EDA

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'r Sys.Date()

```r
library(tidyverse)
library(knitr)
library(broom)
library(nnet) # for multinomial logistic regression
library(patchwork)
```

```r
us_19 <- read_csv('~/df_data/US/us_19.csv') %>%
  mutate(DAST_binary = if_else(DAST_SUM < 3, 0, 1))
#glimpse(us_19)
```

```r
col_names <- colnames(us_19)
us_19 <- lapply(us_19, as.factor)
us_19 <- data.frame(matrix(unlist(us_19), nrow=length(us_19), byrow=TRUE))
us_19 <- data.frame(t(us_19))
colnames(us_19) <- col_names
```

EDA

Distribution of Binary Response Variable

```r
ggplot(data = us_19, aes(x = DAST_binary))+
  geom_bar(fill = "#00539B") +
  labs(title = "Distribution of Binary DAST-10 Score Category",
       x = "DAST-10 Score Category", y = "Count") +
  scale_x_discrete(labels=c("0" = "DAST_SUM < 3", "1" = "DAST_SUM > 3"))
```
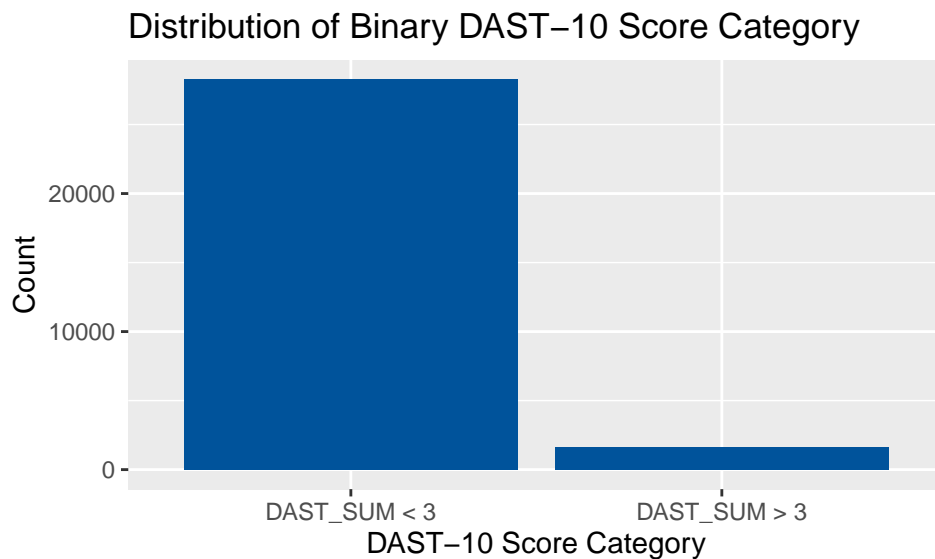
```
theme_bw()
```

```
## List of 93
##  $ line                      :List of 6
##   ..$ colour       : chr "black"
##   ..$ size         : num 0.5
##   ..$ linetype     : num 1
##   ..$ lineend      : chr "butt"
##   ..$ arrow        : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
##  $ rect                      :List of 5
##   ..$ fill         : chr "white"
##   ..$ colour       : chr "black"
##   ..$ size         : num 0.5
##   ..$ linetype     : num 1
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_rect" "element"
##  $ text                      :List of 11
##   ..$ family       : chr ""
##   ..$ face         : chr "plain"
##   ..$ colour       : chr "black"
##   ..$ size         : num 11
##   ..$ hjust        : num 0.5
##   ..$ vjust        : num 0.5
##   ..$ angle        : num 0
##   ..$ lineheight   : num 0.9
##   ..$ margin       : 'margin' num [1:4] 0points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ title                     : NULL
##  $ aspect.ratio              : NULL
##  $ axis.title                : NULL
##  $ axis.title.x              :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : NULL
##   ..$ vjust        : num 1
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 2.75points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.title.x.top          :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
```

```
##   ..$ hjust      : NULL
##   ..$ vjust      : num 0
##   ..$ angle      : NULL
##   ..$ lineheight : NULL
##   ..$ margin     : 'margin' num [1:4] 0points 0points 2.75points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.x.bottom      : NULL
## $ axis.title.y             :List of 11
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : NULL
##   ..$ size       : NULL
##   ..$ hjust      : NULL
##   ..$ vjust      : num 1
##   ..$ angle      : num 90
##   ..$ lineheight : NULL
##   ..$ margin     : 'margin' num [1:4] 0points 2.75points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.y.left        : NULL
## $ axis.title.y.right       :List of 11
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : NULL
##   ..$ size       : NULL
##   ..$ hjust      : NULL
##   ..$ vjust      : num 0
##   ..$ angle      : num -90
##   ..$ lineheight : NULL
##   ..$ margin     : 'margin' num [1:4] 0points 0points 0points 2.75points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text                :List of 11
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : chr "grey30"
##   ..$ size       : 'rel' num 0.8
##   ..$ hjust      : NULL
##   ..$ vjust      : NULL
##   ..$ angle      : NULL
##   ..$ lineheight : NULL
##   ..$ margin     : NULL
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x              :List of 11
##   ..$ family     : NULL
```

```
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : NULL
##   ..$ vjust        : num 1
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 2.2points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.text.x.top          :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : NULL
##   ..$ vjust        : num 0
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 0points 0points 2.2points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.text.x.bottom       : NULL
##  $ axis.text.y              :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : num 1
##   ..$ vjust        : NULL
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 0points 2.2points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.text.y.left         : NULL
