hip-replacement-op-new

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Aim

Plot 'EQ-5D Index' scores pre and post operations for each gender.

Load packages

We only need the tidyverse for this exercise.

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.1     v dplyr   1.0.6
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

Read in data

The data is in the file "Hip Replacement CCG 1819.csv", and it contains patient reported outcomes for hip replacement procedures, from April 2018 to March 2019. It was downloaded from https://digital.nhs.uk/data-and-information/publications/statistical/patient-reported-outcome-measures-proms/for-hip-and-knee-replacement-procedures-april-2018-to-march-2019 We also have the data dictionary for this dataset in "proms_data_dictionary.pdf".

```
hip_data <- read_csv("Hip Replacement CCG 1819.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   .default = col_double(),
##   `Provider Code` = col_character(),
##   Procedure = col_character(),
##   Year = col_character(),
```

```
##   `Age Band` = col_character(),
##   Gender = col_character()
## )
## i Use `spec()` for the full column specifications.
```

Prepare the data

This includes three steps: inspecting the data, selecting only the variables we want, and dealing with missing values. (In more complicated projects we might also need to join datasets, change data types, etc.)

```
glimpse(hip_data)
```

```
## Rows: 28,920
## Columns: 81
## $ `Provider Code`                          <chr> "00C", "00C", "00C", ~
## $ Procedure                                <chr> "Hip Replacement", "H~
## $ `Revision Flag`                          <dbl> 0, 0, 1, 1, 0, 0, 0, ~
## $ Year                                     <chr> "2018/19", "2018/19",~
## $ `Age Band`                               <chr> "*", "*", "*", "*", "~
## $ Gender                                   <chr> "*", "*", "*", "*", "~
## $ `Pre-Op Q Assisted`                      <dbl> 2, 2, 1, 2, 2, 2, 2, ~
## $ `Pre-Op Q Assisted By`                   <dbl> 0, 0, 0, 0, 0, 0, 0, ~
## $ `Pre-Op Q Symptom Period`                <dbl> 4, 2, 4, 1, 2, 1, 1, ~
## $ `Pre-Op Q Previous Surgery`              <dbl> 2, 1, 1, 1, 2, 2, 1, ~
## $ `Pre-Op Q Living Arrangements`           <dbl> 1, 1, 2, 2, 1, 2, 1, ~
## $ `Pre-Op Q Disability`                    <dbl> 9, 1, 1, 1, 2, 1, 2, ~
## $ `Heart Disease`                          <dbl> 9, 9, 9, 9, 9, 9, 9, ~
## $ `High Bp`                                <dbl> 9, 9, 9, 9, 9, 1, 9, ~
## $ Stroke                                   <dbl> 9, 9, 9, 9, 9, 9, 1, ~
## $ Circulation                              <dbl> 9, 9, 9, 9, 1, 9, 9, ~
## $ `Lung Disease`                           <dbl> 9, 9, 9, 9, 9, 9, 9, ~
## $ Diabetes                                 <dbl> 9, 9, 9, 9, 9, 9, 9, ~
## $ `Kidney Disease`                         <dbl> 9, 9, 9, 9, 9, 1, 9, ~
## $ `Nervous System`                         <dbl> 9, 9, 9, 9, 9, 9, 9, ~
## $ `Liver Disease`                          <dbl> 9, 9, 9, 9, 9, 9, 1, ~
## $ Cancer                                   <dbl> 9, 9, 9, 9, 9, 9, 1, ~
## $ Depression                               <dbl> 9, 9, 9, 1, 9, 9, 9, ~
## $ Arthritis                                <dbl> 9, 1, 1, 1, 1, 1, 9, ~
## $ `Pre-Op Q Mobility`                      <dbl> 2, 2, 9, 2, 2, 2, 2, ~
## $ `Pre-Op Q Self-Care`                     <dbl> 1, 2, 9, 1, 2, 1, 1, ~
## $ `Pre-Op Q Activity`                      <dbl> 9, 3, 9, 3, 3, 2, 2, ~
## $ `Pre-Op Q Discomfort`                    <dbl> 9, 3, 9, 3, 3, 3, 2, ~
## $ `Pre-Op Q Anxiety`                       <dbl> 9, 1, 9, 2, 3, 1, 1, ~
## $ `Pre-Op Q EQ5D Index Profile`            <dbl> 21999, 22331, 99999, ~
## $ `Pre-Op Q EQ5D Index`                    <dbl> NA, -0.003, NA, 0.030~
## $ `Post-Op Q Assisted`                     <dbl> 2, 2, 1, 2, 2, 2, 1, ~
## $ `Post-Op Q Assisted By`                  <dbl> 9, 9, 1, 9, 9, 9, 1, ~
## $ `Post-Op Q Living Arrangements`          <dbl> 1, 1, 2, 2, 1, 2, 1, ~
## $ `Post-Op Q Disability`                   <dbl> 2, 9, 1, 2, 1, 2, 2, ~
## $ `Post-Op Q Mobility`                     <dbl> 2, 9, 2, 1, 2, 2, 1, ~
## $ `Post-Op Q Self-Care`                    <dbl> 2, 1, 2, 1, 1, 1, 1, ~
## $ `Post-Op Q Activity`                     <dbl> 2, 9, 3, 1, 2, 2, 1, ~
## $ `Post-Op Q Discomfort`                   <dbl> 2, 1, 3, 2, 2, 2, 1, ~
```

