Pràctica 2 - Aarón Puche i Roger Pardell

1. Plantejament del problema

"Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum."

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2. Carrega inicial de les dades

Carreguem les llibreries que utilitzarem

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

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

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

```
library(ggplot2)
library(magrittr)
```

```
df_householdIncome <- read.csv("data/MedianHouseholdIncome2015.csv", sep=",")
df_poverty <- read.csv("data/PercentagePeopleBelowPovertyLevel.csv", sep=",")
df_highSchool <- read.csv("data/PercentOver25CompletedHighSchool.csv", sep=",")
df_policeKilling <- read.csv("data/PoliceKillingsUS.csv", sep=",")
df_shareRace <- read.csv("data/ShareRaceByCity.csv", sep=",")

head(df_householdIncome)
```

```
##   Geographic.Area            City Median.Income
## 1              AL      Abanda CDP         11207
## 2              AL  Abbeville city         25615
## 3              AL Adamsville city         42575
## 4              AL    Addison town         37083
## 5              AL      Akron town         21667
## 6              AL  Alabaster city         71816
```

```
head(df_poverty)
```

```
##   Geographic.Area            City poverty_rate
## 1              AL      Abanda CDP         78.8
## 2              AL  Abbeville city         29.1
## 3              AL Adamsville city         25.5
## 4              AL    Addison town         30.7
## 5              AL      Akron town           42
## 6              AL  Alabaster city         11.2
```

```
head(df_highSchool)
```

```
##   Geographic.Area            City percent_completed_hs
## 1              AL      Abanda CDP                21.2
## 2              AL  Abbeville city                69.1
## 3              AL Adamsville city                78.9
## 4              AL    Addison town                81.4
## 5              AL      Akron town                68.6
## 6              AL  Alabaster city                89.3
```

```
head(df_policeKilling)
```

```
##   id               name     date  manner_of_death      armed age gender race
## 1  3         Tim Elliot 02/01/15             shot        gun  53      M    A
## 2  4   Lewis Lee Lembke 02/01/15             shot        gun  47      M    W
## 3  5 John Paul Quintero 03/01/15 shot and Tasered    unarmed  23      M    H
## 4  8    Matthew Hoffman 04/01/15             shot toy weapon  32      M    W
## 5  9  Michael Rodriguez 04/01/15             shot   nail gun  39      M    H
## 6 11  Kenneth Joe Brown 04/01/15             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
## 1       FALSE
## 2       FALSE
## 3       FALSE
## 4       FALSE
## 5       FALSE
## 6       FALSE
```

```
head(df_shareRace)
```

```
##   Geographic.area            City share_white share_black share_native_american
## 1              AL      Abanda CDP        67.2        30.2                     0
## 2              AL  Abbeville city        54.4        41.4                   0.1
## 3              AL Adamsville city        52.3        44.9                   0.5
## 4              AL    Addison town        99.1         0.1                     0
## 5              AL      Akron town        13.2        86.5                     0
## 6              AL  Alabaster city        79.4        13.5                   0.4
##   share_asian share_hispanic
## 1           0            1.6
## 2           1            3.1
## 3         0.3            2.3
## 4         0.1            0.4
## 5           0            0.3
## 6         0.9              9
```

3. Descripció i neteja de les dades

Canviem el nom de les columnes

```
colnames(df_householdIncome)[1] <- "area_geografica"
colnames(df_poverty)[1] <- "area_geografica"
colnames(df_highSchool)[1] <- "area_geografica"
colnames(df_shareRace)[1] <- "area_geografica"
```

Merge els distins df:

```
USAv1 <- merge(df_highSchool, df_poverty, by.x=c("area_geografica", "City"), by.y=c("area_geografica",
USAv2 <- merge(USAv1, df_householdIncome, by.x=c("area_geografica", "City"), by.y=c("area_geografica",
USA <- merge(USAv2, df_shareRace, by.x=c("area_geografica", "City"), by.y=c("area_geografica", "City"))
```

Normalitzem els noms de les ciutats:

```
USA$City <- gsub(" CDP| city| town|\\.| ","", USA$City)
df_policeKilling$city <- gsub(" County| Parish|[^[:alnum:]]","",df_policeKilling$city)
```

Merge del dataframe ambtingut amb df_policeKilling i neteja i preparació de les dades:

```
df_clean <- merge(df_policeKilling, USA, by.x=c("state", "city"), by.y=c("area_geografica", "City"))

df_clean$id <- NULL
#df_clean$city <- NULL
#df_clean$state <- NULL

# Convertim el camp date de tipus character a tipus date
df_clean %<>% mutate(date=as.Date(date, format = "%d/%m/%y"))

#rownames(df_clean) <- 1:nrow(df_clean)
```

Tractar camp Median.Income:

```
table(df_clean$Median.Income)[1:5]
```

```
##
##      -    (X) 100469 100849 101689
##      1      6      1      1      1
```

```
# Hem vist que la variable Median.Income te el valor "-" i "(X)", els subtituim per 0
df_clean[df_clean$Median.Income == "-",]$Median.Income <- "0"
df_clean[df_clean$Median.Income == "(X)",]$Median.Income <- "0"

# Convertim la variable a tipus numeric
df_clean$Median.Income <- as.numeric(df_clean$Median.Income)

# Calculem la mitjana i la asignem als valors que haviem subtituit abans
mean_income <- mean(df_clean[df_clean$Median.Income > 0,]$Median.Income)
df_clean$Median.Income[df_clean$Median.Income == 0] <- mean_income
```

Continuem amb el tractament de les dades:

