Numerical Summaries

Summarizing data in R 1/2

- Have seen `summary` (5-number summary of each column). But what if we want:
  - a summary or two of just one column
  - a count of observations in each category of a categorical variable
  - summaries by group
  - a different summary of all columns (eg. SD)
- To do this, meet pipe operator %>%. This takes input data frame, does something to it, and outputs result. (Learn: `Ctrl-Shift-M`.)

Summarizing data in R 2/2

- Output from a pipe can be used as input to something else, so can have a sequence of pipes.
- Summaries include: `mean`, `median`, `min`, `max`, `sd`, `IQR`, `quantile` (for obtaining quartiles or any percentile), `n` (for counting observations).
- Use our Australian athletes data again.

Packages for this section

```r
library(tidyverse)
```

The athletes

```r
summary(athletes)
```

```
     Sex               Sport                RCC             WCC        
 Length:202         Length:202         Min.   :3.800   Min.   : 3.300  
 Class  :character  Class  :character  1st Qu.:4.372   1st Qu.: 5.900  
 Mode   :character  Mode   :character  Median :4.755   Median : 6.850  
                                       Mean   :4.719   Mean   : 7.109  
                                       3rd Qu.:5.030   3rd Qu.: 8.275  
                                       Max.   :6.720   Max.   :14.300  
       Hc              Hg             Ferr             BMI             SSF        
 Min.   :35.90   Min.   :11.60   Min.   :  8.00   Min.   :16.75   Min.   : 28.00  
 1st Qu.:40.60   1st Qu.:13.50   1st Qu.: 41.25   1st Qu.:21.08   1st Qu.: 43.85  
 Median :43.50   Median :14.70   Median : 65.50   Median :22.72   Median : 58.60  
 Mean   :43.09   Mean   :14.57   Mean   : 76.88   Mean   :22.96   Mean   : 69.02  
 3rd Qu.:45.58   3rd Qu.:15.57   3rd Qu.: 97.00   3rd Qu.:24.46   3rd Qu.: 90.35  
 Max.   :59.70   Max.   :19.20   Max.   :234.00   Max.   :34.42   Max.   :200.80  
     %Bfat             LBM               Ht              Wt        
 Min.   : 5.630   Min.   : 34.36   Min.   :148.9   Min.   : 37.80  
 1st Qu.: 8.545   1st Qu.: 54.67   1st Qu.:174.0   1st Qu.: 66.53  
 Median :11.650   Median : 63.03   Median :179.7   Median : 74.40  
 Mean   :13.507   Mean   : 64.87   Mean   :180.1   Mean   : 75.01  
 3rd Qu.:18.080   3rd Qu.: 74.75   3rd Qu.:186.2   3rd Qu.: 84.12  
 Max.   :35.520   Max.   :106.00   Max.   :209.4   Max.   :123.20  
```

Summarizing one column

- Mean height:

```
athletes %>% summarize(m=mean(Ht))
```

```
# A tibble: 1 x 1
      m
  <dbl>
1  180.
```

or to get mean and SD of BMI:

```
athletes %>% summarize(mean_bmi = mean(BMI),
                       sd_bmi = sd(BMI))
```

```
# A tibble: 1 x 2
  mean_bmi sd_bmi
     <dbl>  <dbl>
1     23.0   2.86
```

A warning

This doesn’t work:

```
mean(BMI)
```

```
Error: object 'BMI' not found
```

because R needs to know what *dataframe* `BMI` lives in.

Quartiles

- `quantile` calculates percentiles (“fractiles”), so we want the 25th and 75th percentiles:

```
athletes %>% summarize( Q1=quantile(Wt, 0.25),
                        Q3=quantile(Wt, 0.75))
```

```
# A tibble: 1 x 2
     Q1    Q3
  <dbl> <dbl>
1  66.5  84.1
```

Creating new columns

- These weights are in kilograms. Maybe we want to summarize the weights in pounds.
- Convert kg to lb by multiplying by 2.2.
- Create new column and summarize that:

```
athletes %>% mutate(wt_lb=Wt*2.2) %>%
  summarize(Q1_lb=quantile(wt_lb, 0.25),
            Q3_lb=quantile(wt_lb, 0.75))
```

```
# A tibble: 1 x 2
  Q1_lb Q3_lb
  <dbl> <dbl>
1  146.  185.
```