```
## $ `Post-Op Q Anxiety`                                <dbl> 2, 1, 2, 1, 2, 1, 1, ~
## $ `Post-Op Q Satisfaction`                           <dbl> 2, 3, 2, 1, 3, 1, 1, ~
## $ `Post-Op Q Sucess`                                 <dbl> 1, 1, 1, 1, 2, 2, 1, ~
## $ `Post-Op Q Allergy`                                <dbl> 2, 2, 2, 2, 2, 9, 9, ~
## $ `Post-Op Q Bleeding`                               <dbl> 2, 2, 2, 2, 2, 9, 9, ~
## $ `Post-Op Q Wound`                                  <dbl> 2, 2, 1, 2, 2, 9, 9, ~
## $ `Post-Op Q Urine`                                  <dbl> 2, 2, 2, 2, 2, 1, 9, ~
## $ `Post-Op Q Further Surgery`                        <dbl> 2, 2, 1, 2, 2, 2, 2, ~
## $ `Post-Op Q Readmitted`                             <dbl> 2, 2, 1, 2, 2, 2, 2, ~
## $ `Post-Op Q EQ5D Index Profile`                     <dbl> 22222, 91911, 22332, ~
## $ `Post-Op Q EQ5D Index`                             <dbl> 0.516, NA, -0.074, 0.~
## $ `Hip Replacement EQ5D Index Post-Op Q Predicted`   <dbl> NA, NA, NA, 0.5154424~
## $ `Pre-Op Q EQ VAS`                                  <dbl> 999, 999, 999, 50, 30~
## $ `Post-Op Q EQ VAS`                                 <dbl> 70, 999, 80, 90, 70, ~
## $ `Hip Replacement EQ VAS Post-Op Q Predicted`       <dbl> NA, NA, NA, 60.05266,~
## $ `Hip Replacement Pre-Op Q Pain`                    <dbl> 1, 0, 0, 0, 0, 0, 1, ~
## $ `Hip Replacement Pre-Op Q Sudden Pain`             <dbl> 0, 1, 0, 0, 0, 1, 4, ~
## $ `Hip Replacement Pre-Op Q Night Pain`              <dbl> 2, 0, 1, 0, 0, 1, 1, ~
## $ `Hip Replacement Pre-Op Q Washing`                 <dbl> 3, 1, 1, 2, 2, 4, 4, ~
## $ `Hip Replacement Pre-Op Q Transport`               <dbl> 2, 1, 1, 0, 1, 2, 2, ~
## $ `Hip Replacement Pre-Op Q Dressing`                <dbl> 1, 0, 1, 0, 1, 4, 2, ~
## $ `Hip Replacement Pre-Op Q Shopping`                <dbl> 3, 2, 0, 0, 0, 0, 3, ~
## $ `Hip Replacement Pre-Op Q Walking`                 <dbl> 2, 0, 1, 1, 1, 3, 3, ~
## $ `Hip Replacement Pre-Op Q Limping`                 <dbl> 2, 0, 0, 1, 0, 0, 0, ~
## $ `Hip Replacement Pre-Op Q Stairs`                  <dbl> 2, 1, 1, 1, 1, 2, 4, ~
## $ `Hip Replacement Pre-Op Q Standing`                <dbl> 1, 1, 1, 2, 1, 1, 4, ~
## $ `Hip Replacement Pre-Op Q Work`                    <dbl> 1, 1, 0, 1, 0, 0, 4, ~
## $ `Hip Replacement Pre-Op Q Score`                   <dbl> 20, 8, 7, 8, 7, 18, 3~
## $ `Hip Replacement Post-Op Q Pain`                   <dbl> 3, 4, 2, 2, 4, 2, 2, ~
## $ `Hip Replacement Post-Op Q Sudden Pain`            <dbl> 4, 4, 4, 2, 2, 2, 4, ~
## $ `Hip Replacement Post-Op Q Night Pain`             <dbl> 4, 4, 4, 1, 4, 2, 4, ~
## $ `Hip Replacement Post-Op Q Washing`                <dbl> 4, 3, 3, 4, 3, 4, 4, ~
## $ `Hip Replacement Post-Op Q Transport`              <dbl> 4, 4, 2, 3, 3, 2, 4, ~
## $ `Hip Replacement Post-Op Q Dressing`               <dbl> 2, 4, 3, 3, 4, 4, 3, ~
## $ `Hip Replacement Post-Op Q Shopping`               <dbl> 4, 2, 0, 3, 2, 0, 4, ~
## $ `Hip Replacement Post-Op Q Walking`                <dbl> 4, 3, 1, 4, 3, 2, 4, ~
## $ `Hip Replacement Post-Op Q Limping`                <dbl> 3, 1, 1, 4, 2, 0, 3, ~
## $ `Hip Replacement Post-Op Q Stairs`                 <dbl> 4, 1, 1, 3, 2, 4, 4, ~
## $ `Hip Replacement Post-Op Q Standing`               <dbl> 3, 4, 3, 3, 4, 2, 4, ~
## $ `Hip Replacement Post-Op Q Work`                   <dbl> 4, 4, 2, 4, 2, 2, 3, ~
## $ `Hip Replacement Post-Op Q Score`                  <dbl> 43, 38, 26, 36, 35, 2~
## $ `Hip Replacement OHS Post-Op Q Predicted`          <dbl> 42.20017, 35.29577, 2~
```