- Pasarem les variables: manner_of_death, armed, gender, race, threat_level i flee a tipus factor.
- I les variables: percent_completed_hs, poverty_rate, share_white, share_asian, share_black, share_native_american i share_hispanic a tipus numeric.

```
df_clean$manner_of_death <- as.factor(df_clean$manner_of_death)
df_clean$armed <- as.factor(df_clean$armed)
df_clean$gender <- as.factor(df_clean$gender)
df_clean$race <- as.factor(df_clean$race)
df_clean$threat_level <- as.factor(df_clean$threat_level)
df_clean$flee <- as.factor(df_clean$flee)
df_clean$percent_completed_hs <- as.numeric(df_clean$percent_completed_hs)
df_clean$poverty_rate <- as.numeric(df_clean$poverty_rate)
df_clean$share_white <- as.numeric(df_clean$share_white)
df_clean$share_asian <- as.numeric(df_clean$share_asian)
df_clean$share_black <- as.numeric(df_clean$share_black)
df_clean$share_native_american <- as.numeric(df_clean$share_native_american)
df_clean$share_hispanic <- as.numeric(df_clean$share_hispanic)

head(df_clean)
```

```
##   state      city                  name       date  manner_of_death armed age
## 1    AK    Barrow        Vincent Nageak 2016-02-10             shot   gun  36
## 2    AK   BigLake      Jean R. Valescot 2017-02-17             shot   gun  35
## 3    AK Fairbanks Matthew Colton Stover 2017-06-19             shot   gun  21
## 4    AK Fairbanks          Tristan Vent 2015-09-08             shot   gun  19
## 5    AK Fairbanks     Vincent J. Perdue 2015-09-09             shot   gun  33
## 6    AK Fairbanks James Robert Richards 2016-08-29 shot and Tasered   gun  28
##   gender race signs_of_mental_illness threat_level        flee body_camera
## 1      M    N                  FALSE       attack Not fleeing       FALSE
## 2      M    B                  FALSE       attack Not fleeing       FALSE
## 3      M    N                   TRUE       attack        Foot       FALSE
```

```
## 4      M    N                 FALSE       attack Not fleeing       FALSE
## 5      M    N                 FALSE       attack         Car       FALSE
## 6      M                      FALSE       attack        Foot        TRUE
##   percent_completed_hs poverty_rate Median.Income share_white share_black
## 1                 84.6         11.7         76902        16.9         1.0
## 2                 90.4          9.6         70988        86.1         0.2
## 3                 91.2         13.1         55229        66.1         9.0
## 4                 91.2         13.1         55229        66.1         9.0
## 5                 91.2         13.1         55229        66.1         9.0
## 6                 91.2         13.1         55229        66.1         9.0
##   share_native_american share_asian share_hispanic
## 1                  61.2         9.1            3.1
## 2                   7.0         0.5            3.1
## 3                  10.0         3.6            9.0
## 4                  10.0         3.6            9.0
## 5                  10.0         3.6            9.0
## 6                  10.0         3.6            9.0
```

Valors buits i extrems

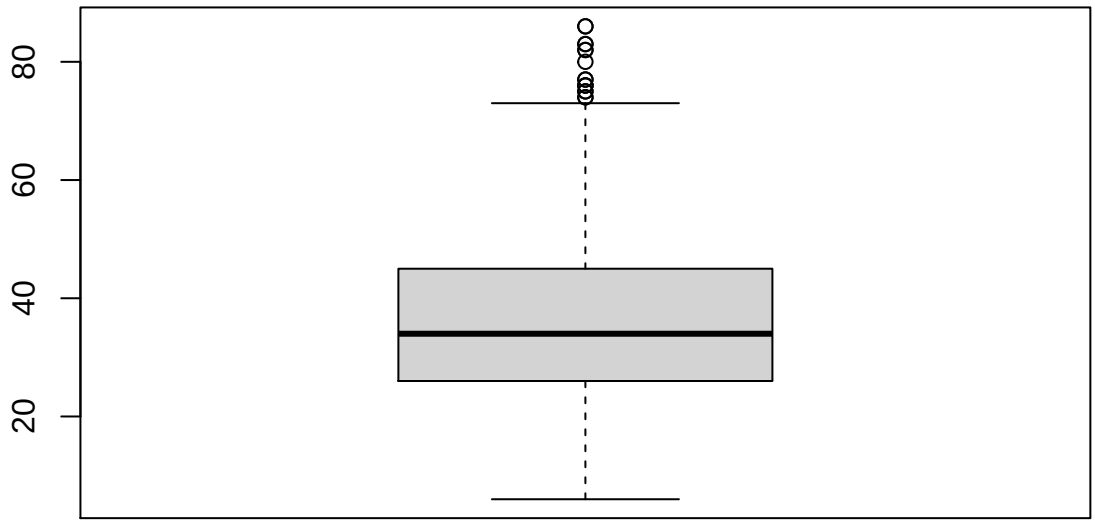
Una vegada tenim les dades en el format que volem, comprovem si hi ha algun valor buit entot el dataframe:

```
colSums(is.na(df_clean))
```

```
##                   state                    city                    name
##                       0                       0                       0
##                    date          manner_of_death                   armed
##                       0                       0                       0
##                     age                  gender                    race
##                      71                       0                       0
## signs_of_mental_illness            threat_level                    flee
##                       0                       0                       0
##             body_camera    percent_completed_hs            poverty_rate
##                       0                       0                       0
##           Median.Income            share_white            share_black
##                       0                       0                       0
##   share_native_american            share_asian         share_hispanic
##                       0                       0                       0
```

age Vegem que tenim 71 edats desconegudes.

```
boxplot(df_clean$age)$out
```




```
##  [1] 77 83 86 82 74 75 75 76 76 83 77 80 86 74 76 82
```

Tenim uns quants valors extrems en la variable edat, que corresponen a edats majors de 70 anys. Com aquest valors podrien influir en la mitjana, anema a assignar als valors NA la mediana, que es mes robusta contra aquests efectes.

```
df_clean$age[is.na(df_clean$age)] <- median(df_clean$age[!is.na(df_clean$age)])
colSums(is.na(df_clean))
```

```
##                   state                    city                    name
##                       0                       0                       0
##                    date          manner_of_death                   armed
##                       0                       0                       0
##                     age                  gender                    race
##                       0                       0                       0
## signs_of_mental_illness            threat_level                    flee
##                       0                       0                       0
##              body_camera    percent_completed_hs            poverty_rate
##                       0                       0                       0
##           Median.Income             share_white             share_black
##                       0                       0                       0
##    share_native_american             share_asian          share_hispanic
##                       0                       0                       0
```

Ya no tenim valors NA en cap variable. Comprovem si hi ha elements amb cadena buida.

```
colSums(df_clean == "")
```

```
##                   state                    city                    name
##                       0                       0                       0
##                    date         manner_of_death                   armed
##                      NA                       0                       8
##                     age                  gender                    race
##                       0                       0                     170
## signs_of_mental_illness            threat_level                    flee
##                       0                       0                      54
##             body_camera    percent_completed_hs            poverty_rate
##                       0                       0                       0
##           Median.Income             share_white             share_black
##                       0                       0                       0
##   share_native_american             share_asian          share_hispanic
##                       0                       0                       0
```

date Ens indica que hi ha valors NA en date, ho comprovem.

```
which(is.na(df_clean$date))
```

```
## integer(0)
```

En la comprovació ens diu que no hi ha camp valor de date amb NA.

armed Com son sols 8 registres, els eliminarem

```
df_clean <- df_clean[df_clean$armed != "",]
```

race Aquestes dades serà una mica mes complicat, ja que no son valors numèrics, si no classes a les que pot pertanyer el registre. Vegem com es distribueixen.

```
table(df_clean$race)
```

```
##
##       A   B   H   N   O   W
## 167  34 545 386  27  26 996
```

Qui mes tenim es de gent "White" pero no podem assignar els 167 registres a white ja que aço podria despres fer-nos caure en analisis erronis ja que estariem inflant aquestes dades. Com no es una gran quantitat de registres respecte al total, els eliminarem.

```
df_clean <- df_clean[df_clean$race != "",]
```

flee

```
table(df_clean$flee)
```

```
##
##                   Car        Foot Not fleeing       Other
##          44         319         249        1324          78
```