##  $ axis.text.y.right        :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : num 0
##   ..$ vjust        : NULL
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 0points 0points 0points 2.2points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
```

```
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.ticks                :List of 6
##    ..$ colour       : chr "grey20"
##    ..$ size         : NULL
##    ..$ linetype     : NULL
##    ..$ lineend      : NULL
##    ..$ arrow        : logi FALSE
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_line" "element"
##  $ axis.ticks.x              : NULL
##  $ axis.ticks.x.top          : NULL
##  $ axis.ticks.x.bottom       : NULL
##  $ axis.ticks.y              : NULL
##  $ axis.ticks.y.left         : NULL
##  $ axis.ticks.y.right        : NULL
##  $ axis.ticks.length         : 'simpleUnit' num 2.75points
##    ..- attr(*, "unit")= int 8
##  $ axis.ticks.length.x       : NULL
##  $ axis.ticks.length.x.top   : NULL
##  $ axis.ticks.length.x.bottom: NULL
##  $ axis.ticks.length.y       : NULL
##  $ axis.ticks.length.y.left  : NULL
##  $ axis.ticks.length.y.right : NULL
##  $ axis.line                 : list()
##    ..- attr(*, "class")= chr [1:2] "element_blank" "element"
##  $ axis.line.x               : NULL
##  $ axis.line.x.top           : NULL
##  $ axis.line.x.bottom        : NULL
##  $ axis.line.y               : NULL
##  $ axis.line.y.left          : NULL
##  $ axis.line.y.right         : NULL
##  $ legend.background         :List of 5
##    ..$ fill         : NULL
##    ..$ colour       : logi NA
##    ..$ size         : NULL
##    ..$ linetype     : NULL
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_rect" "element"
##  $ legend.margin             : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points
##    ..- attr(*, "unit")= int 8
##  $ legend.spacing            : 'simpleUnit' num 11points
##    ..- attr(*, "unit")= int 8
##  $ legend.spacing.x          : NULL
##  $ legend.spacing.y          : NULL
##  $ legend.key                :List of 5
##    ..$ fill         : chr "white"
##    ..$ colour       : logi NA
##    ..$ size         : NULL
##    ..$ linetype     : NULL
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_rect" "element"
##  $ legend.key.size           : 'simpleUnit' num 1.2lines
##    ..- attr(*, "unit")= int 3
```

```
## $ legend.key.height        : NULL
## $ legend.key.width         : NULL
## $ legend.text              :List of 11
##  ..$ family      : NULL
##  ..$ face        : NULL
##  ..$ colour      : NULL
##  ..$ size        : 'rel' num 0.8
##  ..$ hjust       : NULL
##  ..$ vjust       : NULL
##  ..$ angle       : NULL
##  ..$ lineheight  : NULL
##  ..$ margin      : NULL
##  ..$ debug       : NULL
##  ..$ inherit.blank: logi TRUE
##  ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ legend.text.align        : NULL
## $ legend.title             :List of 11
##  ..$ family      : NULL
##  ..$ face        : NULL
##  ..$ colour      : NULL
##  ..$ size        : NULL
##  ..$ hjust       : num 0
##  ..$ vjust       : NULL
##  ..$ angle       : NULL
##  ..$ lineheight  : NULL
##  ..$ margin      : NULL
##  ..$ debug       : NULL
##  ..$ inherit.blank: logi TRUE
##  ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ legend.title.align       : NULL
## $ legend.position          : chr "right"
## $ legend.direction         : NULL
## $ legend.justification     : chr "center"
## $ legend.box               : NULL
## $ legend.box.just          : NULL
## $ legend.box.margin        : 'margin' num [1:4] 0cm 0cm 0cm 0cm
##  ..- attr(*, "unit")= int 1
## $ legend.box.background     : list()
##  ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ legend.box.spacing        : 'simpleUnit' num 11points
##  ..- attr(*, "unit")= int 8
## $ panel.background         :List of 5
##  ..$ fill        : chr "white"
##  ..$ colour      : logi NA
##  ..$ size        : NULL
##  ..$ linetype    : NULL
##  ..$ inherit.blank: logi TRUE
##  ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ panel.border             :List of 5
##  ..$ fill        : logi NA
##  ..$ colour      : chr "grey20"
##  ..$ size        : NULL
##  ..$ linetype    : NULL
##  ..$ inherit.blank: logi TRUE
```

