R Survey Cheat Sheet

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Reading & Exploring Data

To read in your data:

```
# Comma delimited format
dat <- read.csv("~/your/file/path")
# Tab delimited format
dat <- read.table("~/your/file/path")
# Stata (.dta) format
library(haven)
dat <- read_dta("~/your/file/path")
```

To view observations or summaries of a variable:

```
# Print the top few observations of a variable
head(dataframe$vector)
# Print the bottom few observations of a variable
tail(dataframe$vector)
# Print all observations of a variable
print(dataframe$vector)
# Access a summary of a variable or model
summary(dataframe$vector)
summary(model)
```

To learn the structure or format of your data:

```
# Access the type / storage mode of the data
typeof(dataframe$vector)
# Access the structure of the data
str(dataframe)
str(dataframe$vector)
# Access the length of a vector (e.g. the number of observations)
length(dataframe$vector)
# Access the attributes and metadata of an object
attributes(dataframe)
attributes(dataframe$vector)
```

All of the examples in this guide will use the 2016 CCES loaded in `.dta` format. To replicate,

```
library(haven)
cces16 <- read_dta("../../Data/2016 CCES/CCES16_Common_OUTPUT_Feb2018_VV.dta")
```

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Manipulating Data

Recoding Data

To recode values in base R:

```
#Create a new vector to work with
cces16$ban_ar <- cces16$CC16_330d
#Attitudes toward gun control
#Call all values for "oppose" and replace with zero
cces16$ban_ar[cces16$ban_ar==2] <- 0
#Call all values for skipped / not asked and replace with missing
cces16$ban_ar[cces16$ban_ar==8] <- NA
cces16$ban_ar[cces16$ban_ar==9] <- NA
```

To collapse categories of an ordinal variable in base R:

```
#Create a new vector to work with
cces16$pid <- cces16$pid7
#Recode values to missing
cces16$pid[cces16$pid==98] <- NA
cces16$pid[cces16$pid==99] <- NA
cces16$pid[cces16$pid==8] <- NA
#Collapse the categories
cces16$pid[cces16$pid==2] <- 1
cces16$pid[cces16$pid==3] <- 1
cces16$pid[cces16$pid==4] <- 2
cces16$pid[cces16$pid==5] <- 3
cces16$pid[cces16$pid==6] <- 3
cces16$pid[cces16$pid==7] <- 3
```

To cut a continuous variable into an ordinal one in base R:

```
# Create the age variable
cces16$age <- 2016 - cces16$birthyr

cces16$agecats <- cut(cces16$age,
                      breaks=c(-Inf, 35, 50, Inf),
                      labels=c("35 and Under","36 to 50","Over 50"))
```

To flip the direction of coding in base R:

```
#Flip the coding
cces16$pid_reverse <- 4 - cces16$pid
```

To apply labels to factor levels of a recoded variable:

```
cces16$pid_reverse <- factor(cces16$pid_reverse,
                             levels = c(1,2,3),
                             labels = c("Republican", "Independent",
                             "Democrat"))
```

Merging Data

To merge data that have one common vector with the same name:

```r
#Load the supplemental data
cces16s <-  read.csv("../../Data/2016 CCES Supplementary/CC16_Candidates_By_Race.csv")
#Merge the primary and supplemental data by respondent state
cces16c <- merge(cces16, cces16s)
```

To merge data that have a common vector with different names:

```r
#Merge by state with different column names
rm(cces16c)
cces16c <- merge(cces16, cces16s,
                 by.x = "inputstate",
                 by.y = "inputstate")
```

Descriptive Statistics

Summary Statistics

To summarize a variable:

```r
summary(cces16$age)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   18.00   33.00   49.00   47.88   61.00   99.00
```

To call specific summary statistics:

```r
#Mean
mean(cces16$age)
```

```
## [1] 47.88014
```

```r
#Standard deviation
sd(cces16$age)
```

```
## [1] 16.83279
```

```r
#Minimum
min(cces16$age)
```

```
## [1] 18
```

```r
#Maximum
max(cces16$age)
```

```
## [1] 99
```

```r
#Range
range(cces16$age)
```

```
## [1] 18 99
```

```r
#Quantiles
quantile(cces16$age)
```

```
## <Labelled double>
##   0%  25%  50%  75% 100%
##   18   33   49   61   99
##
```

```
## Labels:
##  value     label
##   9998   Skipped
##   9999 Not Asked
```