Select age and quality of life score pre and post operation

```
gender_EQ5D <- hip_data %>%
  select(`Gender`,`Pre-Op Q EQ5D Index`,`Post-Op Q EQ5D Index`) %>%
  rename(EQ5D_Pre = `Pre-Op Q EQ5D Index`,
         EQ5D_Post = `Post-Op Q EQ5D Index`
         )

head(gender_EQ5D)
```

```
## # A tibble: 6 x 3
##   Gender EQ5D_Pre EQ5D_Post
##   <chr>     <dbl>     <dbl>
## 1 *        NA         0.516
## 2 *        -0.003    NA
## 3 *        NA        -0.074
## 4 *         0.03      0.796
## 5 *        -0.239     0.62
## 6 *         0.159     0.691
```

Identify and remove missing values

```
gender_EQ5D$Gender %>% unique()
```

```
## [1] "*" "1" "2"
```

```
gender_EQ5D$Gender %>% table()
```

```
## .
##     *     1     2
##  2309 10255 16356
```

```
gender_EQ5D %>% summary()
```

```
##     Gender             EQ5D_Pre         EQ5D_Post
##  Length:28920       Min.   :-0.5940   Min.   :-0.5940
##  Class :character   1st Qu.: 0.0300   1st Qu.: 0.6910
##  Mode  :character   Median : 0.3640   Median : 0.8150
##                     Mean   : 0.3357   Mean   : 0.7975
##                     3rd Qu.: 0.6200   3rd Qu.: 1.0000
##                     Max.   : 1.0000   Max.   : 1.0000
##                     NA's   :1794      NA's   :1104
```

```
gender_EQ5D_noNA <- gender_EQ5D %>%
  drop_na() %>%
  filter(Gender !='*')

#Recode Gender 1- Male and 2-Female
gender_EQ5D_noNA$Gender[gender_EQ5D_noNA$Gender == 1] <- "male"
gender_EQ5D_noNA$Gender[gender_EQ5D_noNA$Gender == 2] <- "female"

table(gender_EQ5D_noNA$Gender)
```

```
##
## female   male
##  14661   9381
```

```
summary(gender_EQ5D_noNA)
```

```
##     Gender             EQ5D_Pre        EQ5D_Post
##  Length:24042       Min.   :-0.594   Min.   :-0.5940
##  Class :character   1st Qu.: 0.055   1st Qu.: 0.6910
##  Mode  :character   Median : 0.516   Median : 0.8150
##                     Mean   : 0.339   Mean   : 0.7995
##                     3rd Qu.: 0.656   3rd Qu.: 1.0000
##                     Max.   : 1.000   Max.   : 1.0000
```

