Police Shootings

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Import the relevent data sets for EDA and model development

```
#import the data sets for EDA
library(readxl)

#import the police shootings since 2015 data
police_post2015 <- read.csv("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/PoliceShootin

#import supplementary income, poverty, race, and high school graduation data for data blending/joining
median_income <- read_excel("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/MedianHouseho
povery_level <- read_excel("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/PercentagePeop
race_city <- read_excel("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/ShareRaceByCity.x
hs_grad <- read_excel("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/PercentOver25Comple
```

```
library(ggplot2)
library(dplyr)
```

Import the necessary libraries

```
##
## 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
```

```
#develop a median income object to join onto the police shootings data frame
income_df <- data.frame((median_income))

#change data types as needed
income_df$Median.Income <- as.numeric(income_df$Median.Income)
income_df$Geographic.Area <- as.factor(income_df$Geographic.Area)

#aggregate the median income via the median median income of each state
income_table <- aggregate(x = income_df$Median.Income,
          by = list(income_df$Geographic.Area),
          FUN =  median)
```

```r
#save the income_table as a data frame and convert the names of the columns
income_table <- as.data.frame(income_table)
income_table <- rename(income_table, "State" = "Group.1")
income_table <- rename(income_table, "Median.Income" = "x")

#view the developed object
income_table
```

Develop a median income data frame to join onto the police_shootings dataframe

```
##    State Median.Income
## 1     AK       50000.0
## 2     AL       38304.0
## 3     AR       33750.0
## 4     AZ       39000.0
## 5     CA       54667.0
## 6     CO       50220.5
## 7     CT       69200.0
## 8     DC       70848.0
## 9     DE       57448.0
## 10    FL       44679.0
## 11    GA       35833.0
## 12    HI       63453.0
## 13    IA       45714.0
## 14    ID       41250.0
## 15    IL       47969.0
## 16    IN       43359.0
## 17    KS       42500.0
## 18    KY       37632.0
## 19    LA       38569.0
## 20    MA       66370.0
## 21    MD       70511.0
## 22    ME       42227.0
## 23    MI       41228.0
## 24    MN       47188.0
## 25    MO       36852.5
## 26    MS       31800.0
## 27    MT       41875.0
## 28    NC       37000.0
## 29    ND       48702.0
## 30    NE       44167.0
## 31    NH       52636.0
## 32    NJ       75357.5
## 33    NM       37337.0
## 34    NV       50153.0
## 35    NY       56250.0
## 36    OH       43967.5
## 37    OK       37896.0
## 38    OR       43125.0
## 39    PA       45793.5
## 40    RI       71786.0
## 41    SC       34250.0
## 42    SD       43409.0
## 43    TN       37746.0
```

```
## 44    TX       43069.5
## 45    UT       52500.0
## 46    VA       40833.0
## 47    VT       43354.0
## 48    WA       45013.0
## 49    WI       44167.0
## 50    WV       36250.0
## 51    WY       51384.0
```

```
#develop a poverty rate object to join onto the police shootings data frame
pr_df <- data.frame(povery_level)

#change the data types as needed
pr_df$poverty_rate  <- as.numeric(pr_df$poverty_rate)
pr_df$Geographic.Area <- as.factor(pr_df$Geographic.Area)

#aggregate the poverty rate via the median poverty rate of each state
pr_table <- aggregate(x = pr_df$poverty_rate,
          by = list(pr_df$Geographic.Area),
          FUN =  median)

#save the pr_table as a data frame and convert the names of the columns
pr_table <- as.data.frame(pr_table)
pr_table  <- rename(pr_table, "State" = "Group.1")
pr_table <- rename(pr_table, "Median.Below.Poverty" = 'x')

#view the object
pr_table
```

Develop a povery rate data frame to join onto the police_shootings dataframe

```
##    State Median.Below.Poverty
## 1     AK                14.95
## 2     AL                19.10
## 3     AR                22.30
## 4     AZ                20.35
## 5     CA                13.40
## 6     CO                11.55
## 7     CT                 7.70
## 8     DC                18.00
## 9     DE                11.10
## 10    FL                15.00
## 11    GA                23.50
## 12    HI                11.10
## 13    IA                10.70
## 14    ID                16.10
## 15    IL                12.20
## 16    IN                14.80
## 17    KS                12.80
## 18    KY                19.50
## 19    LA                21.00
## 20    MA                 8.20
## 21    MD                 7.45
## 22    ME                17.50
```

```
## 23    MI               16.10
## 24    MN               11.60
## 25    MO               18.50
## 26    MS               26.45
## 27    MT               12.80
## 28    NC               17.95
## 29    ND                8.85
## 30    NE               11.60
## 31    NH               10.50
## 32    NJ                6.40
## 33    NM               19.70
## 34    NV               10.20
## 35    NY                9.60
## 36    OH               13.30
## 37    OK               18.80
## 38    OR               16.20
## 39    PA               10.80
## 40    RI                8.55
## 41    SC               22.20
## 42    SD               11.10
## 43    TN               19.45
## 44    TX               17.00
## 45    UT                9.35
## 46    VA               11.80
## 47    VT               14.20
## 48    WA               12.30
## 49    WI               11.50
## 50    WV               19.15
## 51    WY                6.40
```

```r
#develop a hs rate object to join onto the police shootings data frame
hs_df <- data.frame(hs_grad)

#change the data types as needed
hs_df$Geographic.Area <- as.factor(hs_df$Geographic.Area)
hs_df$percent_completed_hs <- as.numeric(hs_df$percent_completed_hs)

#aggregate the hs_df as a data frame and covert the names of the columns
hs_table <- aggregate( x = hs_df$percent_completed_hs,
                       by = list(hs_df$Geographic.Area),
                       FUN = median)

hs_table <- as.data.frame(hs_table)
hs_table <- rename(hs_table, "State" = "Group.1")
hs_table <- rename(hs_table, "Over.25.Grad.Rate" = "x")

#view the object
hs_table
```

