

# Police Shootings

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11/28/2021

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/PoliceShootings.csv")

#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/MedianHouseholdIncome.xlsx")
poverty_level <- read_excel("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/PercentagePeopleInPoverty.xlsx")
race_city <- read_excel("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/ShareRaceByCity.xlsx")
hs_grad <- read_excel("~/Documents/USD MS-ADS/Applied Data Mining 502/Final Project/PercentOver25CompletedHighSchool.xlsx")
```

```
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)
```

```

#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(poverty_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 poverty 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
```

```
#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

```
#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 == 'SC' ~ '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'))

```

```

#view the final object
head(final_df)

```

Add in a region area by state

##	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
## 1      45013.0              91.60      West
## 2      43125.0              89.75      West
## 3      42500.0              90.00  Midwest
## 4      54667.0              87.50      West
## 5      50220.5              92.35      West
## 6      37896.0              83.80 Southwest

```

## 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.      : 6.00   Length:6735   Length:6735
## Class :character   1st Qu.:27.00   Class :character   Class :character
## Mode  :character   Median :35.00   Mode  :character   Mode  :character
##                      Mean      :37.11
##                      3rd Qu.:45.00
##                      Max.      :92.00
##                      NA's      :326
##      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.: -112.07
## Mode  :character   Mode  :character   Mode  :character   Median :  -94.25
##                      Mean      : -97.11
##                      3rd Qu.: -83.10
##                      Max.      : -67.87