Tabulations & Cross Tabulations

To tabulate a variable:

```
# Tabulate PID
prop.table(table(cces16$pid_reverse))
```

```
##
##  Republican Independent    Democrat
##   0.3336641   0.1679444   0.4983915
```

To cross-tabulate two variables:

```
# Tabulate PID by age categories
pidxage <- table(cces16$pid_reverse, cces16$agecats)
pidxage
```

```
##
##               35 and Under 36 to 50 Over 50
##   Republican          4799     4470   11578
##   Independent         3137     2660    4696
##   Democrat           10427     7059   13653
```

```
prop.table(pidxage,2)
```

```
##
##               35 and Under  36 to 50   Over 50
##   Republican     0.2613407 0.3150328 0.3868747
##   Independent    0.1708327 0.1874692 0.1569152
##   Democrat       0.5678266 0.4974981 0.4562101
```

Summary Statistics by Group

To summarize variables by group in base R:

```
#Create a dataframe of the variables of interest
subgroup_vars <- c("age","pid")
subgroup_matrix <- as.matrix(cces16[subgroup_vars])
subgroup_df <- as.data.frame(subgroup_matrix)
aggregate(subgroup_df$age, list(subgroup_df$pid), mean)
```

```
##   Group.1        x
## 1       1 46.58152
## 2       2 46.97732
## 3       3 51.23725
```

To summarize variables by group with `dplyr`:

```
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
```

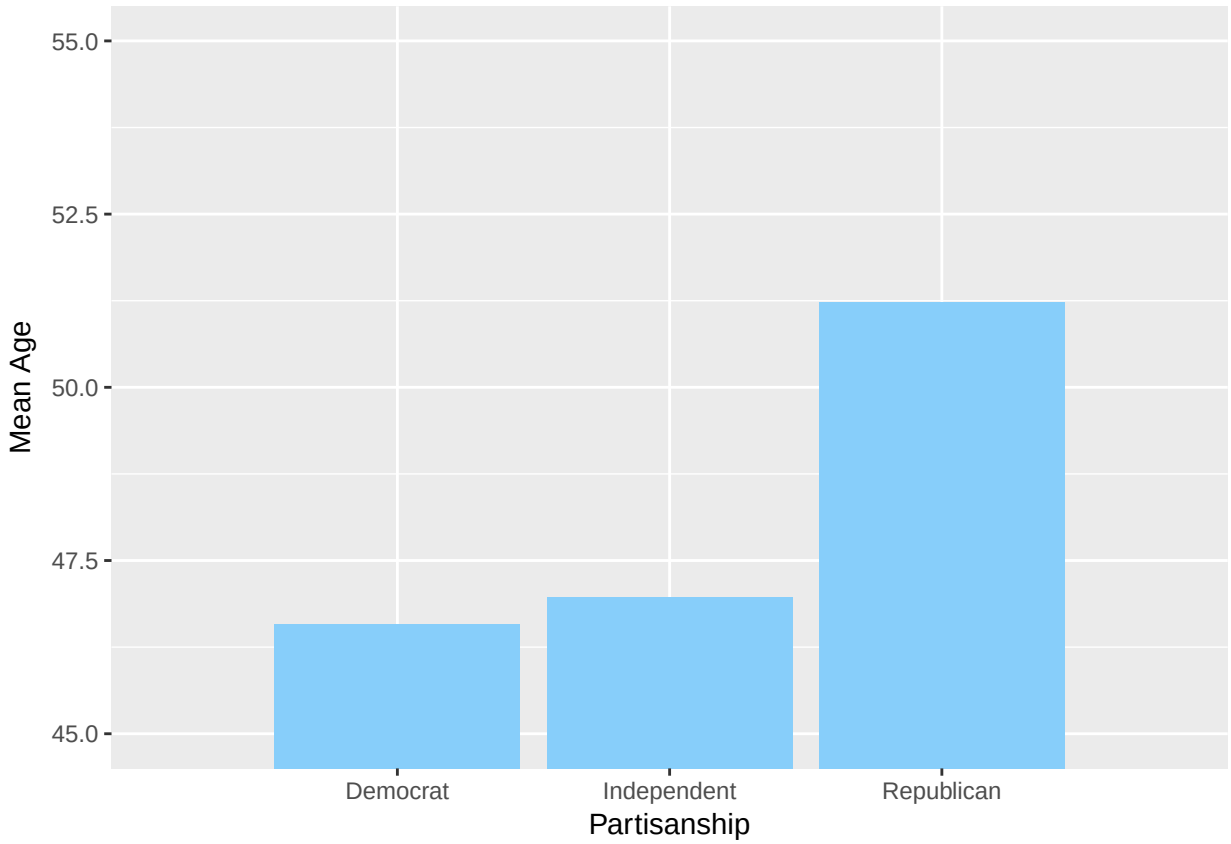
```
subgroup_means <- subgroup_df %>%
  group_by(pid) %>%
  summarise(mean = mean(age))
subgroup_means
```

```
## # A tibble: 4 x 2
##     pid  mean
##   <dbl> <dbl>
## 1     1  46.6
## 2     2  47.0
## 3     3  51.2
## 4    NA  38.4
```