Develop a percent of population over 25 years old that has graduated from high school data frame to join onto the police_shootings dataframe

```
##    State Over.25.Grad.Rate
## 1     AK             88.00
```

```
## 2     AL             81.15
## 3     AR             81.10
## 4     AZ             84.25
## 5     CA             87.50
## 6     CO             92.35
## 7     CT             93.20
## 8     DC             89.30
## 9     DE             89.50
## 10    FL             88.40
## 11    GA             79.30
## 12    HI             92.50
## 13    IA             91.10
## 14    ID             87.50
## 15    IL             89.80
## 16    IN             86.90
## 17    KS             90.00
## 18    KY             82.45
## 19    LA             80.00
## 20    MA             93.90
## 21    MD             91.10
## 22    ME             91.70
## 23    MI             89.90
## 24    MN             90.90
## 25    MO             85.35
## 26    MS             78.30
## 27    MT             91.80
## 28    NC             83.60
## 29    ND             90.00
## 30    NE             91.00
## 31    NH             91.90
## 32    NJ             92.60
## 33    NM             84.50
## 34    NV             89.90
## 35    NY             92.00
## 36    OH             89.60
## 37    OK             83.80
## 38    OR             89.75
## 39    PA             90.30
## 40    RI             91.25
## 41    SC             81.75
## 42    SD             90.10
## 43    TN             82.00
## 44    TX             80.40
## 45    UT             93.15
## 46    VA             86.00
## 47    VT             90.30
## 48    WA             91.60
## 49    WI             91.20
## 50    WV             84.00
## 51    WY             93.70
```

```r
#develop the final_df object from the police shootings and left joined data from the developed objects
final_df <- left_join(police_post2015, pr_table, by = c("state" = "State"))
```

```
final_df <- left_join(final_df, income_table, by = c("state" = "State"))
final_df <- left_join(final_df, hs_table, by = c("state" = "State"))

#create the regional column data frame
head(final_df)
```

Join the developed data frame data onto the police shootings data

```
##   id               name       date  manner_of_death      armed age gender race
## 1  3         Tim Elliot 2015-01-02             shot        gun  53      M    A
## 2  4   Lewis Lee Lembke 2015-01-02             shot        gun  47      M    W
## 3  5 John Paul Quintero 2015-01-03 shot and Tasered    unarmed  23      M    H
## 4  8    Matthew Hoffman 2015-01-04             shot toy weapon  32      M    W
## 5  9  Michael Rodriguez 2015-01-04             shot   nail gun  39      M    H
## 6 11  Kenneth Joe Brown 2015-01-04             shot        gun  18      M    W
##            city state signs_of_mental_illness threat_level        flee
## 1       Shelton    WA                   True       attack Not fleeing
## 2         Aloha    OR                  False       attack Not fleeing
## 3       Wichita    KS                  False        other Not fleeing
## 4 San Francisco    CA                   True       attack Not fleeing
## 5         Evans    CO                  False       attack Not fleeing
## 6       Guthrie    OK                  False       attack Not fleeing
##   body_camera longitude latitude is_geocoding_exact Median.Below.Poverty
## 1       False  -123.122   47.247               True                12.30
## 2       False  -122.892   45.487               True                16.20
## 3       False   -97.281   37.695               True                12.80
## 4       False  -122.422   37.763               True                13.40
## 5       False  -104.692   40.384               True                11.55
## 6       False   -97.423   35.877               True                18.80
##   Median.Income Over.25.Grad.Rate
## 1       45013.0             91.60
## 2       43125.0             89.75
## 3       42500.0             90.00
## 4       54667.0             87.50
## 5       50220.5             92.35
## 6       37896.0             83.80
```

```
final_df <- final_df %>% mutate(Region =
                     case_when(state == 'AL' ~ 'Southeast',
                               state == 'AK' ~ 'West',
                               state == 'AZ' ~ 'Southwest',
                               state == 'AR' ~ 'Southeast',
                               state == 'CA' ~ 'West',
                               state == 'CO' ~ 'West',
                               state == 'CT' ~ 'Northeast',
                               state == 'DE' ~ 'Northeast',
                               state == 'DC' ~ 'Southeast',
                               state == 'FL' ~ 'Southeast',
                               state == 'GA' ~ 'Southeast',
                               state == 'GU' ~ 'West',
                               state == 'HI' ~ 'West',
                               state == 'ID' ~ 'West',
                               state == 'IL' ~ 'Midwest',
```

```
                                state == 'IN' ~ 'Midwest',
                                state == 'IA' ~ 'Midwest',
                                state == 'KS' ~ 'Midwest',
                                state == 'KY' ~ 'Southeast',
                                state == 'LA' ~ 'Southeast',
                                state == 'ME' ~ 'Northeast',
                                state == 'MD' ~ 'Northeast',
                                state == 'MA' ~ 'Northeast',
                                state == 'MI' ~ 'Midwest',
                                state == 'MN' ~ 'Midwest',
                                state == 'MS' ~ 'Southeast',
                                state == 'MO' ~ 'Midwest',
                                state == 'MT' ~ 'West',
                                state == 'NE' ~ 'Midwest',
                                state == 'NV' ~ 'West',
                                state == 'NH' ~ 'Northeast',
                                state == 'NJ' ~ 'Northeast',
                                state == 'NM' ~ 'Southwest',
                                state == 'NY' ~ 'Northeast',
                                state == 'NC' ~ 'Southeast',
                                state == 'ND' ~ 'Midwest',
                                state == 'OH' ~ 'Midwest',
                                state == 'OK' ~ 'Southwest',
                                state == 'OR' ~ 'West',
                                state == 'PA' ~ 'Northeast',
                                state == 'PR' ~ 'Southeast',
                                state == 'RI' ~ 'Northeast',
                                state == 'SC' ~ 'Southeast',
                                state == 'SD' ~ 'Midwest',
                                state == 'TN' ~ 'Southeast',
                                state == 'TX' ~ 'Southwest',
                                state == 'UT' ~ 'West',
                                state == 'VA' ~ 'Southeast',
                                state == 'VT' ~ 'Northeast',
                                state == 'WA' ~ 'West',
                                state == 'WV' ~ 'Southeast',
                                state == 'WI' ~ 'Midwest',
                                state == 'WY' ~ 'West'))
```

```
final_df <- final_df %>% mutate(Armed.Flag =
                     case_when(armed == 'undertermed' ~ '0',
                               armed == 'unarmed' ~ '0',
                               armed == 'NA' ~ '0'))
#repalce all NA's in the Armed.Flag with a 1 flag
final_df[is.na(final_df)] <- 1
```

```
#develop an attribute that depicts if a person is a minority or not
final_df <- final_df %>% mutate(Is.Minority =
                                  case_when(race == 'W' ~ '0'))
final_df[is.na(final_df)] <- '1'
```

```
#display a contigency table to review that the output of the above mutation is correct
```

```
a <- table(final_df$race, final_df$Is.Minority)
a
```

Add in a region area by state

```
##
##        0    1
##        0  882
##   A    0  106
##   B    0 1555
##   H    0 1085
##   N    0   91
##   O    0   47
##   W 2969    0
```