Check that data is tidy

The data frame is not tidy, because the column names EQ5D_Pre and EQ5D_Post contain *data*: the time point when EQ5D was measured: pre or post operation.

```
head(gender_EQ5D_noNA)
```

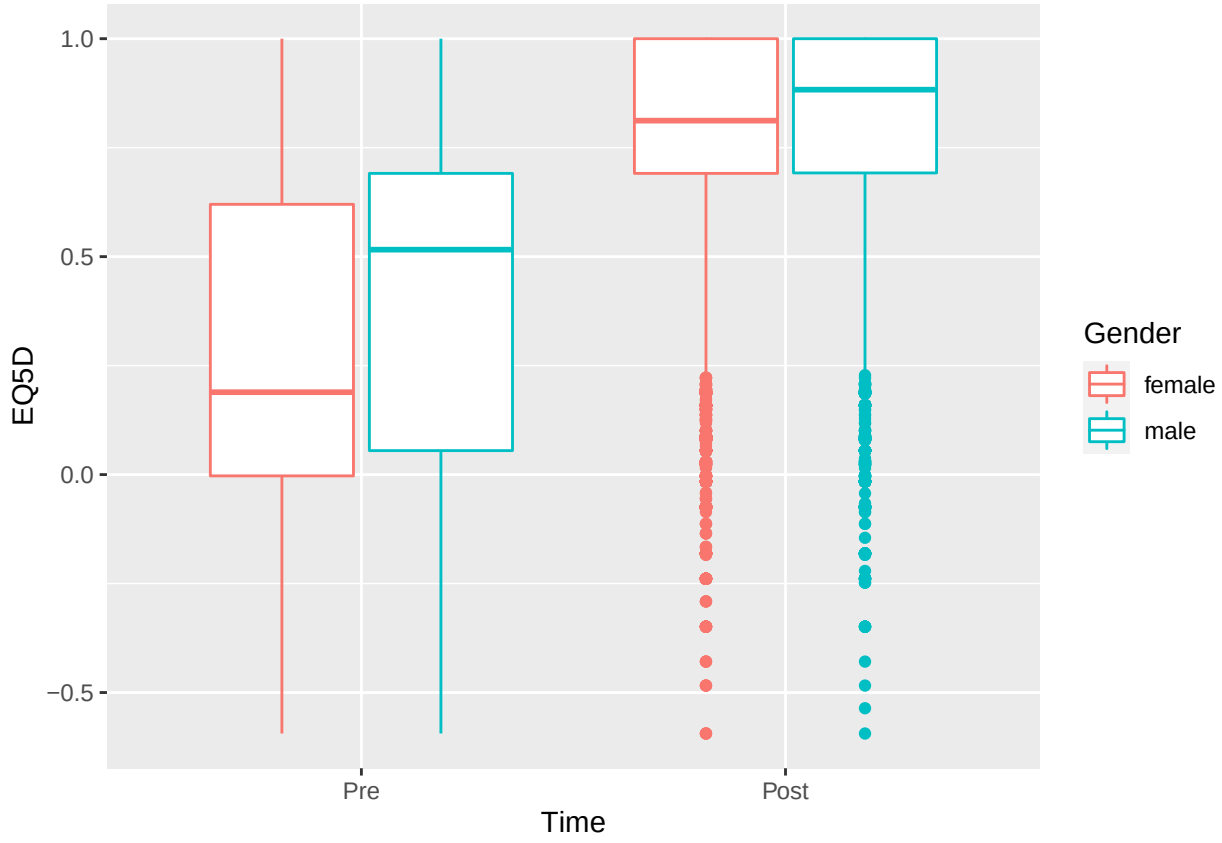
```
## # A tibble: 6 x 3
##   Gender EQ5D_Pre EQ5D_Post
##   <chr>     <dbl>     <dbl>
## 1 male     -0.016     0.516
## 2 male      0.159     0.743
## 3 male      0.03      0.727
## 4 male      0.587     0.85
## 5 male      0.623     0.796
## 6 male      0.691     1
```

```
tidy_gender_EQ5D_noNA <- gender_EQ5D_noNA %>%
  pivot_longer(c(EQ5D_Pre,EQ5D_Post),
               names_to = 'Time',    # the name of the column to create from the data stored in the orig
               names_prefix = 'EQ5D_',  # remove this text from the start of each variable name
               values_to = 'EQ5D' # the name of the column to create from the data stored in cell value
               )

head(tidy_gender_EQ5D_noNA)
```

```
## # A tibble: 6 x 3
##   Gender Time    EQ5D
##   <chr>  <chr>  <dbl>
## 1 male   Pre   -0.016
## 2 male   Post   0.516
## 3 male   Pre    0.159
## 4 male   Post   0.743
## 5 male   Pre    0.03
## 6 male   Post   0.727
```