```

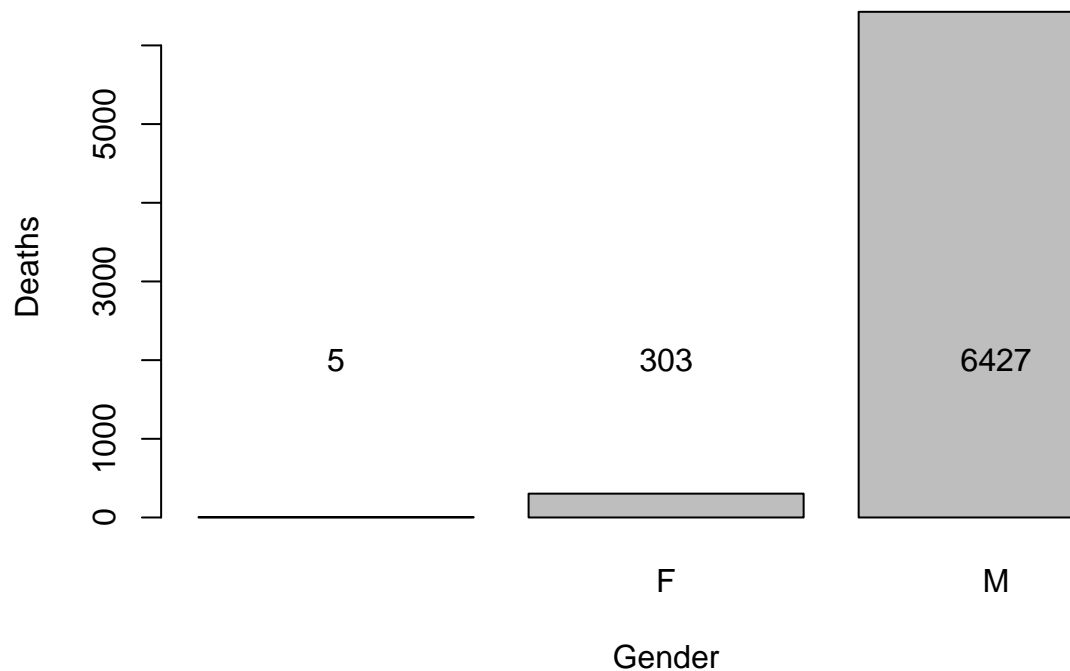


```
##                                     NA's      :321
##      latitude      is_geocoding_exact Median.Below.Poverty Median.Income
## Min.      :19.50   Length:6735      Min.      : 6.40   Min.      :31800
## 1st Qu.:33.48   Class :character  1st Qu.:12.30   1st Qu.:38304
## Median :36.10   Mode  :character  Median :15.00   Median :43359
## Mean    :36.66                Mean    :15.49   Mean    :45278
## 3rd Qu.:40.00                3rd Qu.:18.80   3rd Qu.:50220
## Max.    :71.30                Max.     :26.45   Max.     :75358
## NA's     :321
## Over.25.Grad.Rate      Region
## Min.      :78.30      Length:6735
## 1st Qu.:82.45      Class :character
## Median :87.50      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 Post-2015



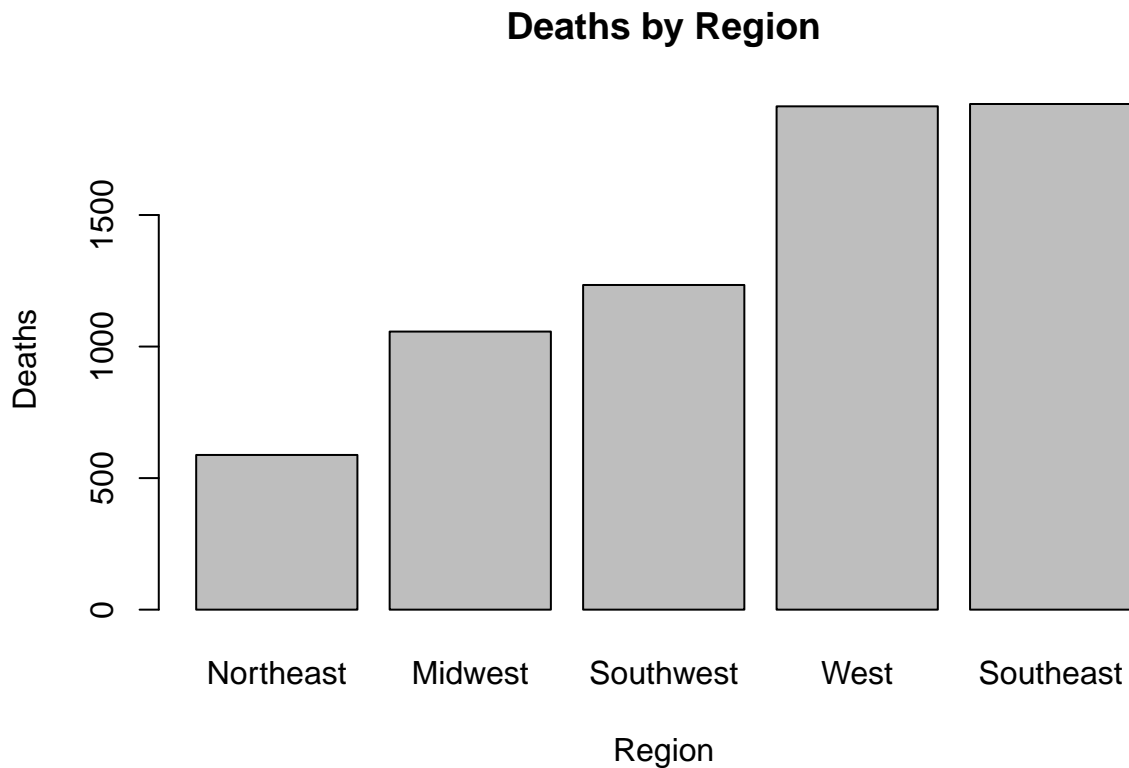
Deaths by Gender bar chart

### Deaths by Region

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