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```
##   ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ panel.spacing            : 'simpleUnit' num 5.5points
##   ..- attr(*, "unit")= int 8
## $ panel.spacing.x          : NULL
## $ panel.spacing.y          : NULL
## $ panel.grid               :List of 6
##   ..$ colour      : chr "grey92"
##   ..$ size        : NULL
##   ..$ linetype    : NULL
##   ..$ lineend     : NULL
##   ..$ arrow       : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ panel.grid.major         : NULL
## $ panel.grid.minor         :List of 6
##   ..$ colour      : NULL
##   ..$ size        : 'rel' num 0.5
##   ..$ linetype    : NULL
##   ..$ lineend     : NULL
##   ..$ arrow       : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ panel.grid.major.x       : NULL
## $ panel.grid.major.y       : NULL
## $ panel.grid.minor.x       : NULL
## $ panel.grid.minor.y       : NULL
## $ panel.ontop              : logi FALSE
## $ plot.background          :List of 5
##   ..$ fill        : NULL
##   ..$ colour      : chr "white"
##   ..$ size        : NULL
##   ..$ linetype    : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ plot.title               :List of 11
##   ..$ family      : NULL
##   ..$ face        : NULL
##   ..$ colour      : NULL
##   ..$ size        : 'rel' num 1.2
##   ..$ hjust       : num 0
##   ..$ vjust       : num 1
##   ..$ angle       : NULL
##   ..$ lineheight  : NULL
##   ..$ margin      : 'margin' num [1:4] 0points 0points 5.5points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug       : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.title.position      : chr "panel"
## $ plot.subtitle            :List of 11
##   ..$ family      : NULL
##   ..$ face        : NULL
##   ..$ colour      : NULL
##   ..$ size        : NULL
```

```
##   ..$ hjust        : num 0
##   ..$ vjust        : num 1
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 0points 0points 5.5points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.caption           :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : 'rel' num 0.8
##   ..$ hjust        : num 1
##   ..$ vjust        : num 1
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 5.5points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.caption.position  : chr "panel"
## $ plot.tag               :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : 'rel' num 1.2
##   ..$ hjust        : num 0.5
##   ..$ vjust        : num 0.5
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : NULL
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.tag.position      : chr "topleft"
## $ plot.margin            : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points
##   ..- attr(*, "unit")= int 8
## $ strip.background       :List of 5
##   ..$ fill         : chr "grey85"
##   ..$ colour       : chr "grey20"
##   ..$ size         : NULL
##   ..$ linetype     : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ strip.background.x     : NULL
## $ strip.background.y     : NULL
## $ strip.placement        : chr "inside"
## $ strip.text             :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : chr "grey10"
```