Plot quality of life pre and post operation for each age group

```
# Turn Time into a "factor" so we can order the categories any way we want
# otherwise they are alphabetical and "Post" ends up before "Pre"
tidy_gender_EQ5D_noNA$Time <- factor(tidy_gender_EQ5D_noNA$Time,levels=c('Pre','Post'))

# ggplot creates a blank canvas, to which we add a boxplot with "geom_boxplot"
tidy_gender_EQ5D_noNA %>%
  ggplot() +
  geom_boxplot(aes(x = Time, y = EQ5D, colour = Gender))
```



Exercise 2: Calculate how many patients in this dataset have been told by a doctor that they have problems caused by a stroke

Select Stroke column only

```
stroke_data <- hip_data %>%
  select(`Stroke`)
head(stroke_data)
```

```
## # A tibble: 6 x 1
##   Stroke
##    <dbl>
## 1      9
```

```
## 2      9
## 3      9
## 4      9
## 5      9
## 6      9
```

calculate frequencies

```
table(stroke_data)
```

```
## stroke_data
##     1     9
##   400 28520
```

Exercise 3: Create a clean and tidy table with pre and post operation activity levels

Select activity pre and post operation

```
activity_data <- hip_data %>%
  select(`Pre-Op Q Activity`,`Post-Op Q Activity`) %>%
  rename(Activity_Pre = `Pre-Op Q Activity`,
         Activity_Post = `Post-Op Q Activity`
         )

head(activity_data)
```

```
## # A tibble: 6 x 2
##   Activity_Pre Activity_Post
##          <dbl>         <dbl>
## 1            9             2
## 2            3             9
## 3            9             3
## 4            3             1
## 5            3             2
## 6            2             2
```

#remove missing values in activity data

```
activity_data %>%table()
```

```
##             Activity_Post
## Activity_Pre     1     2     3     9
##            1  1343   250    14    18
##            2 12393  7513   335   381
##            3  2196  2714   476   113
##            9   670   441    33    30
```

```
activity_data_noNA <- activity_data %>%
  filter(Activity_Pre !=9,
         Activity_Post !=9)

activity_data_noNA %>%table()
```

```
##              Activity_Post
## Activity_Pre     1     2     3
##            1  1343   250    14
##            2 12393  7513   335
##            3  2196  2714   476
```

#check data is tidy

```
head(activity_data_noNA)
```

```
## # A tibble: 6 x 2
##   Activity_Pre Activity_Post
##          <dbl>         <dbl>
## 1            3             1
## 2            3             2
## 3            2             2
## 4            2             1
## 5            2             1
## 6            2             1
```

```
tidy_activity_data_noNA <- activity_data_noNA %>%
  pivot_longer(c(Activity_Pre,Activity_Post),
               names_to='Time',
               names_prefix = 'Activity_',
               values_to = 'Activity'
              )

head(tidy_activity_data_noNA)
```

```
## # A tibble: 6 x 2
##   Time  Activity
##   <chr>    <dbl>
## 1 Pre          3
## 2 Post         1
## 3 Pre          3
## 4 Post         2
## 5 Pre          2
## 6 Post         2
```