Fleeing Contigency Tables

```
#table for armed
armed_table <- table(final_df$Armed.Flag, final_df$race)
armed_table
```

```
##
##             A    B    H    N    O    W
##   0   16    8  137   79    6    5  175
##   1  866   98 1418 1006   85   42 2794
```

```
round(prop.table(armed_table, margin = 2)*100,1)
```

```
##
##             A    B    H    N    O    W
##   0  1.8  7.5  8.8  7.3  6.6 10.6  5.9
##   1 98.2 92.5 91.2 92.7 93.4 89.4 94.1
```

Begin Exploratory Data Analysis

```
summary(final_df)
```

```
##        id           name               date           manner_of_death
##  Min.   :   3   Length:6735        Length:6735        Length:6735
##  1st Qu.:1898   Class :character   Class :character   Class :character
##  Median :3737   Mode  :character   Mode  :character   Mode  :character
##  Mean   :3727
##  3rd Qu.:5554
##  Max.   :7347
##     armed                age           gender             race
##  Length:6735        Min.   : 1.00   Length:6735        Length:6735
##  Class :character   1st Qu.:26.00   Class :character   Class :character
##  Mode  :character   Median :34.00   Mode  :character   Mode  :character
##                     Mean   :35.36
##                     3rd Qu.:45.00
##                     Max.   :92.00
##      city              state           signs_of_mental_illness
##  Length:6735        Length:6735        Length:6735
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
```

```
##
##
##
##  threat_level          flee           body_camera          longitude
##  Length:6735        Length:6735        Length:6735        Min.   :-160.01
##  Class :character   Class :character   Class :character   1st Qu.:-111.91
##  Mode  :character   Mode  :character   Mode  :character   Median : -92.85
##                                                           Mean   : -92.44
##                                                           3rd Qu.: -82.08
##                                                           Max.   :   1.00
##     latitude     is_geocoding_exact Median.Below.Poverty Median.Income
##  Min.   : 1.00   Length:6735        Min.   : 6.40        Min.   :31800
##  1st Qu.:32.86   Class :character   1st Qu.:12.30        1st Qu.:38304
##  Median :35.77   Mode  :character   Median :15.00        Median :43359
##  Mean   :34.96                      Mean   :15.49        Mean   :45278
##  3rd Qu.:39.89                      3rd Qu.:18.80        3rd Qu.:50220
##  Max.   :71.30                      Max.   :26.45        Max.   :75358
##  Over.25.Grad.Rate    Region           Armed.Flag        Is.Minority
##  Min.   :78.30     Length:6735        Length:6735        Length:6735
##  1st Qu.:82.45     Class :character   Class :character   Class :character
##  Median :87.50     Mode  :character   Mode  :character   Mode  :character
##  Mean   :86.46
##  3rd Qu.:89.90
##  Max.   :93.90
```

```
gender_summary_post <- table(police_post2015$gender)

gender_post <- barplot(gender_summary_post[order(gender_summary_post, decreasing = FALSE)],
                main = "Deaths by Gender Post-2015",
                xlab = 'Gender',
                ylab = 'Deaths')
text(gender_post,  + 2000 , gender_summary_post, font=1)
```

Deaths by Gender bar chart

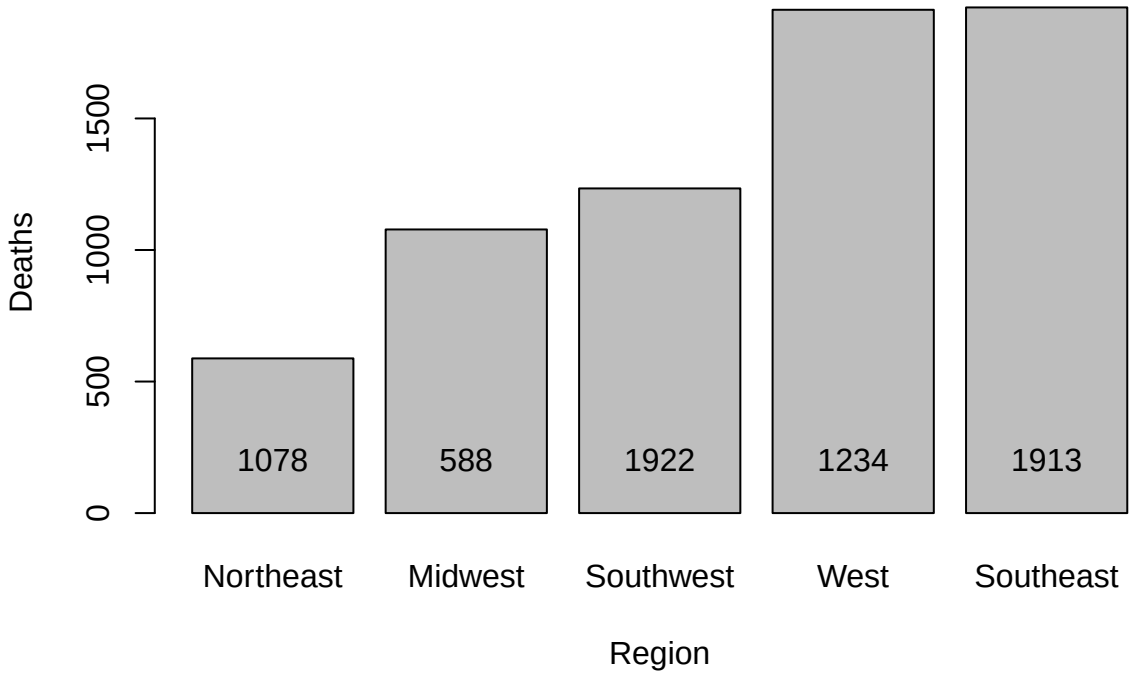
Deaths by Region

```
cont_table_region <- table(final_df$Region)
cont_table_region
```

```
##
##   Midwest Northeast Southeast Southwest      West
##      1078       588      1922      1234      1913
```

```
region_summary_table <- table(final_df$Region)

region_summary <- barplot(region_summary_table[order(region_summary_table, decreasing = FALSE)],
                main = "Deaths by Region",
                xlab = 'Region',
                ylab = 'Deaths')
text(region_summary,  + 200 , region_summary_table, font=1)
```