```
##
##   Midwest Northeast Southeast Southwest      West
##     1057      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')
```



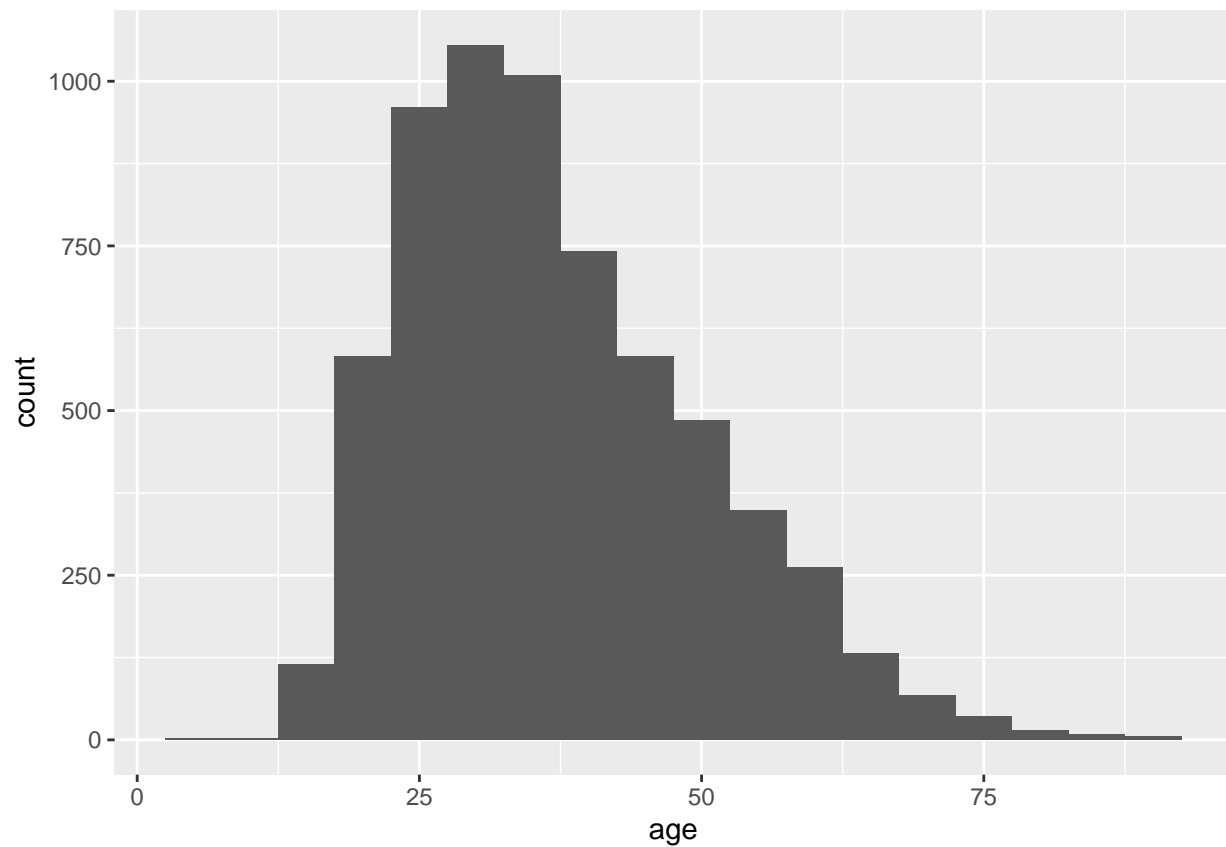
```
cont_table_region <- table(final_df$Region)
cont_table_region
```