Tenim una situació semblant a la variable race. Com son sols 44 registres els eliminarem.

```
df_clean <- df_clean[df_clean$flee != "",]
```

En aquest punt ja tenim les dades tractades. Comprovem:

```
colSums(df_clean == "")
```

```
##                   state                    city                    name
##                       0                       0                       0
##                    date         manner_of_death                   armed
##                      NA                       0                       0
##                     age                  gender                    race
##                       0                       0                       0
## signs_of_mental_illness            threat_level                   flee
##                       0                       0                       0
##             body_camera    percent_completed_hs            poverty_rate
##                       0                       0                       0
##           Median.Income             share_white             share_black
##                       0                       0                       0
##   share_native_american             share_asian          share_hispanic
##                       0                       0                       0
```

Cap valor buit.

```
str(df_clean)
```

```
## 'data.frame':    1970 obs. of  21 variables:
##  $ state                  : chr  "AK" "AK" "AK" "AK" ...
##  $ city                   : chr  "Barrow" "BigLake" "Fairbanks" "Fairbanks" ...
##  $ name                   : chr  "Vincent Nageak" "Jean R. Valescot" "Matthew Colton Stover" "Tristar
##  $ date                   : Date, format: "2016-02-10" "2017-02-17" ...
##  $ manner_of_death        : Factor w/ 2 levels "shot","shot and Tasered": 1 1 1 1 1 1 1 1 1 1 ...
##  $ armed                  : Factor w/ 62 levels "","air conditioner",..: 20 20 20 20 20 20 20 20 27 1
##  $ age                    : num  36 35 21 19 33 23 38 36 33 29 ...
##  $ gender                 : Factor w/ 2 levels "F","M": 2 2 2 2 2 2 1 2 2 2 ...
##  $ race                   : Factor w/ 7 levels "","A","B","H",..: 5 3 5 5 5 7 5 7 7 3 ...
##  $ signs_of_mental_illness: logi  FALSE FALSE TRUE FALSE FALSE FALSE ...
##  $ threat_level           : Factor w/ 3 levels "attack","other",..: 1 1 1 1 1 1 1 1 2 1 ...
##  $ flee                   : Factor w/ 5 levels "","Car","Foot",..: 4 4 3 4 2 2 4 5 4 4 ...
##  $ body_camera            : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ percent_completed_hs   : num  84.6 90.4 91.2 91.2 91.2 91.2 90.2 91.8 91.8 69.1 ...
##  $ poverty_rate           : num  11.7 9.6 13.1 13.1 13.1 13.1 14.8 11.7 11.7 29.1 ...
##  $ Median.Income          : num  76902 70988 55229 55229 55229 ...
##  $ share_white            : num  16.9 86.1 66.1 66.1 66.1 66.1 82.2 83.4 83.4 54.4 ...
##  $ share_black            : num  1 0.2 9 9 9 9 0.4 1.4 1.4 41.4 ...
##  $ share_native_american  : num  61.2 7 10 10 10 10 6.7 5.2 5.2 0.1 ...
##  $ share_asian            : num  9.1 0.5 3.6 3.6 3.6 3.6 0.6 2.1 2.1 1 ...
##  $ share_hispanic         : num  3.1 3.1 9 9 9 9 3.3 4.3 4.3 3.1 ...
```

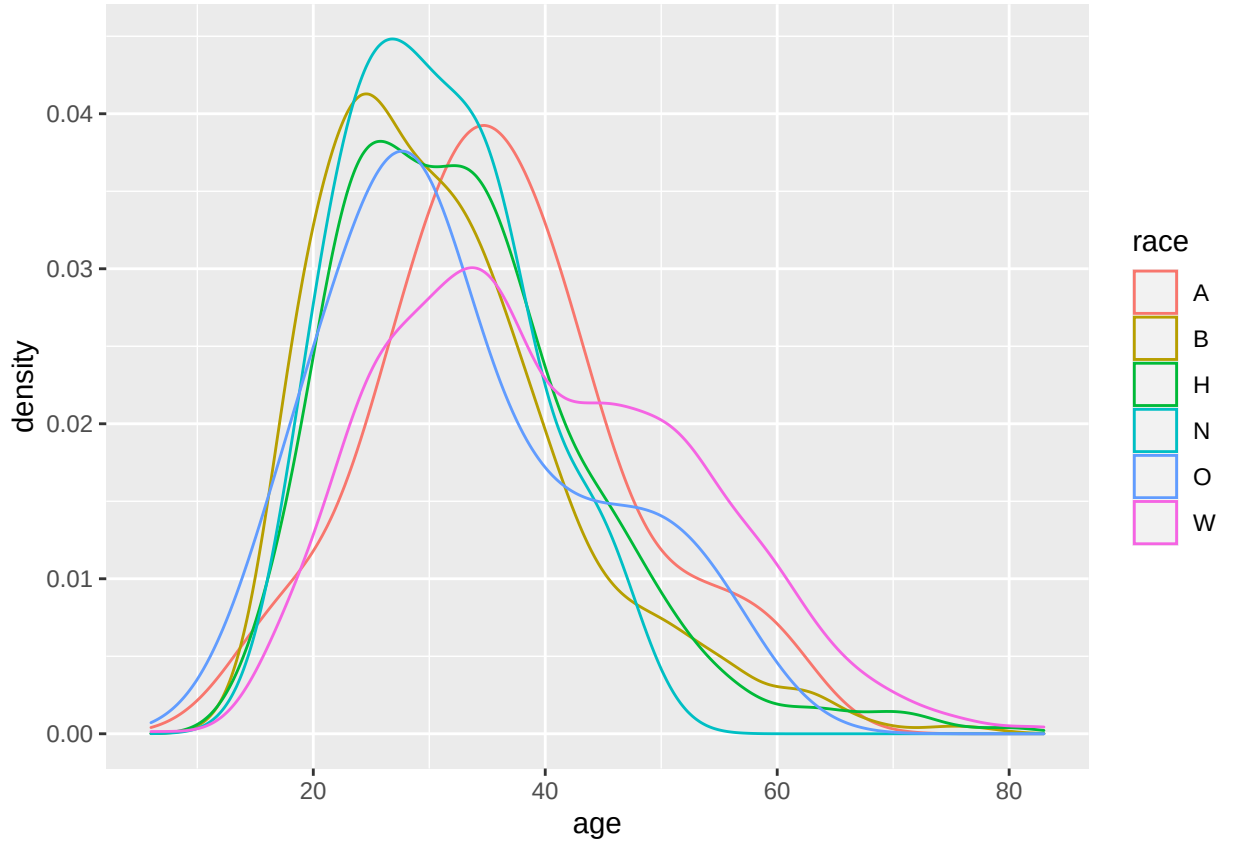
I amb el tipus adequat.