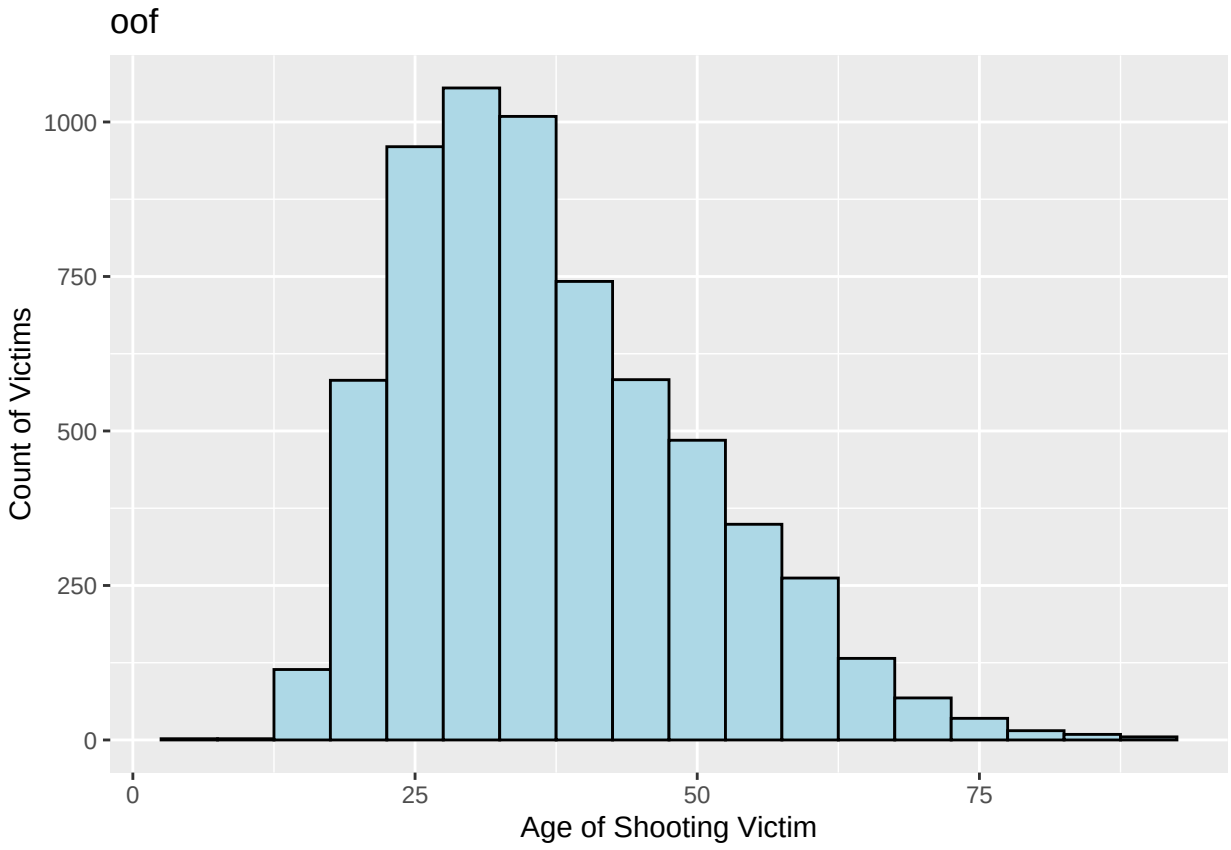

```
cont_table_region <- table(final_df$Region)
cont_table_region
```

```
##
##   Midwest Northeast Southeast Southwest      West
##      1078       588      1922      1234      1913
```

```
#histogram of age post-2015
ggplot(data = police_post2015, aes(age)) + geom_histogram(binwidth = 5, color='black'  ,fill ='lightblu
```

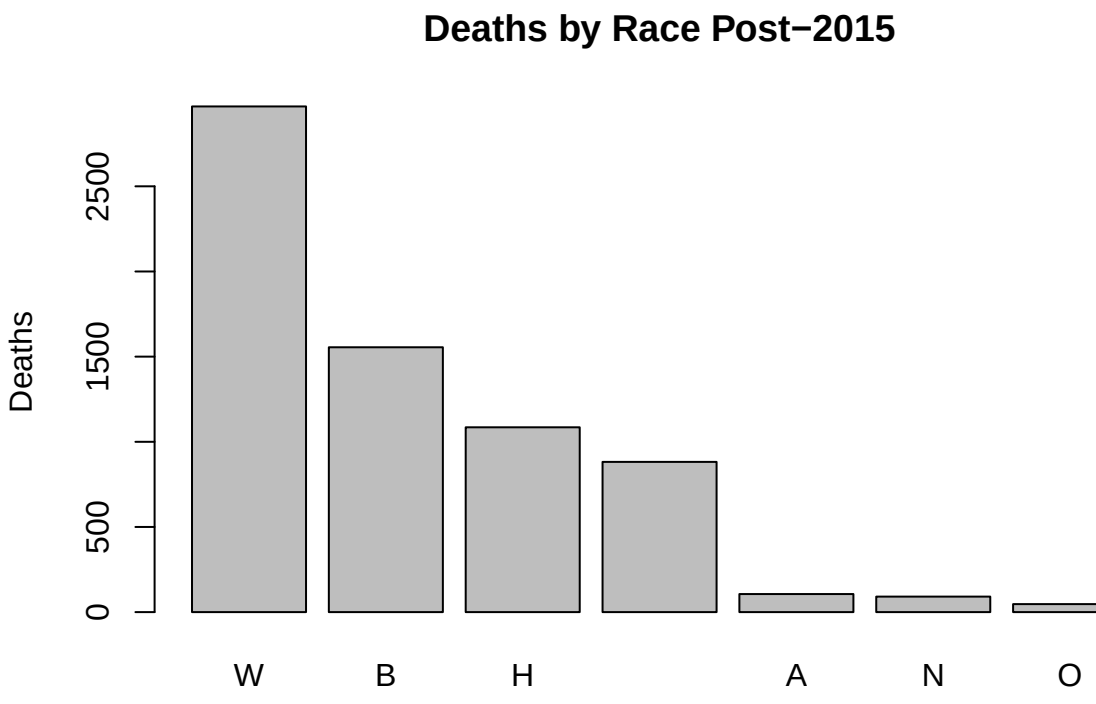
Deaths by Age histogram

```
## Warning: Removed 326 rows containing non-finite values (stat_bin).
```




```
#create a table of the deaths by race
race_summary_post <- table(police_post2015$race)

#develop the bar chart in decreasing order
race_post <- barplot(race_summary_post[order(race_summary_post, decreasing = TRUE)],
                main = "Deaths by Race Post-2015",
                xlab = 'Race',
                ylab = 'Deaths')
```



Deaths by Race bar chart

```
# W = White, B = Black, H = Hispanic, A = Asian, Empty = Unknown, N = Native American, O = Other
```

```
#return the vector of only the deaths by race category
race_summary_post
```

```
##
##         A    B    H    N    O    W
##  882  106 1555 1085   91   47 2969
```

```
#contigency tables and percentages of shooting by race
cont_table_race <- table(police_post2015$race)
prop_table_race <- prop.table(cont_table_race)
perc_table_race <- prop.table(cont_table_race) * 100

race_table <- rbind(cont_table_race, prop_table_race, perc_table_race)
rownames(race_table) <- c("Count","Proportion","Percentage")
race_table
```