To visualize subgroup means with `ggplot`:

```
library(ggplot2)
pid_labels <- c("Democrat", "Independent", "Republican")
sg_bp <- ggplot(subgroup_means, aes(y=mean, x=pid)) +
  geom_bar(fill="lightskyblue",stat="identity") +
  #xlab("Partisanship") +
  ylab("Mean Age") +
  scale_x_discrete(name = "Partisanship",
                   limits=pid_labels)
sg_bp <- sg_bp + coord_cartesian(ylim=c(45,55))
sg_bp
```

```
## Warning: Removed 1 rows containing missing values (position_stack).
```

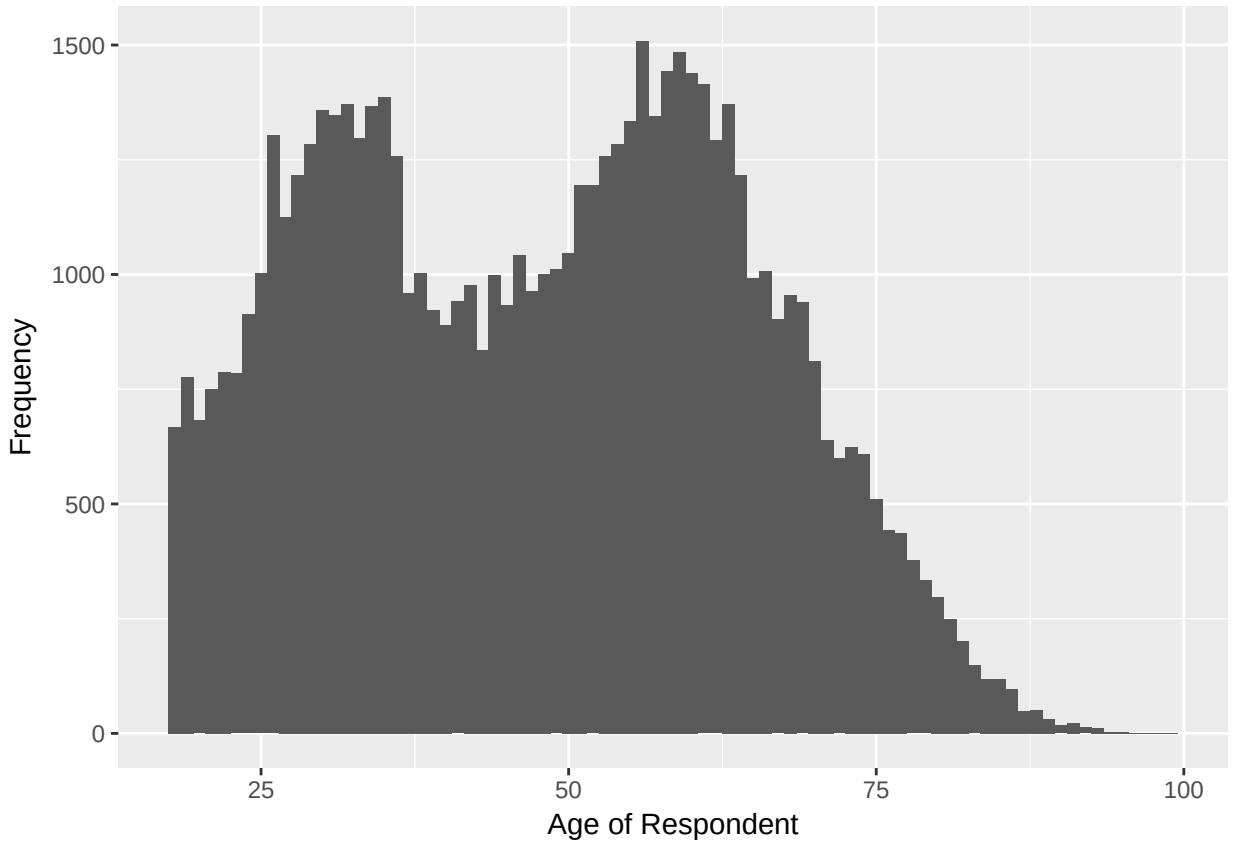


Distributions

To plot a histogram of a variable's distribution using `ggplot2`:

```
#Histogram for age
library(ggplot2)
age_matrix <- as.matrix(cces16$age)
age_df <- as.data.frame(age_matrix)
ggplot(data = age_df, aes(x=age_df)) +
  geom_histogram(binwidth = 1) +
  xlab("Age of Respondent") +
  ylab("Frequency")
```

```
## Don't know how to automatically pick scale for object of type data.frame. Defaulting to continuous.
```




```
#Density plot
ggplot(data = age_df, aes(x=age_df)) +
  geom_density(fill="lightblue") +
  xlab("Age of Respondent") +
  ylab("Density")
```

```
## Don't know how to automatically pick scale for object of type data.frame. Defaulting to continuous.
```

Modeling

OLS Regression

```
# Prepare Obama approval as the DV
cces16$oa <- cces16$CC16_320a