4. Anàlisis exploratori de les dades

En aquest punt ens centrarem en les variables gender, race, poverty, hig school i age.

En primer lloc mirarem si la distribució de l'edat es igual a totes les races:

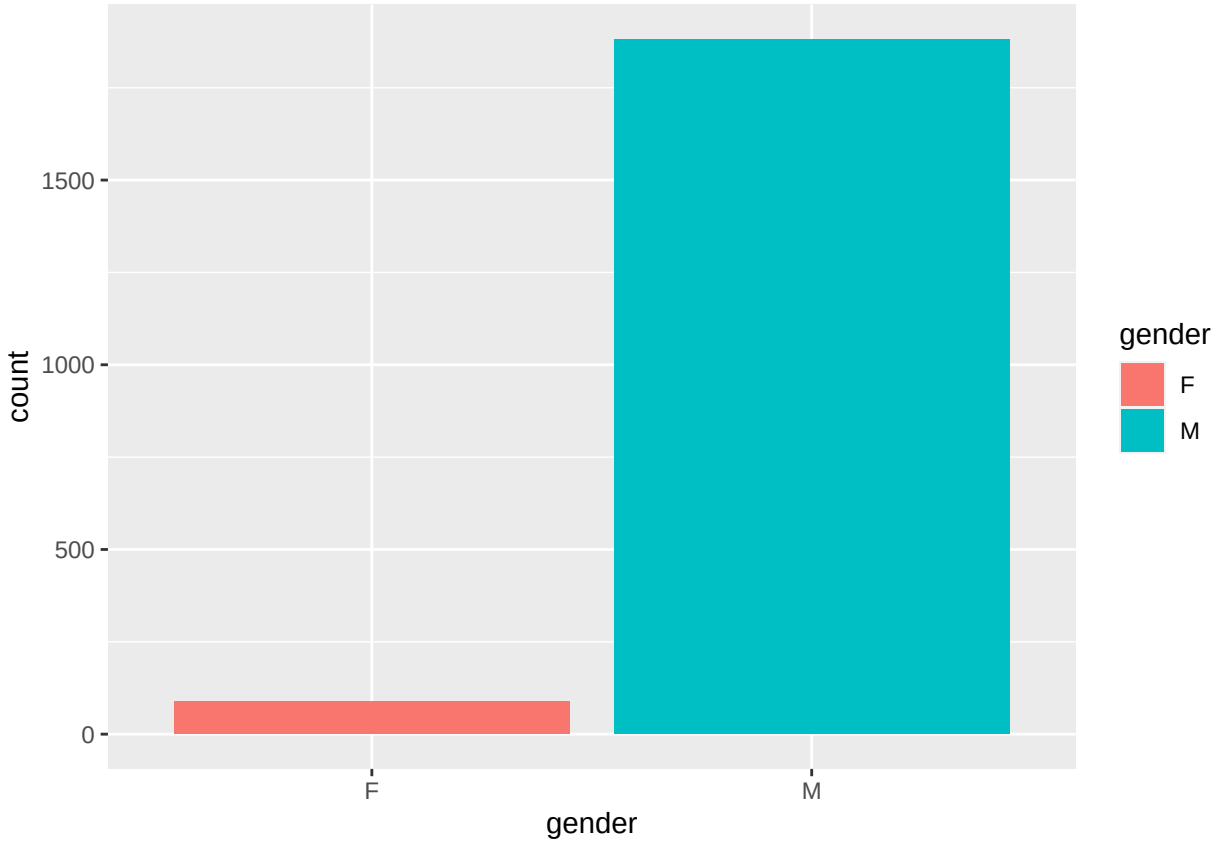
```
#ggplot(df_clean) + geom_density(map = aes((x = age)))

ggplot(df_clean, aes(x = age, colour=race, group=race)) + geom_density()
```



Com es pot observat, les persones disparades de raça Black, Hispanic i Native-Americans tenen una distribucio bastant similars d'edats. Assian es una mica mes majors pero on es veu una diferencia mes gran es amb White, aquestes ultimes persones son mes majors, no s'agrupen tanten dades entonr als 20-30 anys com els altres.

Vegem tambe la distribucio per sexes.

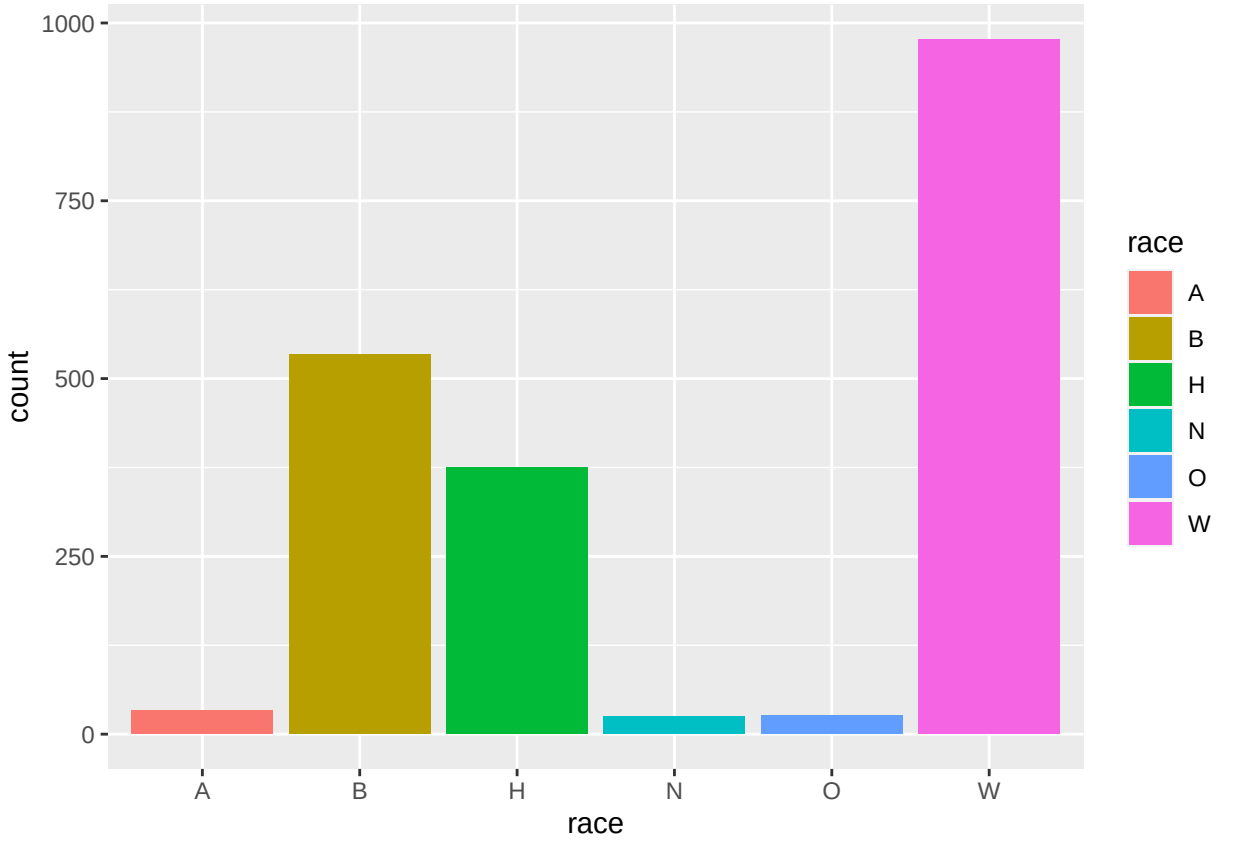
```
ggplot(df_clean) + geom_bar(map = aes(gender, fill=gender))
```



