CHARITÉ
UNIVERSITÄTSMEDIZIN BERLIN

Day 2 – Data and Statistics

Lukas Mödl, Matthias Becher, Erin Sprünken

biometrie-rkurs@charite.de

Institut für Biometrie und klinische Epidemiologie

R-Course

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Loading Data

Indexing

Descriptive Statistics

Conversion and filtering

Plots

LOAD

- `load()`
- `read.table()`
- `read.csv()`

OPTIONS OF READ.CSV()

If we load CSV files in R, multiple parameters can be adjusted to tell R how the CSV is formatted. The most important parameters are:

- `header(TRUE/FALSE)`: Whether the first row contains variable names
- `sep`: What symbol is used as a separator. Default is ",". Often ";" or "\t"are used
- `dec`: What is the decimal separator, i.e. do we use "." or "," for decimal places
- Example: `read.csv("data.csv", header=TRUE, sep=";", dec=",")`

INDEXING

Often we only want certain elements of a vector, list or data.frame. There are multiple solutions to that. The most straightforward one is to use indices directly. Consider the following vector: `x <- c(1, 2, 3, 4, 5)`

- Choosing a certain value $\Leftrightarrow$ `x[1]`
- Choosing multiple values $\Leftrightarrow$ `x[c(1, 3, 5)]`
- Choose multiple contiguous values $\Leftrightarrow$ `x[1:3]`
- Leave a certain value out $\Leftrightarrow$ `x[-1]`

INDEXING OF LISTS AND DATA FRAMES

List

- `x[1]`
- `x[[1]]`

Data Frame

- `x[1,]`
- `x[,1]`
- `x[,"Column1" ]`
- `x$Column1`

SUMMARY()

```
    Numeric       Factor   Character            Logical              Date
Min.   :  1.00   a:25   Length:100         Mode :logical   Min.   :2022-01-01
1st Qu.: 25.75   b:25   Class :character   FALSE:50        1st Qu.:2022-01-25
Median : 50.50   c:25   Mode  :character   TRUE :50        Median :2022-02-19
Mean   : 50.50   d:25                                      Mean   :2022-02-19
3rd Qu.: 75.25                                             3rd Qu.:2022-03-16
Max.   :100.00                                             Max.   :2022-04-10
```

FUNCTIONS FOR DESCRIPTIVE STATISTICS

- Mean = `mean()`
- Median = `median()`
- Minimum = `min()`
- Maximum = `max()`
- Standard Deviation = `sd()`
- Variance = `var()`
- Quantile = `quantile()`
- Correlation = `cor()`
- Covariance = `cov()`
- Contingency Table = `table()`

Remark: sd() und var() divide by `n-1`

HANDLING OF NAS

When computing different statistics, NAs can pose a problem.

- Example: `mean(c(1,2,3,4,5,NA))` returns `NA`

We solve this by providing `na.rm = TRUE` as an additional argument.

- Example: `mean(c(1,2,3,4,5,NA), na.rm = TRUE)` returns `3`

The function `is.na()` detects whether there are NAs in a vector, data frame etc.

CONVERSION OF DATA

- Numeric $\Leftrightarrow$ `as.numeric()`
- Character $\Leftrightarrow$ `as.character()`
- Factor $\Leftrightarrow$ `as.factor()`
- Date $\Leftrightarrow$ `as.Date()`
- Logical $\Leftrightarrow$ `as.logical()`

FILTERING OF DATA

Often, we want to filter our data regarding certain criteria, e.g. if we want to analyze only female subjects or only patients above a certain age. R provides different options to do so.

- `==`
  - `data[data$Sex == "F",]`
- `%in%`
  - `data[data$Color %in% c("blue", "red"),]`
- `subset()`
  - `subset(data, Age < 50)`

LOGICAL OPERATORS

If we want to check for multiple conditions at the same time, we can connect them with a logical operator instead of filtering one after another. R understands the following operators:

- and = `&`
- or (inclusive) = `|`
- Not = `!`

Furthermore, there are functions simplifying operations:

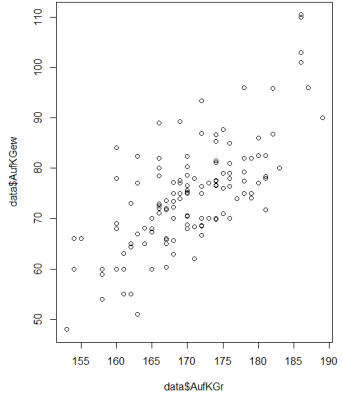
- all(x) ⇔ checks, whether a logical vector contains only `TRUE`
- any(x) ⇔ checks, whether a logical vector contains at least one `TRUE`
- which(x) ⇔ checks, at which positions a logical vector contains `TRUE`

Example:

- `data[data$Sex != "M" & data$Age > 50,]`

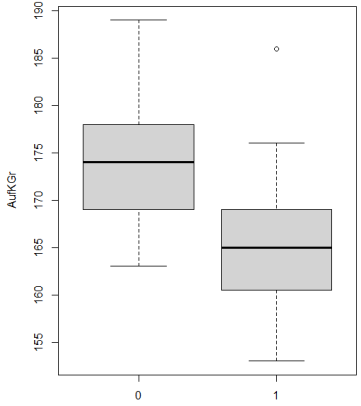
SCATTERPLOT

- `plot(data$Height, data$Weight)`



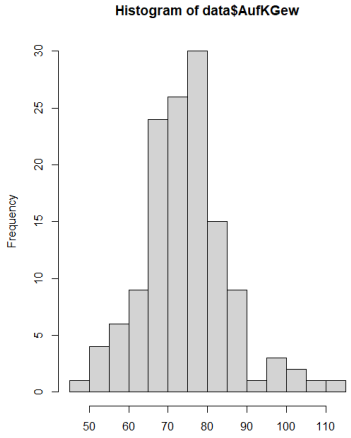
BOXPLOT

- `boxplot(data$Sex == 0,]$Height, data[data$Sex == 1,]$Height)`



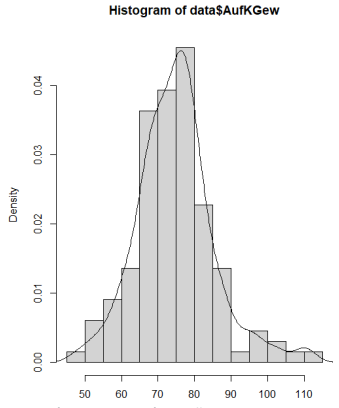
HISTOGRAM

- `hist(data$Weight)`



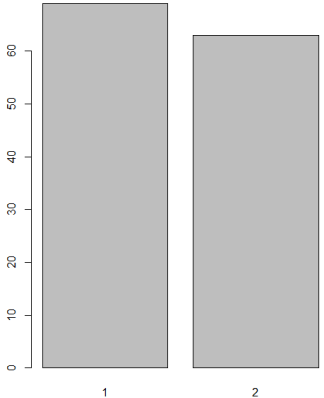
HISTOGRAM WITH DENSITY

- `hist(data$Weight, probability = T)`
  `lines(density(data$Weight))`



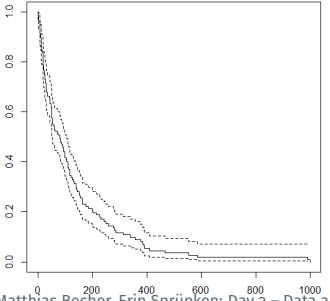
BARPLOT

- `barplot(summary(as.factor(data$Klinik)))`



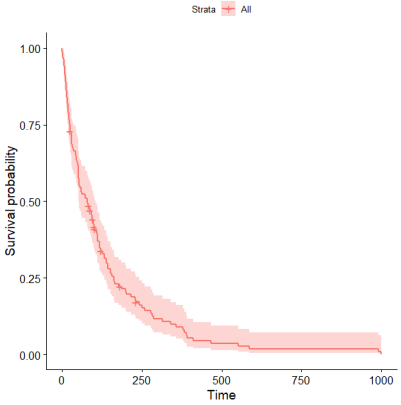
KAPLAN-MEIER PLOT

- ```
  library(survival)
  data_vet <- veteran
  km_fit <- survfit(Surv(time, status) ~ 1, data=data_vet)
  plot(km_fit)
  ```


  ```

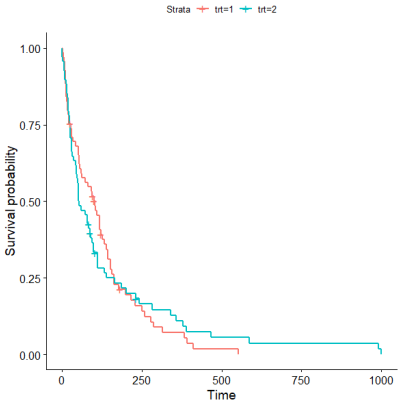
KAPLAN-MEIER PLOT

- `library(survminer)`
  `ggsurvplot(km_fit)`



KAPLAN-MEIER PLOT

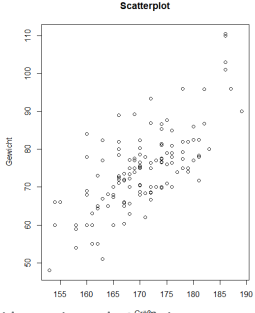
- `km_fit <- survfit(Surv(time, status) ~ trt, data=data_vet)`
  `ggsurvplot(km_fit)`



LABELS FOR PLOTS

Plots are very flexibel and can be adjusted in many different ways. For example, we can include axis labels and a title.

- Beispiel:
```
plot(data$Height, data$Weight, xlab="Größe,"
     ylab="Gewicht", main="Scatterplot")
```



SAVING OF PLOTS