cces16$oa[cces16$oa=="5"] <- NA
cces16$oa[cces16$oa=="8"] <- NA
cces16$oa <- 5 - cces16$oa
# Fit the OLS model
olsfit <- lm(oa ~ pid + gender + age,
             data = cces16)
# Print the model summary
summary(olsfit)
```

```
##
## Call:
## lm(formula = oa ~ pid + gender + age, data = cces16)
##
## Residuals:
## <Labelled double>
##      Min       1Q   Median       3Q      Max
## -2.58510 -0.41900 -0.21139  0.61911  2.95471
##
```

```
## Labels:
##  value               label
##      1    Strongly approve
##      2    Somewhat approve
##      3 Somewhat disapprove
##      4 Strongly disapprove
##      5            Not sure
##      8             Skipped
##      9           Not Asked
##
## Coefficients:
##               Estimate Std. Error  t value Pr(>|t|)
## (Intercept)  4.6247560  0.0164018  281.967  < 2e-16 ***
## pid         -1.0051598  0.0038097 -263.844  < 2e-16 ***
## gender       0.0450371  0.0068463    6.578  4.8e-11 ***
## age         -0.0069207  0.0002041  -33.903  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8351 on 60142 degrees of freedom
##   (4454 observations deleted due to missingness)
## Multiple R-squared:  0.5542, Adjusted R-squared:  0.5542
## F-statistic: 2.493e+04 on 3 and 60142 DF,  p-value: < 2.2e-16
```

