) high school
diploma/equivalency
## 5 (3) hispanic, non-black       (3) average                            (1)
none
## 6               (1) white       (3) average (2) high school
diploma/equivalency
##   HISPANIC    MARITLST JOBSTAT_1      PHYSHLTH      MNTLHLTH
## 1   (0) no (1) married   (1) yes (4) very good (4) very good
## 2   (0) no (5) widowed    (0) no (4) very good (4) very good
## 3   (0) no (1) married   (1) yes      (3) good (5) excellent
## 4   (0) no (1) married    (0) no      (3) good      (3) good
## 5  (1) yes (5) widowed   (1) yes      (1) poor      (2) fair
## 6   (0) no (1) married    (0) no      (2) fair      (3) good
##                    ATNDSERV
## 1  (3) several times a year
## 2 (1) less than once a year
## 3            (5) every week
## 4  (6) several times a week
## 5                 (0) never
## 6  (6) several times a week
```

```
nrow(da20541.0001)
```

```
## [1] 3005
```

```
da20541.0004 <- da20541.0004 %>%
  group_by(ID) %>%
  filter(n() > 2) %>%
  ungroup()

da20541.0004 <- da20541.0004 %>%
  pivot_longer(
    cols = starts_with("TALKFREQ"),
    names_to = "TALKFREQ",
    values_to = "FREQ"
  )

da20541.0004 <- da20541.0004 %>%
  group_by(ID) %>%
  summarize(
    BRIDGE = if_else(any(FREQ == '(0) have never spoken to each other', na.rm
= TRUE), 1, 0),
    HEALTHDISCUSSIONS = if_else(any(HEALTHTALK == '(3) very likely', na.rm =
TRUE), 1, 0),
    LIVEALONE = if_else(any(LIVEWITH == '(1) yes -- lives in the same
household', na.rm = TRUE), 0,1))

head(da20541.0004)

## # A tibble: 6 × 4
##   ID     BRIDGE HEALTHDISCUSSIONS LIVEALONE
##   <fct>   <dbl>             <dbl>     <dbl>
## 1 100005      1                 1         0
## 2 100033      0                 1         0
## 3 100080      1                 1         0
## 4 100154      1                 1         0
## 5 100203      0                 1         0
## 6 100359      0                 1         0

nrow(da20541.0004)

## [1] 2522

modeldata <- da20541.0001 %>%
  left_join(da20541.0004, by = "ID")

modeldata <- modeldata %>%
  left_join(obesity, by = "ID")

modeldata<- na.omit(modeldata)
modeldata <- modeldata %>% select(-ID)

modeldata$BRIDGE <- as.factor(modeldata$BRIDGE)
modeldata$HEALTHDISCUSSIONS <- as.factor(modeldata$HEALTHDISCUSSIONS)
modeldata$LIVEALONE <- as.factor(modeldata$LIVEALONE)
modeldata$OBESITY <- as.factor(modeldata$OBESITY)

modeldata <- modeldata %>% select(BRIDGE,HEALTHDISCUSSIONS, ATNDSERV,
OBESITY)
head(modeldata)

##   BRIDGE HEALTHDISCUSSIONS                       ATNDSERV OBESITY
## 1      1                 1       (3) several times a year       0
## 2      0                 1      (1) less than once a year       1
## 3      1                 1                 (5) every week       1
## 4      1                 1       (6) several times a week       0
## 7      0                 1                 (5) every week       0
## 9      1                 1 (2) about once or twice a year       0
```

Creating Data Partition for 70% Training Data and 30% Testing Data

```
library(rpart)
library(caret)
```

```
set.seed(19032023)

index <- createDataPartition(modeldata$OBESITY,
                             p=0.7,
                             list=FALSE,
                             times = 1
                          )

modeldata.train <- modeldata[index,]
modeldata.test <- modeldata[-index,]

nrow(modeldata.train)

## [1] 995

nrow(modeldata.test)

## [1] 425
```

Applying Logistic Regression on to find the association between Bridge and Obesity.

```
model.lr <- glm(OBESITY ~ ., data = modeldata.train, family = "binomial")

summary.lr <- summary(model.lr)
```

p-value for Bridge variable

```
print(summary.lr)

##
## Call:
## glm(formula = OBESITY ~ ., family = "binomial", data = modeldata.train)
##
## Coefficients:
##                                          Estimate Std. Error z value
Pr(>|z|)
## (Intercept)                            -1.027671   0.538241  -1.909
0.0562 .
## BRIDGE1                                -0.331379   0.132519  -2.501
0.0124 *
## HEALTHDISCUSSIONS1                      0.663332   0.525805   1.262
0.2071
## ATNDSERV(1) less than once a year      -0.176920   0.392388  -0.451
0.6521
## ATNDSERV(2) about once or twice a year -0.000846   0.278230  -0.003
0.9976
## ATNDSERV(3) several times a year        0.381114   0.250173   1.523
```

```
0.1277
## ATNDSERV(4) about once a month          0.127340   0.267209   0.477
0.6337
## ATNDSERV(5) every week                 -0.085351   0.201324  -0.424
0.6716
## ATNDSERV(6) several times a week        0.279676   0.236659   1.182
0.2373
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1327.1  on 994  degrees of freedom
## Residual deviance: 1311.8  on 986  degrees of freedom
## AIC: 1329.8
##
## Number of Fisher Scoring iterations: 4
```

