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

```
library(tidyverse)
```

```
summary(athletes)
```

```
     Sex                Sport                RCC              
 Length:202         Length:202         Min.   :3.800   Min.   
 Class :character   Class :character   1st Qu.:4.372   1st Qu.
 Mode  :character   Mode  :character   Median :4.755   Median
                                       Mean   :4.719   Mean   
                                       3rd Qu.:5.030   3rd Qu.
                                       Max.   :6.720   Max.   
       Hc              Hg             Ferr             BMI       
 Min.   :35.90   Min.   :11.60   Min.   :  8.00   Min.   :1  
 1st Qu.:40.60   1st Qu.:13.50   1st Qu.: 41.25   1st Qu.:2  
 Median :43.50   Median :14.70   Median : 65.50   Median :2  
 Mean   :43.09   Mean   :14.57   Mean   : 76.88   Mean   :2  
 3rd Qu.:45.58   3rd Qu.:15.57   3rd Qu.: 97.00   3rd Qu.:2  
 Max.   :59.70   Max.   :19.20   Max.   :234.00   Max.   :3  
```

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(m = mean(BMI), s = sd(BMI)) -> d
d
```

```
# A tibble: 1 x 2
      m     s
  <dbl> <dbl>
1  23.0  2.86
```

This doesn't work:

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

- 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
  <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
```

- 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
```

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