Counting how many

for example, number of athletes in each sport:

```
athletes %>% count(Sport)
```

```
# A tibble: 10 x 2
   Sport       n
   <chr>   <int>
 1 BBall      25
 2 Field      19
 3 Gym         4
 4 Netball    23
 5 Row        37
 6 Swim       22
 7 T400m      29
 8 TSprnt     15
 9 Tennis     11
10 WPolo      17
```

Counting how many, variation 2:

Another way (which will make sense in a moment):

```
athletes %>% group_by(Sport) %>%
  summarize(count=n())
```

```
# A tibble: 10 x 2
   Sport   count
   <chr>   <int>
 1 BBall      25
 2 Field      19
 3 Gym         4
 4 Netball    23
 5 Row        37
 6 Swim       22
 7 T400m      29
 8 TSprnt     15
 9 Tennis     11
10 WPolo      17
```

Summaries by group

- Might want separate summaries for each “group”, eg. mean and SD of height for males and females. Strategy is `group_by` (to define the groups) and then `summarize`:

```
athletes %>% group_by(Sex) %>%
  summarize(mean_Ht = mean(Ht), sd_Ht = sd(Ht))
```

```
# A tibble: 2 x 3
  Sex    mean_Ht sd_Ht
  <chr>    <dbl> <dbl>
1 female    175.  8.24
2 male      186.  7.90
```

Count plus stats

- If you want number of observations per group plus some stats, you need to go the `n()` way:

```
athletes %>% group_by(Sex) %>%
summarize(n = n(), mean_Ht = mean(Ht), sd_Ht = sd(Ht))
```

```
# A tibble: 2 x 4
  Sex          n mean_Ht sd_Ht
  <chr>  <int>   <dbl> <dbl>
1 female   100    175.  8.24
2 male     102    186.  7.90
```

- This explains second variation on counting within group: “within each sport/Sex, how many athletes were there?”

Summarizing several columns 1/2

- Standard deviation of each (numeric) column:

```
athletes %>%
  summarize(across(where(is.numeric), \(x) sd(x)))
```

```
# A tibble: 1 x 11
    RCC   WCC    Hc    Hg  Ferr   BMI   SSF `%Bfat`   LBM     H
  <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>   <dbl> <dbl> <dbl
1 0.458  1.80  3.66  1.36  47.5  2.86  32.6    6.19  13.1  9.7
```

Summarizing several columns 2/2

- Median and IQR of all columns whose name starts with H:

```
athletes %>% summarize(across(starts_with("H"),
                       list(med = \(x) median(x),
                            iqr = \(x) IQR(x))))
```

```
# A tibble: 1 x 6
  Hc_med Hc_iqr Hg_med Hg_iqr Ht_med Ht_iqr
   <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
1   43.5   4.98   14.7   2.07   180.   12.2
```

Same thing by group

```
athletes %>%
  group_by(Sex) %>%
  summarize(across(starts_with("H"),
                   list(med = \(h) median(h),
                        iqr = \(h) IQR(h))))
```

```
# A tibble: 2 x 7
  Sex    Hc_med Hc_iqr Hg_med Hg_iqr Ht_med Ht_iqr
  <chr>   <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
1 female   40.6   4.03   13.5  1.60     175    8.68
2 male     45.5   2.57   15.5  0.975    186.  11.3
```

… another one

```
athletes %>%
  group_by(Sex) %>%
  summarize(across(ends_with("C"),
                   list(med = \(h) median(h),
                        iqr = \(h) IQR(h))))
```

```
# A tibble: 2 x 7
  Sex    RCC_med RCC_iqr WCC_med WCC_iqr Hc_med Hc_iqr
  <chr>    <dbl>   <dbl>   <dbl>   <dbl>  <dbl>  <dbl>
1 female    4.38   0.370     6.7    2.15   40.6   4.03
2 male      5.01   0.315     7.1    2.35   45.5   2.57
```