```
##   ..$ size         : 'rel' num 0.8
##   ..$ hjust        : NULL
##   ..$ vjust        : NULL
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 4.4points 4.4points 4.4points 4.4points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ strip.text.x          : NULL
##  $ strip.text.y          :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : NULL
##   ..$ vjust        : NULL
##   ..$ angle        : num -90
##   ..$ lineheight   : NULL
##   ..$ margin       : NULL
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ strip.switch.pad.grid    : 'simpleUnit' num 2.75points
##   ..- attr(*, "unit")= int 8
##  $ strip.switch.pad.wrap    : 'simpleUnit' num 2.75points
##   ..- attr(*, "unit")= int 8
##  $ strip.text.y.left        :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : NULL
##   ..$ vjust        : NULL
##   ..$ angle        : num 90
##   ..$ lineheight   : NULL
##   ..$ margin       : NULL
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  - attr(*, "class")= chr [1:2] "theme" "gg"
##  - attr(*, "complete")= logi TRUE
##  - attr(*, "validate")= logi TRUE
```

Distribution of demographic predictor variables

```r
gender <- ggplot(data = us_19, aes(x = DEM_GENDER))+
  geom_bar(fill = "#00539B") +
    xlab("Gender") + ylab("Count") +
    ggtitle("Gender of Respondent") +
    scale_x_discrete(labels=c("1" = "Male", "2" = "Female")) +
    theme_bw(base_size = 9) +
    theme(plot.title = element_text(size = 9, hjust = 0.5))
```

```r
age <- ggplot(data = us_19, aes(x = DEM_AGE10))+
  geom_bar(fill = "#00539B") +
   xlab("Age") + ylab("Count") +
   ggtitle("Age of Respondent") +
   scale_x_discrete(labels=c("1" = "18-24", "2" = "25-34 ", "3" = "35-44",
                             "4" = "45-54", "5" = "55-64", "6" = "65+")) +
   theme_bw(base_size = 9) +
   theme(plot.title = element_text(size = 9, hjust = 0.5))

region <- ggplot(data = us_19, aes(x = DEM_REGION))+
  geom_bar(fill = "#00539B") +
   xlab("Region") + ylab("Count") +
   ggtitle("Region Currently Living In") +
   scale_x_discrete(labels=c("1" = "Northeast ", "2" = "Midwest", "3" = "South ",
                             "4" = "West ")) +
   theme_bw(base_size = 9) +
   theme(plot.title = element_text(size = 9, hjust = 0.5))

income <- ggplot(data = us_19, aes(x = DEM_INCOME))+
  geom_bar(fill = "#00539B") +
   xlab("Income (in $)") + ylab("Count") +
   ggtitle("Combined Household Income in the Last 12 Months") +
   scale_x_discrete(labels=c("1" = "< 25,000", "2" = "25,000-49,999", "3" = "50,000-74,999",
                             "4" = "75,000-99,999", "5" = "> 100,000")) +
   theme_bw(base_size = 9) +
   theme(plot.title = element_text(size = 9, hjust = 0.5))

smoking <- ggplot(data = us_19, aes(x = TOB_LIFE))+
  geom_bar(fill = "#00539B") +
   xlab("Response") + ylab("Count") +
   ggtitle("Smoking Status") +
   scale_x_discrete(labels=c("1" = "Every day", "2" = "Some days", "3" = "Not at all",
                             "4" = "Don't know")) +
   theme_bw(base_size = 9) +
   theme(plot.title = element_text(size = 9, hjust = 0.5))