Develop contingency tables of police shootings by race, and associated proportions/percentages of whole

```
##                                A            B            H           N
## Count      882.0000000 106.00000000 1555.0000000 1085.0000000 91.00000000
## Proportion   0.1309577   0.01573868    0.2308834    0.1610987  0.01351151
## Percentage  13.0957684   1.57386785   23.0883445   16.1098738  1.35115071
##                        O            W
## Count      47.000000000 2969.0000000
## Proportion  0.006978471    0.4408315
## Percentage  0.697847068   44.0831477
```

```
#race_table["Count", "B"]
```

```
#from: https://www.visualcapitalist.com/visualizing-u-s-population-by-race/ -- retrieve U.S. Population

#estimated U.S. Populations as of 2019
total_pop <- 328239523

#estimated U.S. race demographic proportions
white_pop <- .601 * total_pop
black_pop <- .122 *total_pop
hisp_pop <- .185 *total_pop
asian_pop <- .056 * total_pop
other_pop <- 100 - white_pop -black_pop - hisp_pop - asian_pop

#develop an object by race of the count of deaths by the population proportion
white_prop <- (race_table["Count","W"] / white_pop) * 100
black_prop <- (race_table["Count","B"] / black_pop) * 100
hisp_prop <-  (race_table["Count","H"] / hisp_pop)  * 100
asian_prop <- (race_table["Count","A"] / asian_pop) * 100
```

```
#print the developed race proportions of deaths by police shooting
print(black_prop)
```

From the total U.S. Population statistics in 2019, develop the race proporitions of the U.S. and determine the associated distributions of police shootings by race relative to race proportion in the U.S.

```
## [1] 0.00388311
```

```
print(hisp_prop)
```

```
## [1] 0.001786764
```

```
print(white_prop)
```

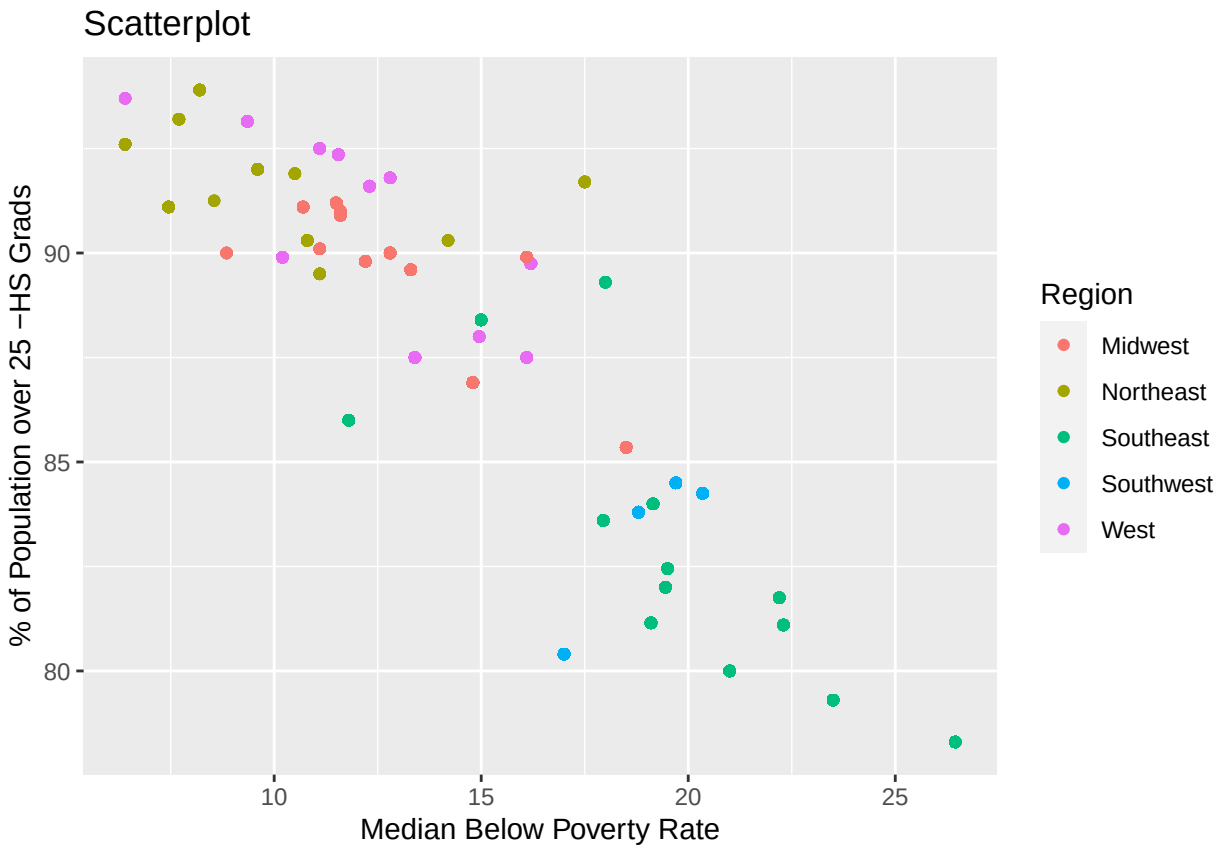
```
## [1] 0.001505029
```

```
print(asian_prop)
```

```
## [1] 0.0005766695
```

Scatterplot of HS Grad Rate, Median Below Povery by Region

```
ggplot(data=final_df) +
  geom_point(mapping = aes( x = Median.Below.Poverty, y = Over.25.Grad.Rate, color = Region)) + ggtitle
```