```
##
##   Midwest Northeast Southeast Southwest      West
##     1057      588      1922      1234      1913
```

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

Deaths by Age histogram

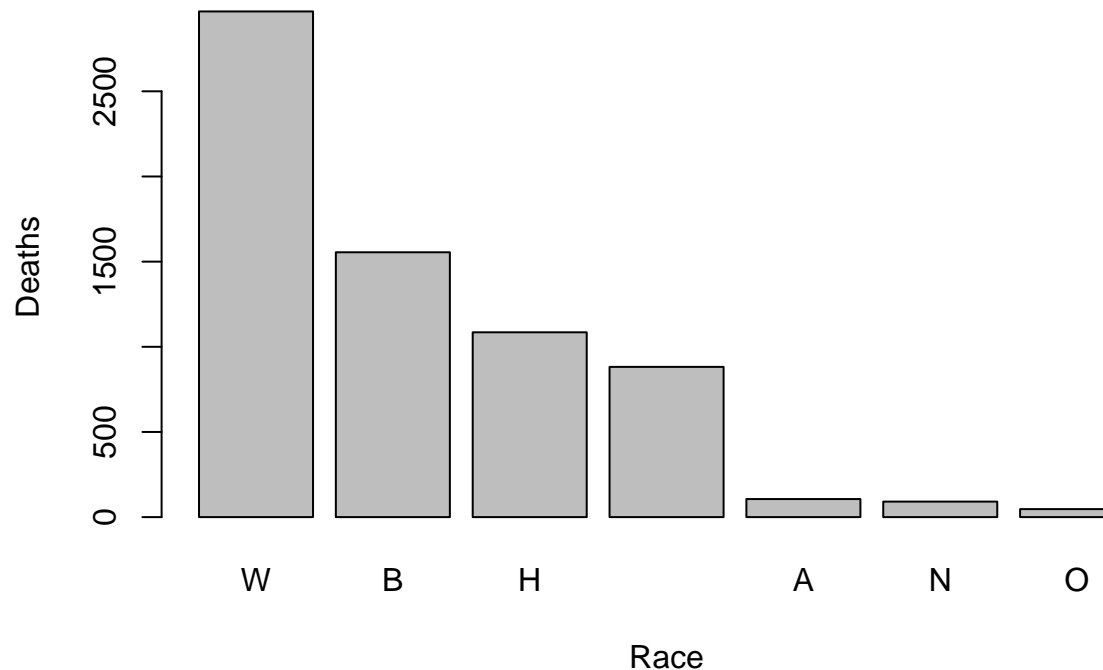
```
## Warning: Removed 326 rows containing non-finite values (stat_bin).
```



```
#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 Post-2015



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
```

*#contingency 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 106.0000000 1555.0000000 1085.0000000 91.0000000
## 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      47.00000000 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 proportions 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
```