(gender | age ) /
  (region | smoking)
```

```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>
```

```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>
```
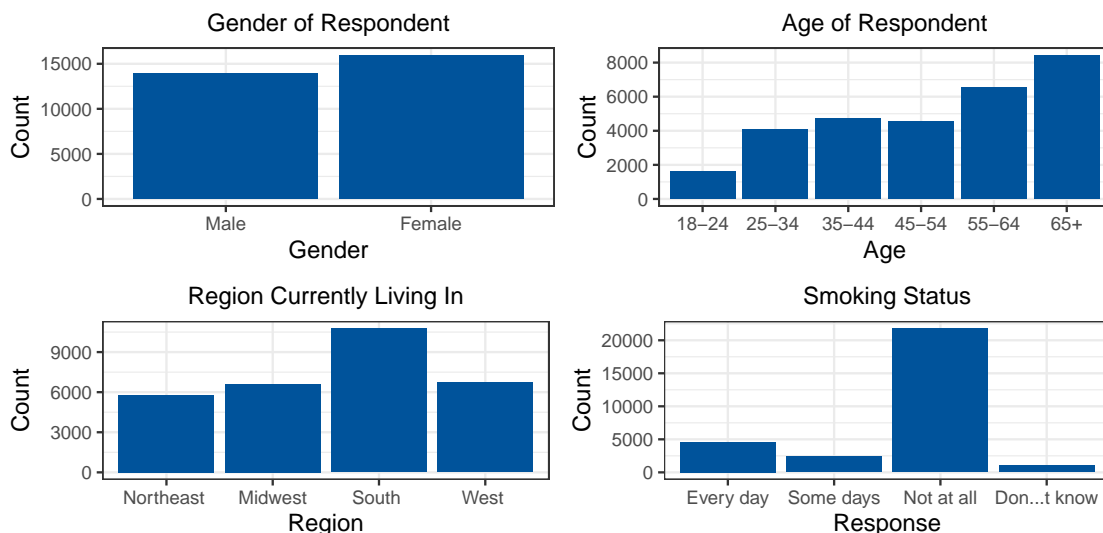
```
## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>

## Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <80>

## Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
## conversion failure on 'Don't know' in 'mbcsToSbcs': dot substituted for <99>
```

```
income
```


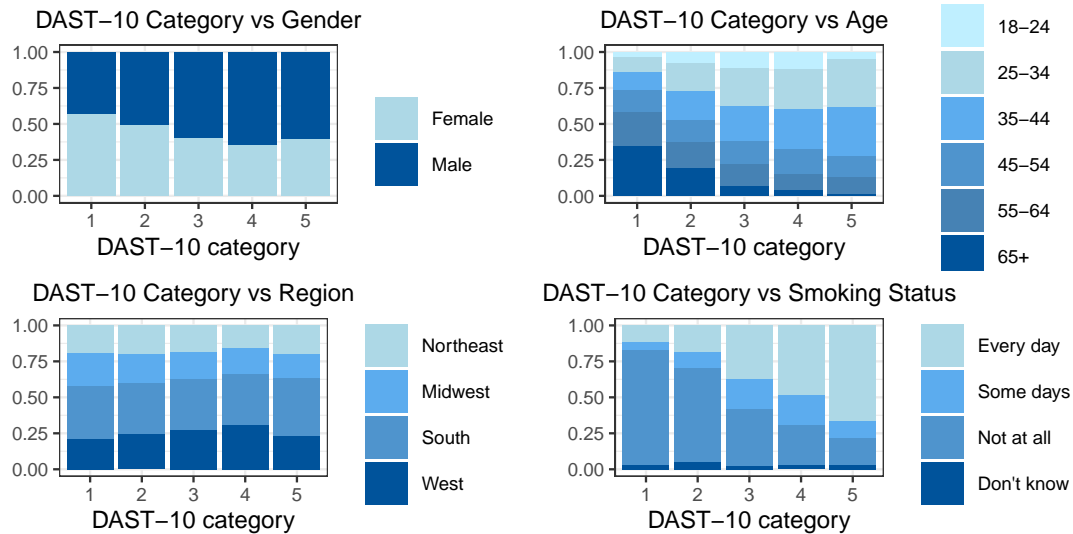Combined Household Income in the Last 12 Months
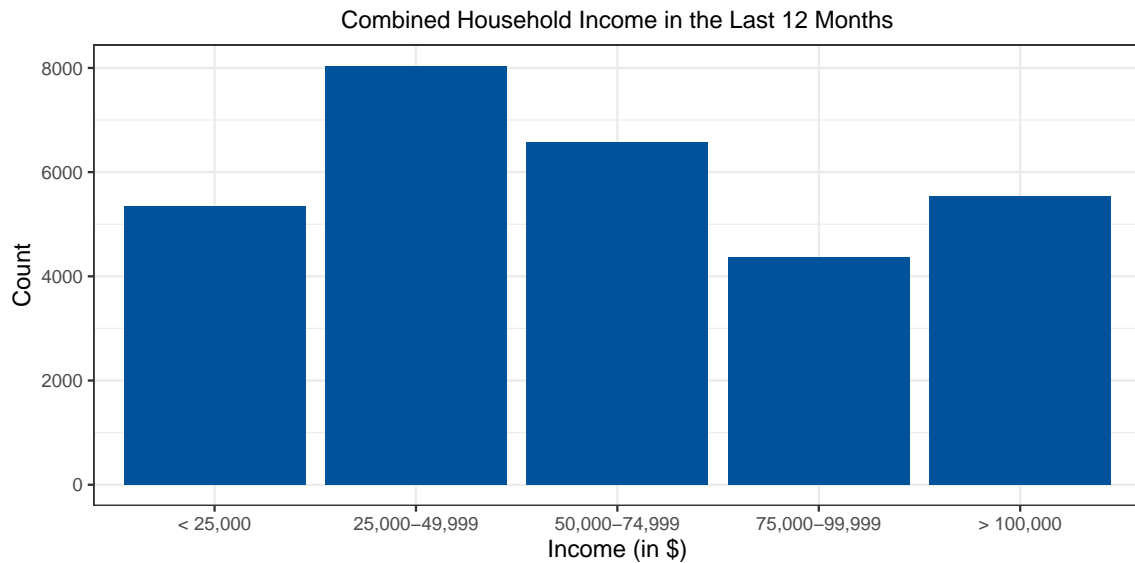
Relationship between demographic predictor variables and response variable