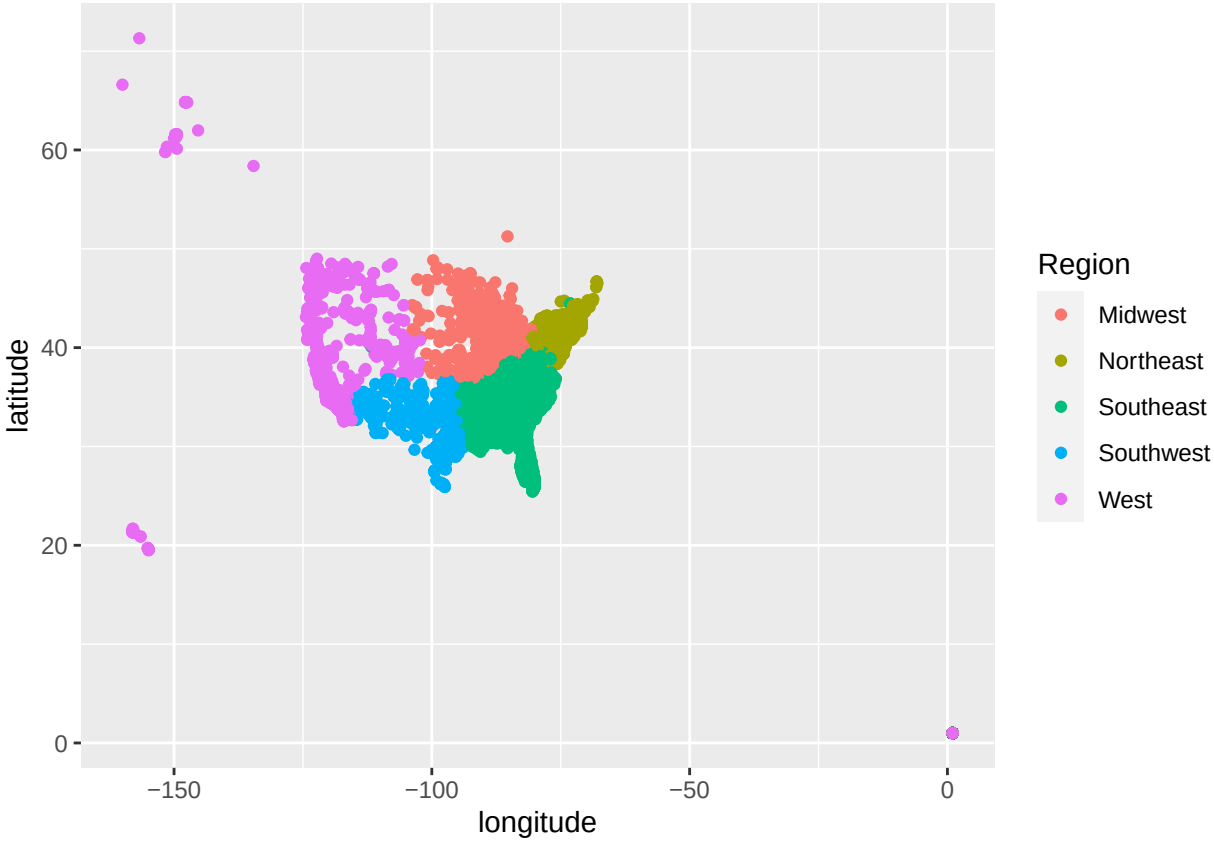

```
head(final_df)
```

```
##   id              name       date  manner_of_death      armed age gender race
## 1  3         Tim Elliot 2015-01-02             shot        gun  53      M    A
## 2  4   Lewis Lee Lembke 2015-01-02             shot        gun  47      M    W
## 3  5 John Paul Quintero 2015-01-03 shot and Tasered    unarmed  23      M    H
## 4  8    Matthew Hoffman 2015-01-04             shot toy weapon  32      M    W
## 5  9  Michael Rodriguez 2015-01-04             shot   nail gun  39      M    H
## 6 11  Kenneth Joe Brown 2015-01-04             shot        gun  18      M    W
##            city state signs_of_mental_illness threat_level        flee
## 1       Shelton    WA                   True       attack Not fleeing
## 2         Aloha    OR                  False       attack Not fleeing
## 3       Wichita    KS                  False        other Not fleeing
## 4 San Francisco    CA                   True       attack Not fleeing
## 5         Evans    CO                  False       attack Not fleeing
## 6       Guthrie    OK                  False       attack Not fleeing
##   body_camera longitude latitude is_geocoding_exact Median.Below.Poverty
## 1       False  -123.122   47.247               True                12.30
## 2       False  -122.892   45.487               True                16.20
## 3       False   -97.281   37.695               True                12.80
## 4       False  -122.422   37.763               True                13.40
## 5       False  -104.692   40.384               True                11.55
## 6       False   -97.423   35.877               True                18.80
##   Median.Income Over.25.Grad.Rate    Region Armed.Flag Is.Minority
## 1       45013.0             91.60      West          1           1
## 2       43125.0             89.75      West          1           0
## 3       42500.0             90.00   Midwest          0           1
```

```
## 4       54667.0             87.50      West          1           0
## 5       50220.5             92.35      West          1           1
## 6       37896.0             83.80 Southwest          1           0
```

Scatterplot of Lat $ Long by Region

```
ggplot(data=final_df) +
  geom_point(mapping = aes( x = longitude, y = latitude, color = Region))
```



Race and Region Contigency Tables

```
race_region_cont <- table(final_df$race,final_df$Region)
race_region_cont
```

```
##
##     Midwest Northeast Southeast Southwest West
##         103        80       232       188  279
##   A      10         4        15         9   68
##   B     319       212       602       181  241
##   H      52        50       101       358  524
##   N      23         1         3        27   37
##   O       7         2         7         3   28
##   W     564       239       962       468  736
```

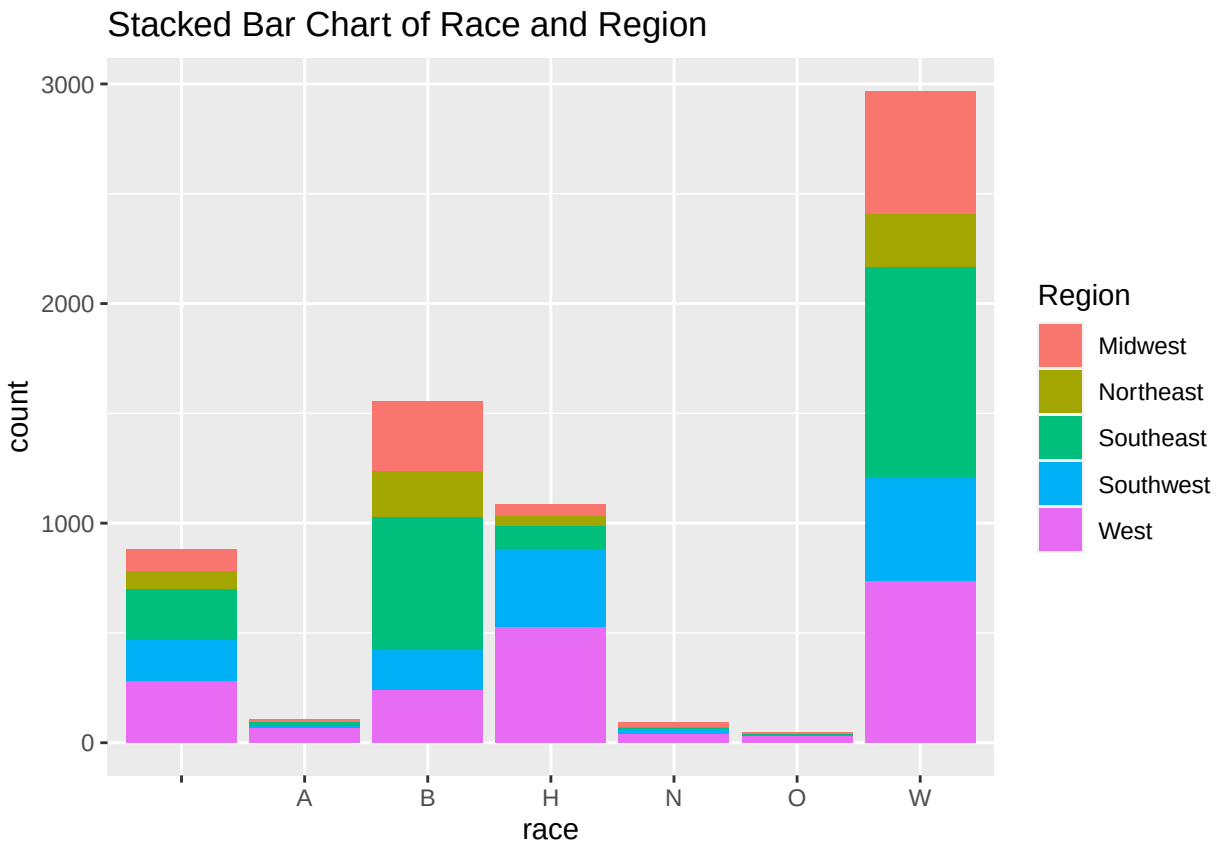
```
round(prop.table(race_region_cont, margin = 2)*100,1)
```

```
##
```