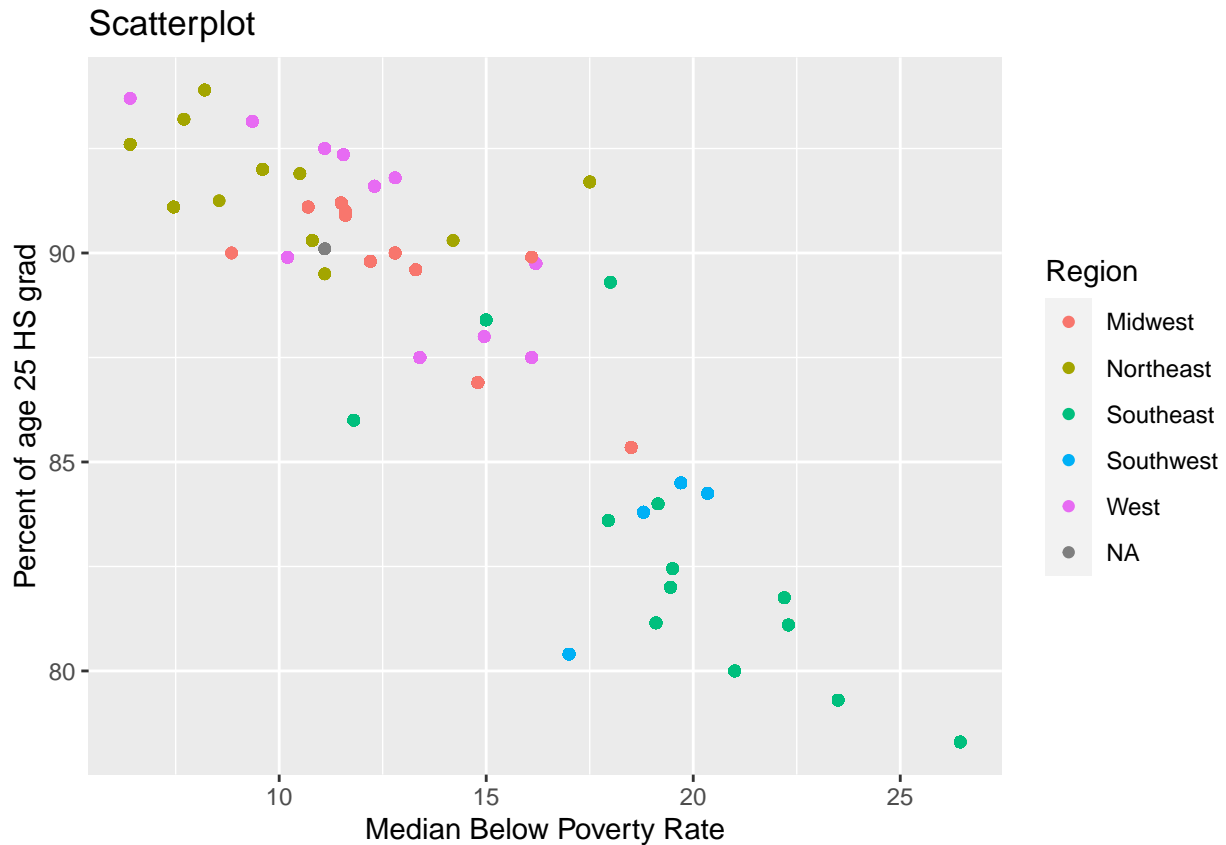
```
print(asian_prop)
```

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

Scatterplot of HS Grad Rate, Median Below Poverty 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

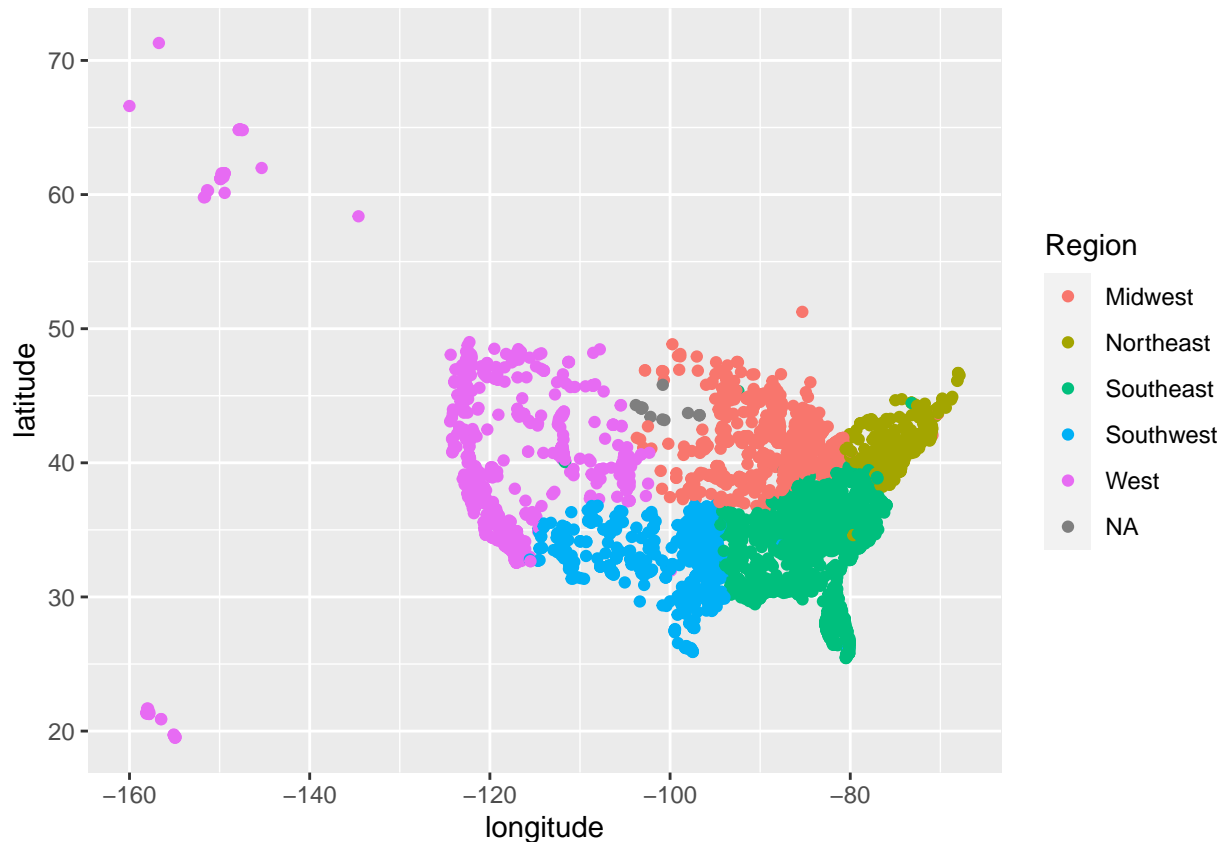
##	Median.Income	Over.25.Grad.Rate	Region
## 1	45013.0	91.60	West
## 2	43125.0	89.75	West
## 3	42500.0	90.00	Midwest