```r
gender_dast_10 <- ggplot(data = us_19, mapping = aes(x = DAST_CAT, fill = DEM_GENDER)) +
  geom_bar(position = "fill") +
  labs(title = "DAST-10 Category vs Gender",
       x = "DAST-10 category", y = "") +
  theme_bw(base_size = 9) +
  theme(plot.title = element_text(size = 9, hjust = 0.5)) +
  scale_fill_manual(values=c("#00539B", "lightblue"), name = "", labels = c("Male", "Female"), guide = g

age_dast_10 <- ggplot(data = us_19, mapping = aes(x = DAST_CAT, fill = DEM_AGE10)) +
  geom_bar(position = "fill") +
  labs(title = "DAST-10 Category vs Age",
       x = "DAST-10 category", y = "") +
  theme_bw(base_size = 9) +
  theme(plot.title = element_text(size = 9, hjust = 0.5)) +
  scale_fill_manual(values=c("lightblue1", "lightblue", "steelblue2", "steelblue3", "steelblue", "#0053

region_dast_10 <- ggplot(data = us_19, mapping = aes(x = DAST_CAT, fill = DEM_REGION)) +
  geom_bar(position = "fill") +
  labs(title = "DAST-10 Category vs Region",
       x = "DAST-10 category", y = "") +
  theme_bw(base_size = 9) +
  theme(plot.title = element_text(size = 9, hjust = 0.5)) +
  scale_fill_manual(values=c("lightblue", "steelblue2", "steelblue3", "#00539B"), name = "", labels = c

income_dast_10 <- ggplot(data = us_19, mapping = aes(x = DAST_CAT, fill = DEM_INCOME)) +
  geom_bar(position = "fill") +
  labs(title = "DAST-10 Category vs Income",
       x = "DAST-10 category", y = "") +
  theme_bw(base_size = 9) +
  theme(plot.title = element_text(size = 9, hjust = 0.5)) +
  scale_fill_manual(values=c("lightblue", "steelblue2", "steelblue3", "steelblue", "#00539B"), name = "
```

```
smoking_dast_10 <- ggplot(data = us_19, mapping = aes(x = DAST_CAT, fill = TOB_LIFE)) +
  geom_bar(position = "fill") +
  labs(title = "DAST-10 Category vs Smoking Status",
       x = "DAST-10 category", y = "") +
  theme_bw(base_size = 9) +
  theme(plot.title = element_text(size = 9, hjust = 0.5)) +
  scale_fill_manual(values=c("lightblue", "steelblue2", "steelblue3", "#00539B"), name = "", labels = c

(gender_dast_10 | age_dast_10 ) /
  (region_dast_10 | smoking_dast_10)
```



```
income_dast_10
```