Logistic Regression

```
## Logistic Regression
# Prepare preference for AR ban as DV
cces16$ban_ar <- cces16$CC16_330d
cces16$ban_ar[cces16$ban_ar==2] <- 0
cces16$ban_ar[cces16$ban_ar==8] <- NA
cces16$ban_ar[cces16$ban_ar==9] <- NA
# Fit the logit model
lfit <- glm(ban_ar ~ pid + agecats + gender,
           data=cces16, family = binomial())
# Print the model summary
summary(lfit)
```

```
##
## Call:
## glm(formula = ban_ar ~ pid + agecats + gender, family = binomial(),
##     data = cces16)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.2356  -0.9485   0.4895   0.8301   1.7229
##
## Coefficients:
##                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)      1.08299    0.03785   28.61   <2e-16 ***
## pid             -1.05779    0.01104  -95.85   <2e-16 ***
## agecats36 to 50  0.30957    0.02638   11.74   <2e-16 ***
## agecatsOver 50   0.66148    0.02279   29.03   <2e-16 ***
```

```
## gender           0.86323    0.01924   44.87   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 79067  on 62049  degrees of freedom
## Residual deviance: 66063  on 62045  degrees of freedom
##   (2550 observations deleted due to missingness)
## AIC: 66073
##
## Number of Fisher Scoring iterations: 4
```

Ordinal Logistic Regression

```
## Ordinal Logistic Regression
# Convert Obama approval to a factor
cces16$oaf <- factor(cces16$oa)
library(MASS)
```

```
##
## Attaching package: 'MASS'
```

```
## The following object is masked from 'package:dplyr':
##
##     select
```

```
# Fit the ordinal logit model
olfit <- polr(oaf ~ pid + gender + age,
              data = cces16, Hess = TRUE)
# Print the model summary
summary(olfit)
```

```
## Call:
## polr(formula = oaf ~ pid + gender + age, data = cces16, Hess = TRUE)
##
## Coefficients:
##           Value Std. Error  t value
## pid    -2.01316  0.0121435 -165.781
## gender  0.14036  0.0167348    8.387
## age    -0.01447  0.0005025  -28.794
##
## Intercepts:
##     Value     Std. Error t value
## 1|2   -5.2717    0.0459  -114.8740
## 2|3   -4.3865    0.0436  -100.6132
## 3|4   -2.6727    0.0406   -65.7525
##
## Residual Deviance: 116936.77
## AIC: 116948.77
## (4454 observations deleted due to missingness)
```

Multinomial Logistic Regression

```
## Multinomial Logistic Regression
## Create a 2012 vote choice factor variable
cces16$vc <- cces16$CC16_326
cces16$vc[cces16$vc=="4"] <- NA
cces16$vc[cces16$vc=="5"] <- NA
cces16$vc <- factor(cces16$vc,
                    levels = c(1,2,3),
                    labels = c("Obama", "Romney","Other"))

library(nnet)
# Fit the multinomial logit model
mlfit <- multinom(vc ~ pid + agecats + gender,
                  data=cces16)
```

```
## # weights:  18 (10 variable)
## initial  value 51855.598637
## iter  10 value 23914.700591
## iter  20 value 18733.374011
## final  value 18733.298819
## converged
```

```
# weights:  27 (16 variable)
```

```
# Print the model summary
summary(mlfit)
```

```
## Call:
## multinom(formula = vc ~ pid + agecats + gender, data = cces16)
##
## Coefficients:
##        (Intercept)      pid agecats36 to 50 agecatsOver 50     gender
## Romney   -6.432394 2.776238       0.5026041      1.0392971 -0.1359982
## Other    -4.064238 1.497458       0.1057551     -0.2319235 -0.7827882
##
## Std. Errors:
##        (Intercept)        pid agecats36 to 50 agecatsOver 50     gender
## Romney  0.08088099 0.02171768      0.05035074     0.04370033 0.03297672
## Other   0.11463718 0.03257481      0.07268663     0.06687796 0.05765850
##
## Residual Deviance: 37466.6
## AIC: 37486.6
```

survey Package

All examples in this section require the survey package:

```
library(survey)
```

```
## Loading required package: grid
```

```
## Loading required package: Matrix
```

```
## Loading required package: survival
```

```
##
## Attaching package: 'survey'
```

```
## The following object is masked from 'package:graphics':
##
##     dotchart
```