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

### Scatterplot of Lat \$ Long by Region

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

```
## Warning: Removed 321 rows containing missing values (geom_point).
```



### Race and Region Contingency Tables

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

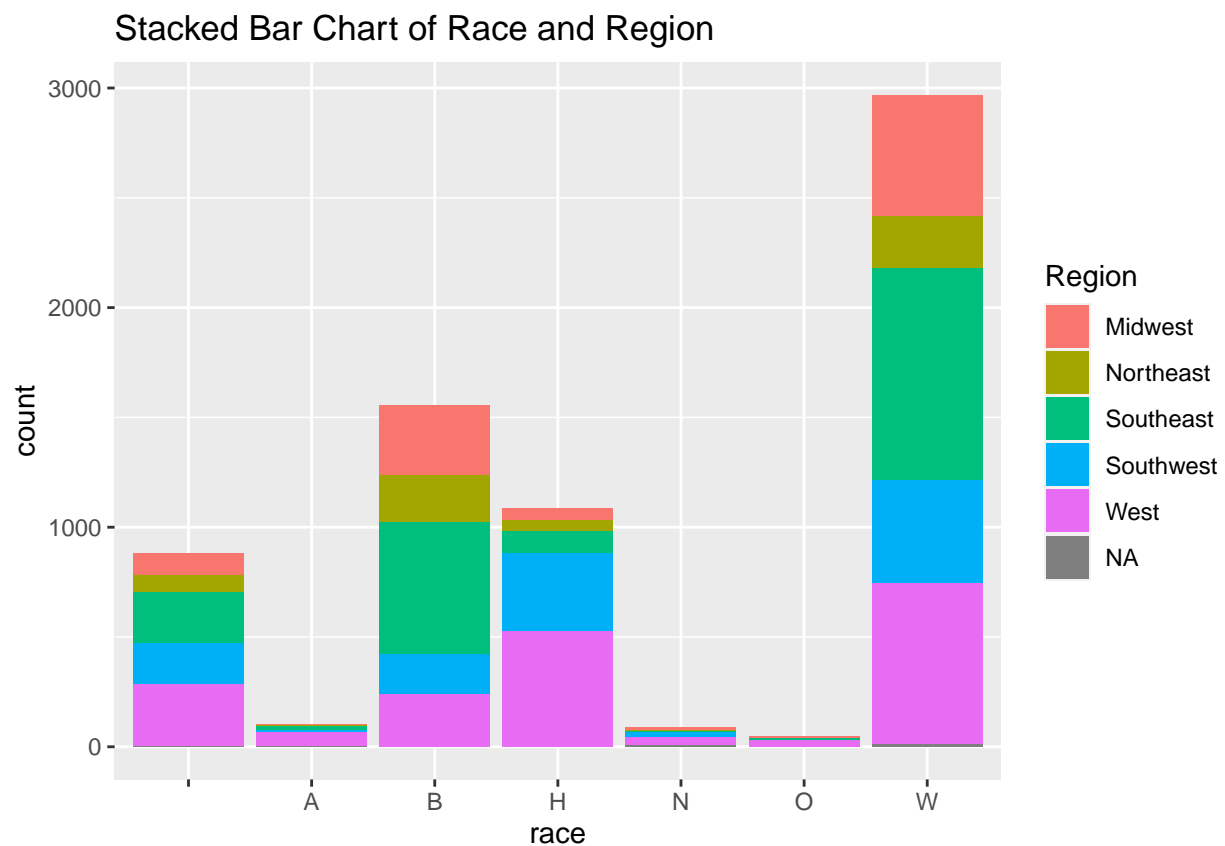
```
##
##      Midwest Northeast Southeast Southwest West
##      99      80      232      188  279
## A      9       4       15       9   68
## B     319     212     602     181  241
## H     52      50     101     358  524
## N     18       1       3      27   37
## O      7       2       7       3   28
## W     553     239     962     468  736
```