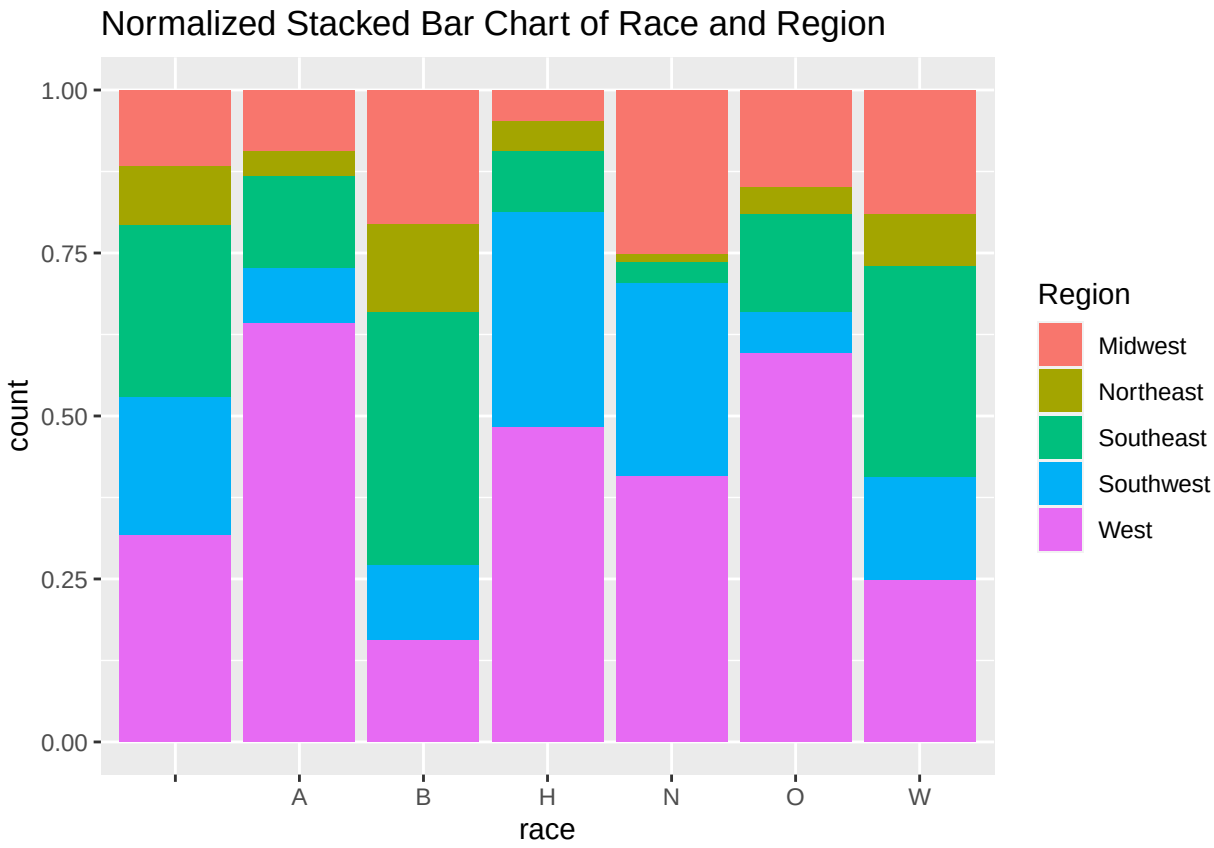
```
##      Midwest Northeast Southeast Southwest West
##         9.6      13.6      12.1      15.2 14.6
##   A     0.9       0.7       0.8       0.7  3.6
##   B    29.6      36.1      31.3      14.7 12.6
##   H     4.8       8.5       5.3      29.0 27.4
##   N     2.1       0.2       0.2       2.2  1.9
##   O     0.6       0.3       0.4       0.2  1.5
##   W    52.3      40.6      50.1      37.9 38.5
```

Bar Chart of Total Police Shootings with Race Overlay

```
ggplot(final_df, aes(race)) + geom_bar(aes(fill=Region)) + ggtitle("Stacked Bar Chart of Race and Regio
```