Podem destacar que, clarament, la gran majoria de persones disparades son homes.

Vegem ara com es distribueixen les races de les persones disparades:

```
ggplot(df_clean) + geom_bar(map = aes(race, fill=race))
```



De qui mes registres tenim es de raça "blanca". Es llogic veure aquests resultats ja que la majoria de persones en estats units son de raça blanca, però, quina es la proporcio de victimes de cada respectiva raça respecta al total de persones d'eixa raça?

Per saber el total de la població de cada raça ens basarem en les dades de Demographics of the United States, de 2017. Les nostres dades, com podem veure, van de 2015 a 2017, aixi que s'ajustaran bastant be.

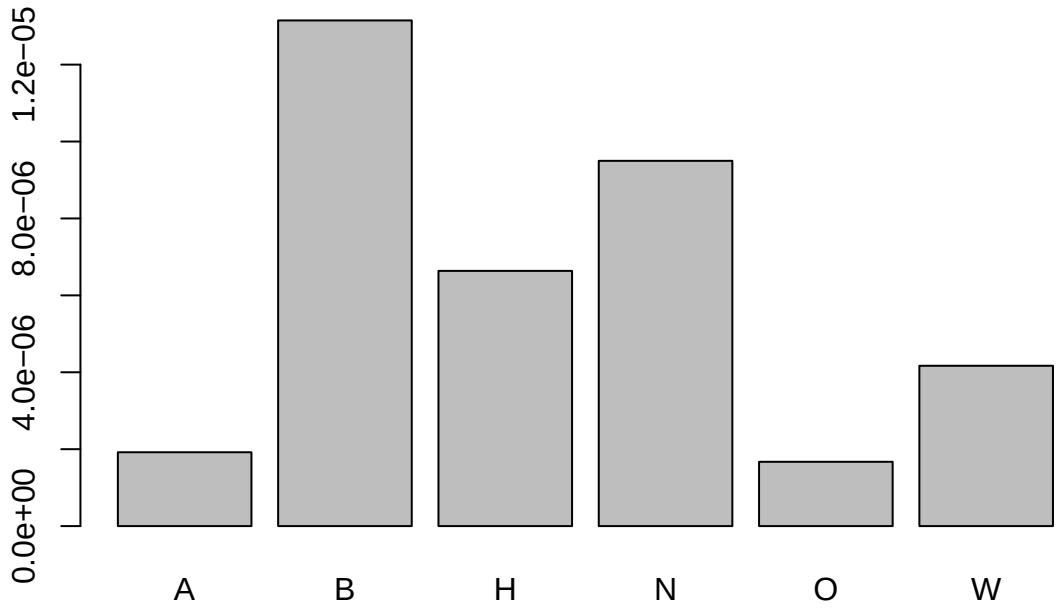
```
summary(df_clean$date)
```

```
##         Min.      1st Qu.       Median         Mean      3rd Qu.         Max.
## "2015-01-02" "2015-08-06" "2016-03-10" "2016-03-20" "2016-11-03" "2017-07-31"
```

La data minima deles dades es 02/01/2015 i la màxima, 31/07/2017

Vegem el gràfic de les victimes de dispars tenint en compter la població total:

```
races_total <- c((sum(df_clean$race == 'A') / 17186320), (sum(df_clean$race == 'B') / 40610815), (sum(d
races <- c('A', 'B', 'H', 'N', 'O', 'W')

barplot(races_total, names.arg = races)
```



Vegent el grafic amb les dades comparades amb el total de poblacio de cada raça pareix indicar que les persones de raça negra, natius americans i hispanos son mes probables de rebre un tir d'un policia que una persona blanca.

Per analitzar un poc mes en profunditat algunes posibles relacions entre les persones que han sigut disparadaes, discritzarem les variables percent_completed_hs i poverty_rate. Dividirem els seus valors en les franjes: 0-24, 25-49, 50-74 i 75-100.

```
df_clean["range_highSchool"]<- cut(df_clean$percent_completed_hs, breaks = c(0,24,49,74,100), labels = c
df_clean["range_poverty"]<- cut(df_clean$poverty_rate, breaks = c(0,24,49,74,100), labels = c("0 - 24",
```