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

```
##
##      Midwest Northeast Southeast Southwest West
##      9.4      13.6      12.1      15.2 14.6
## A      0.9      0.7      0.8      0.7 3.6
## B     30.2     36.1     31.3     14.7 12.6
## H      4.9      8.5      5.3     29.0 27.4
## N      1.7      0.2      0.2      2.2 1.9
## O      0.7      0.3      0.4      0.2 1.5
## W     52.3     40.6     50.1     37.9 38.5
```

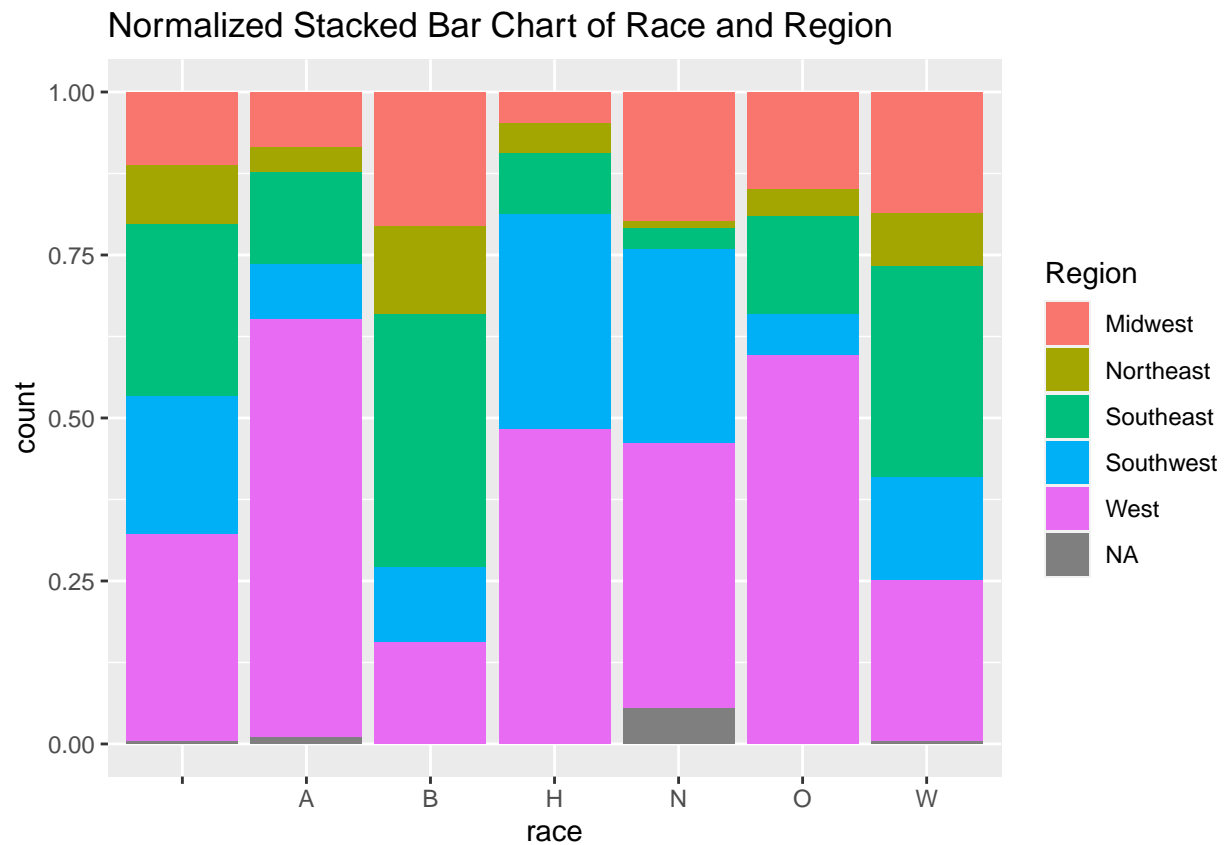
### Bar Chart of Total Police Shootings with Race Overlay