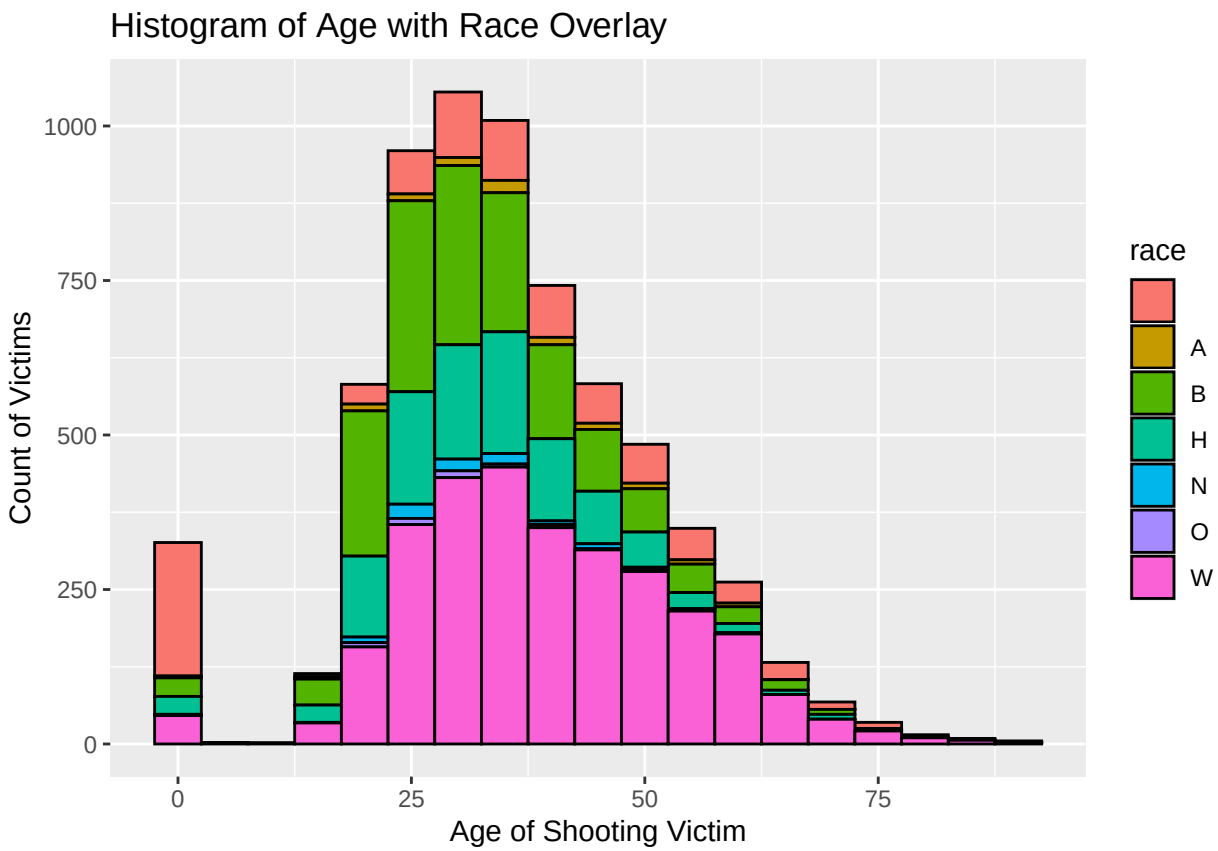



```
#normalized bar chart
ggplot(final_df, aes(race)) + geom_bar(aes(fill=Region) , position = "fill") + ggtitle("Normalized Stac
```

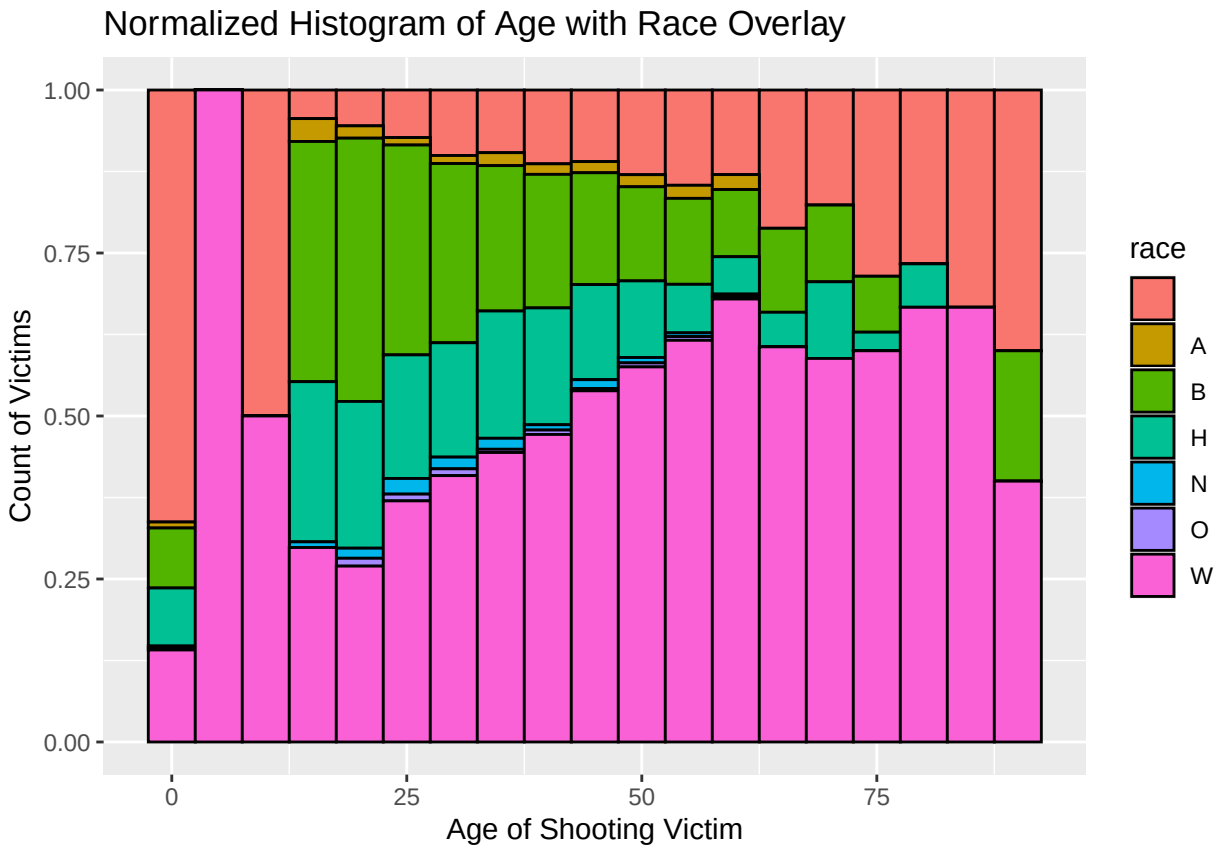


Histograms of Age with Race Overlay

```
#histogram of age with race underlay
ggplot(final_df, aes(age)) + geom_histogram(aes(fill=race), color="black", binwidth = 5) + ggtitle("His
```




```
#histogram of age with race underlay
ggplot(final_df, aes(age)) + geom_histogram(aes(fill=race), color="black", binwidth = 5, position = "fi
```


Normalized Histogram of Age with Race Overlay
Count of Victims
1.00
0.75
0.50
0.25
0.00
0
25
50
75
Age of Shooting Victim
race
A
B
H
N
O
W