Weighted Tabulations

```
## WITHOUT WEIGHTING
# Tabulate PID
prop.table(table(cces16$pid_reverse))
```

```
##
##  Republican Independent    Democrat
##   0.3336641   0.1679444   0.4983915
```

```
## WITHOUT WEIGHTING
# Tabulate PID by age categories
pidxage <- table(cces16$pid_reverse, cces16$agecats)
pidxage
```

```
##
##               35 and Under 36 to 50 Over 50
##   Republican          4799     4470   11578
##   Independent         3137     2660    4696
##   Democrat           10427     7059   13653
```

```
prop.table(pidxage,2)
```

```
##
##               35 and Under  36 to 50   Over 50
##   Republican     0.2613407 0.3150328 0.3868747
##   Independent    0.1708327 0.1874692 0.1569152
##   Democrat       0.5678266 0.4974981 0.4562101
```

```
## WITH WEIGHTING
# Create a survey design dataframe
svy.cces16 <- svydesign(ids = ~1,
                        data = cces16,
                        weights = cces16$commonweight_vv)
# Weighted tabulation of PID
prop.table(svytable(~cces16$pid_reverse, design = svy.cces16))
```

```
## cces16$pid_reverse
##  Republican Independent    Democrat
##   0.3732446   0.1539131   0.4728423
```

```
## WITH WEIGHTING
# Weighted tabulation of PID by age categories
prop.table(svytable(~cces16$pid_reverse+cces16$agecats,
                    design = svy.cces16),2)
```

```
##                    cces16$agecats
## cces16$pid_reverse 35 and Under  36 to 50   Over 50
##        Republican     0.3103759 0.3544857 0.4244888
##        Independent    0.1614909 0.1740768 0.1395962
```

```
##        Democrat       0.5281332 0.4714375 0.4359151
```

Weighted Models

```
## WITHOUT WEIGHTING
# Run a logit regression for attitudes toward gun control
fit <- glm(ban_ar ~ pid_reverse + agecats + gender,
           data=cces16, family = binomial())
summary(fit)
```

```
##
## Call:
## glm(formula = ban_ar ~ pid_reverse + agecats + gender, family = binomial(),
##     data = cces16)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.2748  -0.9804   0.4639   0.7933   1.6830
##
## Coefficients:
##                         Estimate Std. Error z value Pr(>|z|)
## (Intercept)            -1.99725    0.03790  -52.69   <2e-16 ***
## pid_reverseIndependent  0.62226    0.02510   24.79   <2e-16 ***
## pid_reverseDemocrat     2.13318    0.02241   95.20   <2e-16 ***
## agecats36 to 50         0.32115    0.02651   12.11   <2e-16 ***
## agecatsOver 50          0.65539    0.02286   28.67   <2e-16 ***
## gender                  0.85891    0.01927   44.58   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 79067  on 62049  degrees of freedom
## Residual deviance: 65697  on 62044  degrees of freedom
##   (2550 observations deleted due to missingness)
## AIC: 65709
##
## Number of Fisher Scoring iterations: 4
```

```
## WITH WEIGHTING
wfit <- svyglm(ban_ar ~ pid_reverse + agecats + gender,
               design=svy.cces16, family = binomial())
```

```
## Warning in eval(family$initialize): non-integer #successes in a binomial
## glm!
```

```
summary(wfit)
```

```
##
## Call:
## svyglm(formula = ban_ar ~ pid_reverse + agecats + gender, design = svy.cces16,
##     family = binomial())
##
## Survey design:
```

```
## svydesign(ids = ~1, data = cces16, weights = cces16$commonweight_vv)
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)             -2.10613    0.05543 -37.999   <2e-16 ***
## pid_reverseIndependent   0.59609    0.03475  17.154   <2e-16 ***
## pid_reverseDemocrat      2.09675    0.03212  65.285   <2e-16 ***
## agecats36 to 50          0.30622    0.03701   8.274   <2e-16 ***
## agecatsOver 50           0.66999    0.03259  20.557   <2e-16 ***
## gender                   0.89915    0.02683  33.509   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 0.9962514)
##
## Number of Fisher Scoring iterations: 4
```

Creating Post-Stratification Weights

In progress.