```
names(coef(model.lr))
```

```
## [1] "(Intercept)"
## [2] "BRIDGE1"
## [3] "HEALTHDISCUSSIONS1"
## [4] "ATNDSERV(1) less than once a year"
## [5] "ATNDSERV(2) about once or twice a year"
## [6] "ATNDSERV(3) several times a year"
## [7] "ATNDSERV(4) about once a month"
## [8] "ATNDSERV(5) every week"
## [9] "ATNDSERV(6) several times a week"
```

Odds Ratio and 95% Confidence Interval

```
odds_ratio <- exp(coef(model.lr)["BRIDGE1"])
print(odds_ratio)
```

```
##   BRIDGE1
## 0.7179334
```

```
conf_int <- exp(confint(model.lr, "BRIDGE1"))
```

```
## Waiting for profiling to be done...
```

```
print(conf_int)
```

```
##     2.5 %    97.5 %
## 0.5532668 0.9303226
```

```
predicted.prob.lr <- predict(model.lr, modeldata.test, type = "response")
predicted.obesity.lr <- ifelse(predicted.prob.lr > 0.5, 1, 0)

actual.obesity.lr <- modeldata.test$OBESITY
```

```
conf.matrix.lr <- table(Predicted = predicted.obesity.lr, Actual =
actual.obesity.lr)

print(conf.matrix.lr)
```

```
##          Actual
## Predicted   0   1
##         0 241 157
##         1  20   7
```

```
confusionMatrix(factor(predicted.obesity.lr), factor(modeldata.test$OBESITY),
positive = as.character(1))
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction   0   1
##          0 241 157
##          1  20   7
##
##                Accuracy : 0.5835
##                  95% CI : (0.535, 0.6308)
##     No Information Rate : 0.6141
##     P-Value [Acc > NIR] : 0.9103
##
##                   Kappa : -0.0402
##
##  Mcnemar's Test P-Value : <2e-16
##
##             Sensitivity : 0.04268
##             Specificity : 0.92337
##          Pos Pred Value : 0.25926
##          Neg Pred Value : 0.60553
##              Prevalence : 0.38588
##          Detection Rate : 0.01647
##    Detection Prevalence : 0.06353
##       Balanced Accuracy : 0.48303
##
##        'Positive' Class : 1
##
```

Decision Tree

Classification and Regression Tree implementation using rpart

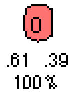
```
rpart.tree <- rpart(OBESITY ~ ., data = modeldata.train, parms  = list(split
= "information"))
rpart.tree
```

```
## n= 995
##
## node), split, n, loss, yval, (yprob)
##       * denotes terminal node
##
## 1) root 995 384 0 (0.6140704 0.3859296) *
```

```r
library(rpart.plot)
```

```
## Warning: package 'rpart.plot' was built under R version 4.3.3
```

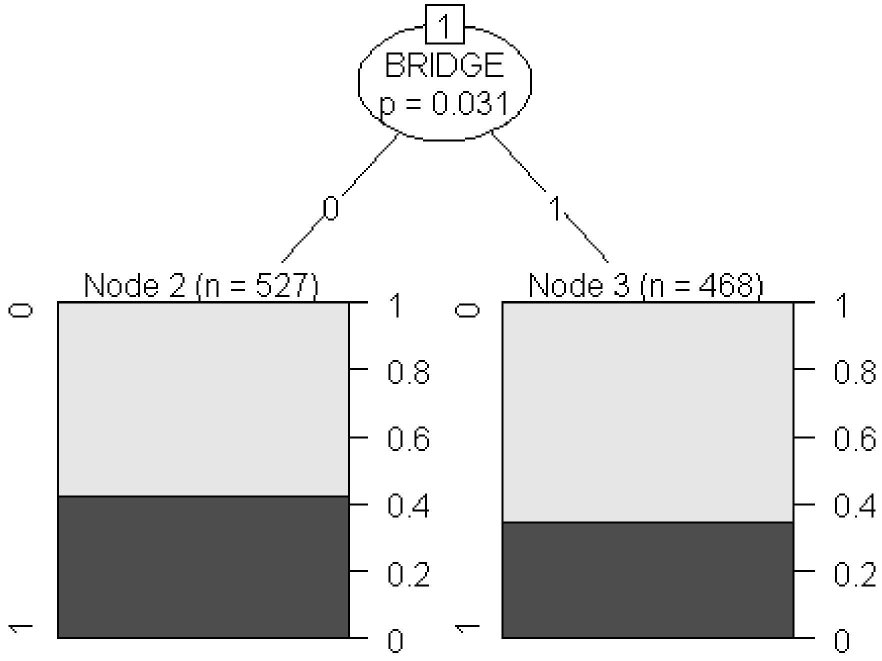
```r
rpart.plot(
  rpart.tree,
  type = 2,
  extra = 104,
  under = TRUE,
  cex = 0.7,
  #tweak = 1.1,
  box.palette = "RdYlGn",
  compress = TRUE
)
```



# Cinditional Inference Tree implementation using rpart

```r
set.seed(123)

model.dt <- ctree(OBESITY ~ .,
                              data=modeldata.train)
plot(model.dt)
```


BRIDGE
p = 0.031
Node 2 (n = 527)
Node 3 (n = 468)