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



```
#normalized bar chart
ggplot(final_df, aes(race)) + geom_bar(aes(fill=Region) , position = "fill") + ggtitle("Normalized Stacked Bar Chart of Race and Region")
```





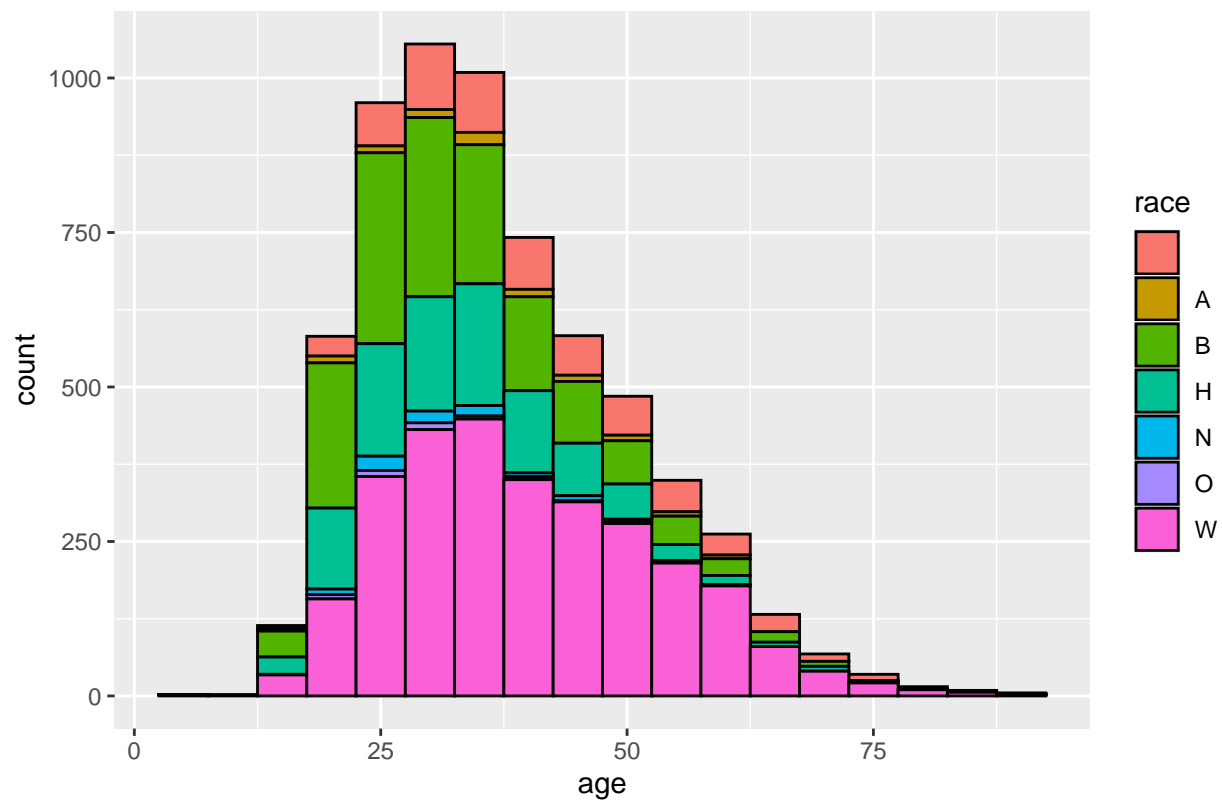
### Histograms of Age with Race Overlay

*#histogram of age with race underlay*

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

## Warning: Removed 326 rows containing non-finite values (stat\_bin).

# Histogram 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, position = "fill")

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