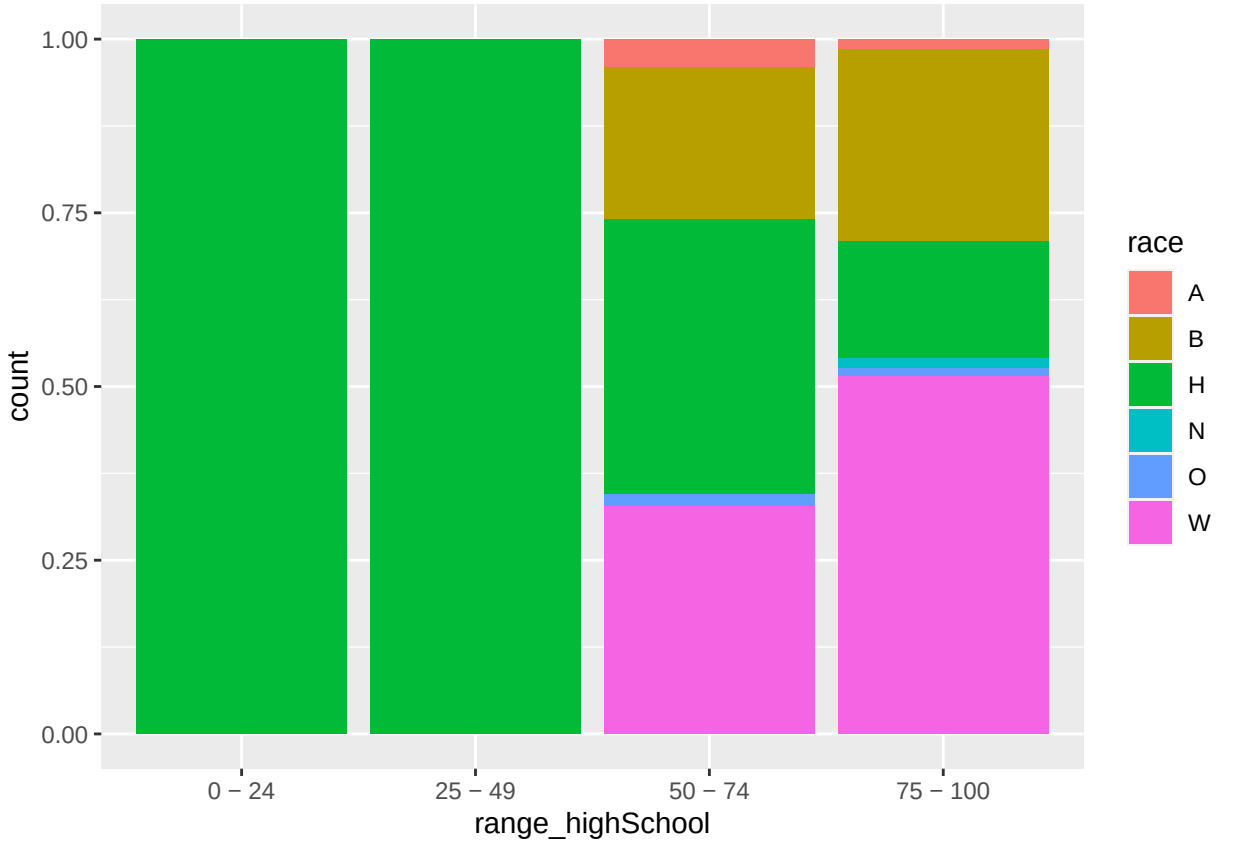
```
table(df_clean$range_highSchool)
```

```
##
##   0 - 24  25 - 49  50 - 74 75 - 100
##        1        6      174     1789
```

```
table(df_clean$range_poverty)
```

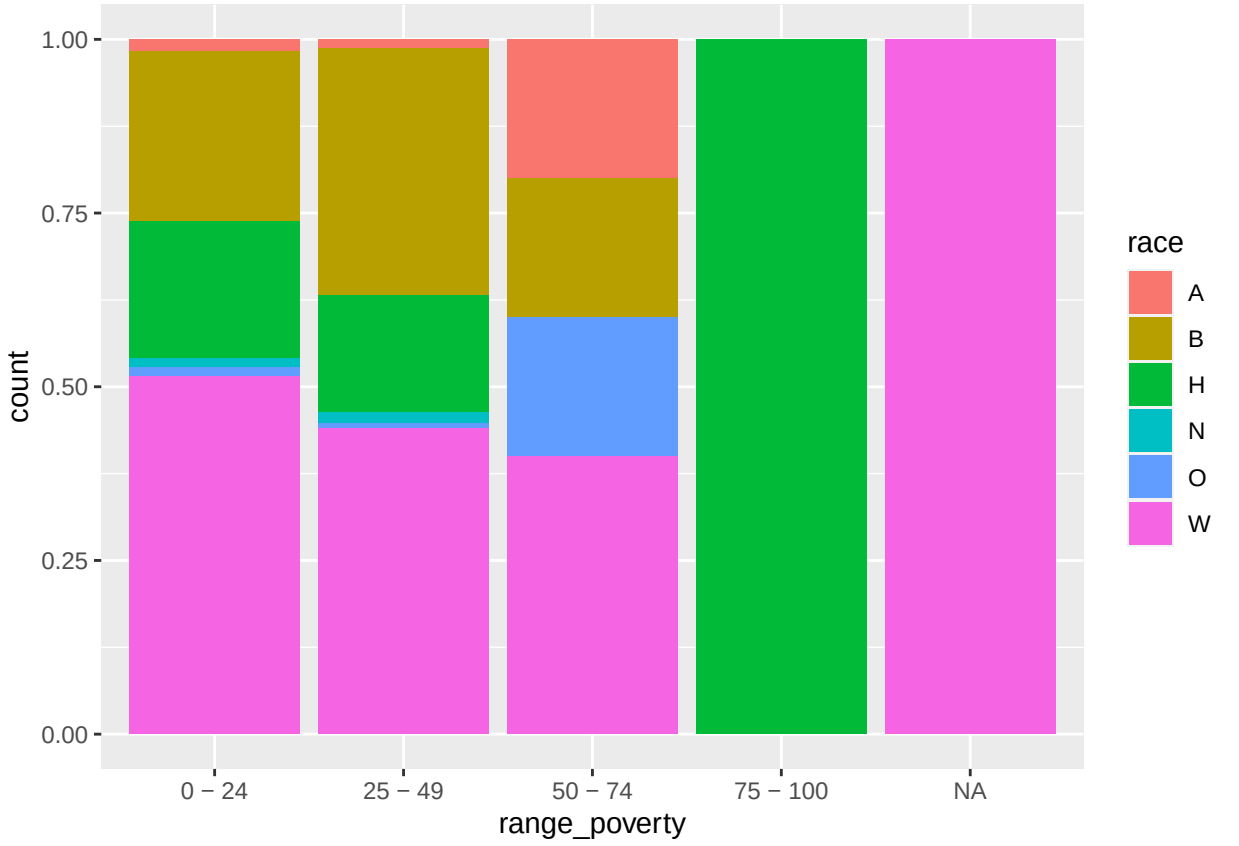
```
##
##   0 - 24  25 - 49  50 - 74 75 - 100
##     1479      484        5        1
```

```
ggplot(df_clean) + geom_bar(map = aes(x = range_highSchool, fill=race), position = "fill")
```



Ens fixem amb els percentatges entre 50 i 100% perque en els anteriors hi han molt poques dades. Pareix que les victimes blanques solen viure en ciutats amb un nievell d'estudis superiors. Destaca sobretot la diferencia amb la gent hispana.

```
ggplot(df_clean) + geom_bar(map = aes(x = range_poverty, fill=race), position = "fill")
```

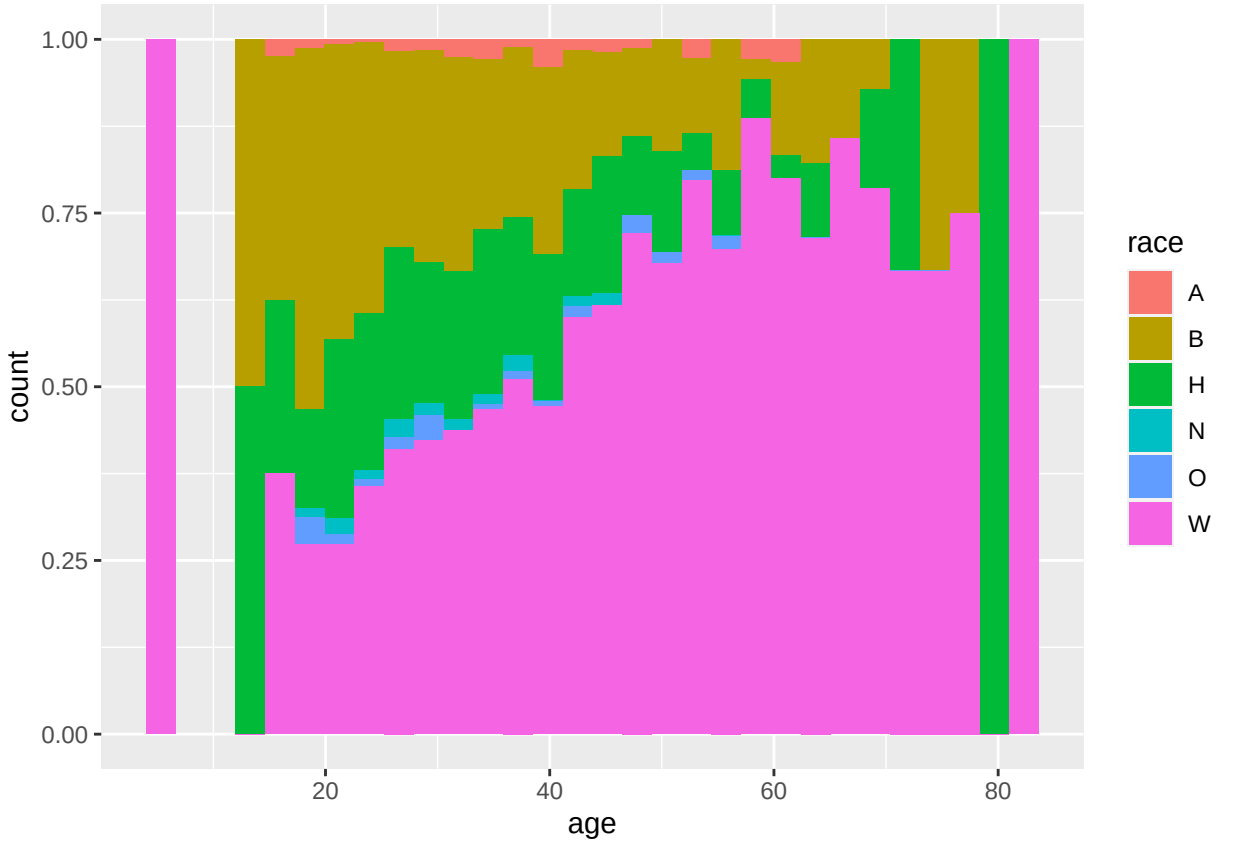


Per ultim, mitjançant histogrames vegem com es distribueixen els tipus d'amenaça que s'indiquin i la manera en que ha mort la persona:

```
ggplot(df_clean) + geom_histogram(map = aes(age, fill = race), position = "fill")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

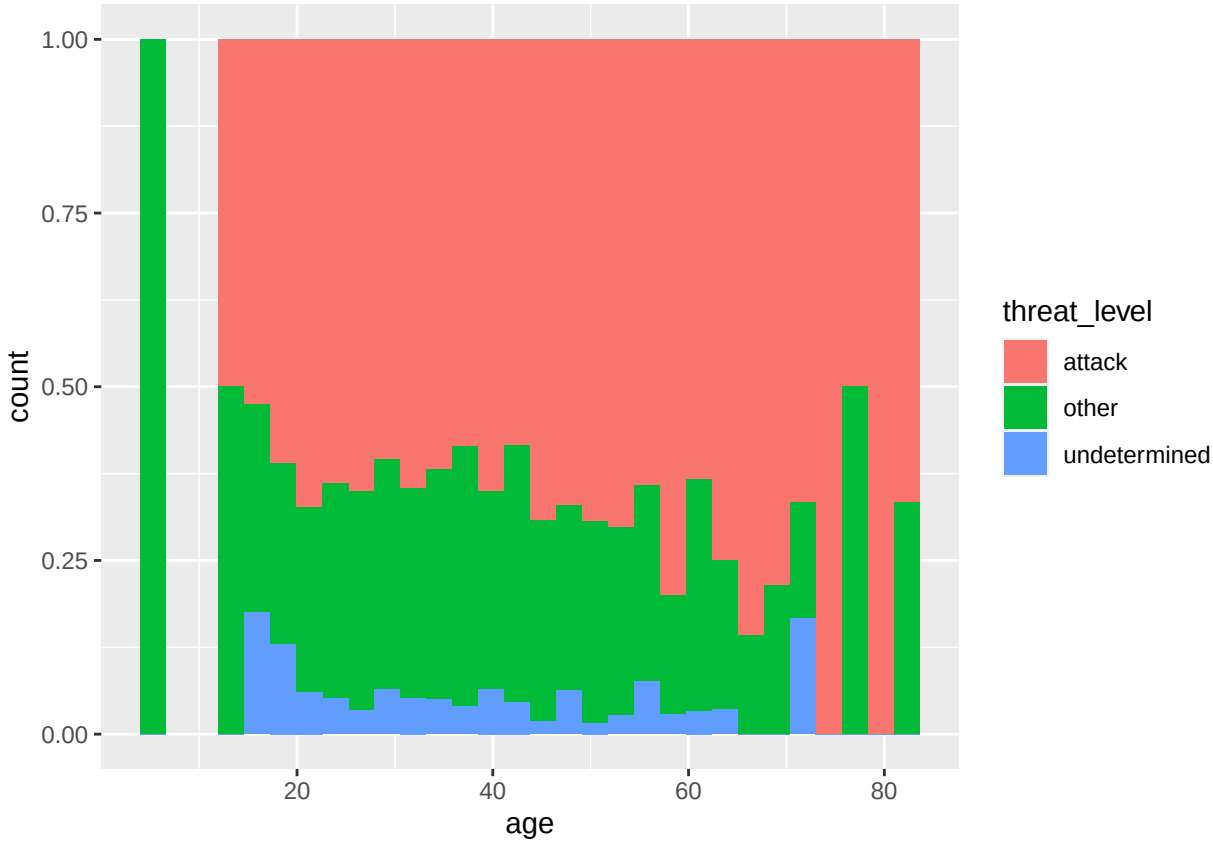
```
## Warning: Removed 12 rows containing missing values (geom_bar).
```




```
ggplot(df_clean) + geom_histogram(map = aes(age, fill = threat_level), position = "fill")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

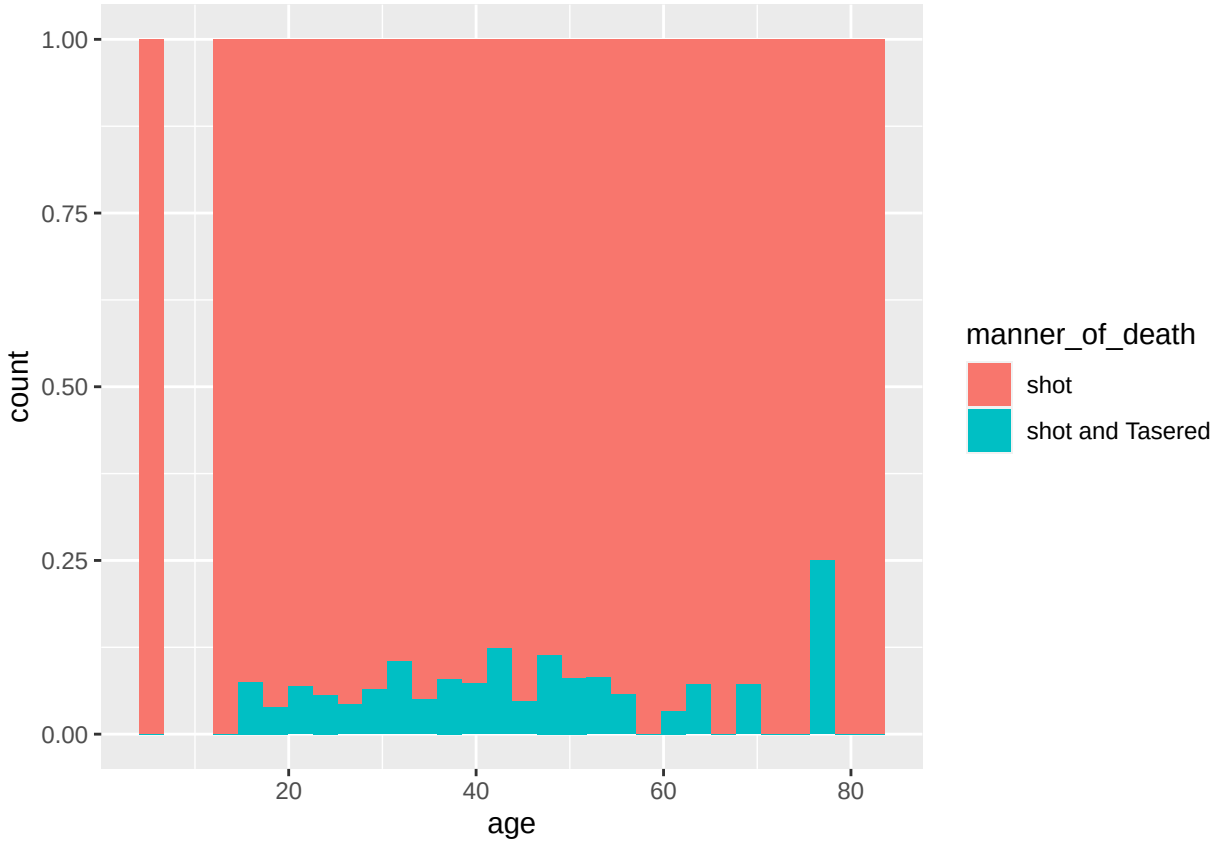
```
## Warning: Removed 6 rows containing missing values (geom_bar).
```



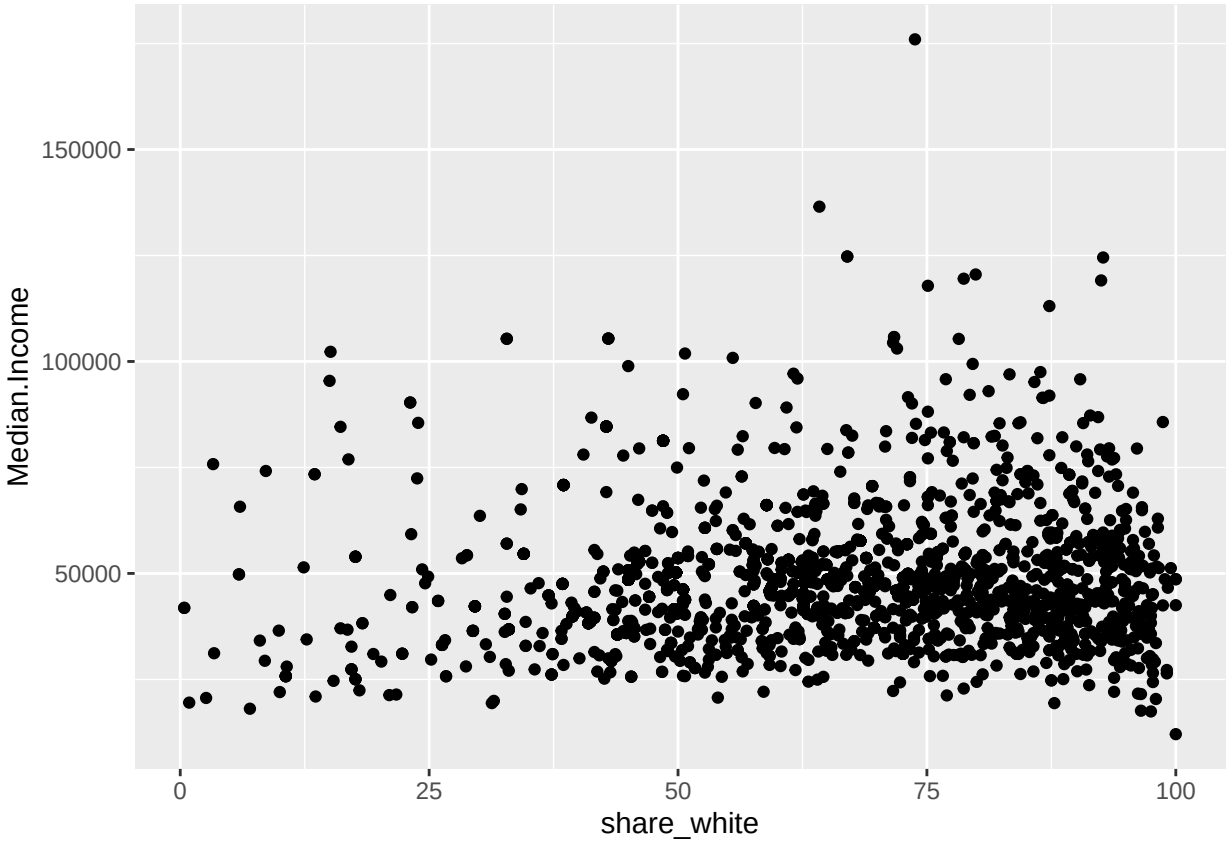

```
ggplot(df_clean) + geom_histogram(map = aes(age, fill = manner_of_death), position = "fill")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 4 rows containing missing values (geom_bar).
```




```
ggplot(df_clean) + geom_point(map = aes(x = share_white, y = Median.Income))
```



5. Contrast d'hipotesis