



UNIVERSITY
OF OSLO



Transforming Medical Statistics Classroom

With R and Quarto

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2023-07-21 R/Basel

About me



Lead developer of MF9130 course website with R+quarto



Statistician, 50% lecturer in biostatistics, University of Oslo, Norway



R developer, **automated real-time public health reporting** during Covid pandemic

Why Basel? More on that later



Carpentry@UiO



This is a story of



Zero to Hero
(sort of)



quarto®



GitHub

Informal demo session: 3pm

Introductory Statistics Classroom

University of Oslo, Faculty of Medicine

PhD students at UiO (and/or hospital) + other Norwegian universities

Background (2023 spring class, ~50 candidates):
randomized clinical trials (20%), in vitro research (15%),
human observational study (36%), animal research, ...

Statistical competency: very basic – **basic:** over 75%

Software: none, some SPSS / Stata. **Few know R.**

MF9130: 8 days intensive course, offered 3 times per year (8/30 credits required for PhD)

Topics: probability and distributions, sensitivity/specificity, commonly used hypothesis tests, regression, survival analysis

Format: lectures and exercise sessions

No emphasis on software

2023 Spring class: use **R**, teach more **data skills**

Change I: course website

R + Quarto + GitHub

MF9130E - V23

Home

Get Started

Course material

R Lab and Code

About

Lab notes	Topics	Links
Getting started in Rstudio	Create new project, workspace navigation	
Introduction to R	Create a variable, data types, data structure, basic data manipulation, import data	code
Diagnostic tests	Evaluation of diagnostic tests, sensitivity, specificity	
Statistical distributions	Statistical distributions	
EDA I	Exploring a dataset, descriptive statistics	exercise , code
EDA II	(Week 2) More on data manipulation, visualisation	code
t-test	One sample, two sample t-tests	exercise , code
Categorical data analysis	Proportions, contingency table, chi-square test	exercise , code
Non-parametric tests	Wilcoxon signed test, rank sum test	exercise , code
Sample size, power	Sample size, power calculation	code: lecture , code: exercises

On this page

Set up

Data and R scripts

Lab notes and exercises

Useful resources

For students

Beginner friendly

Useful for future reference

Easy to navigate

Suitable for different levels (e.g.ggplot)

Change I: course website

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Exercise 1 (heart data)

The weight of the hearts of 20 men with age betw and is given below (in ounces, 1 ounce = 28g)

11.50 14.75 13.75 10.50 14.75 13.50 10.75
10.50 11.75 10.00 14.50 12.00 11.00 14.00

1a)

Create a variable in R, and enter the data. Compute the formula; then verify it with R function.

💡 Formula: mean

The mean of data $X = (x_1, x_2, \dots, x_n)$, $\bar{x} = \frac{1}{n} \sum_{i=1}^N$

```
# enter the data
heart <- c(11.5, 14.75, 13.75, 10.5, 14.75, 13.5, 10.75, 10.5, 11.75, 10, 14.5, 12, 11, 14, 15, 11.5, 10.25)
```

```
# compute
sum_heart
13.5 + 1
10.5 + 1
11 + 14

# this is
sum_heart
```

[1] 243.25

```
# sample s
n <- 20
# if we do
sum_heart,
```

[1] 12.162

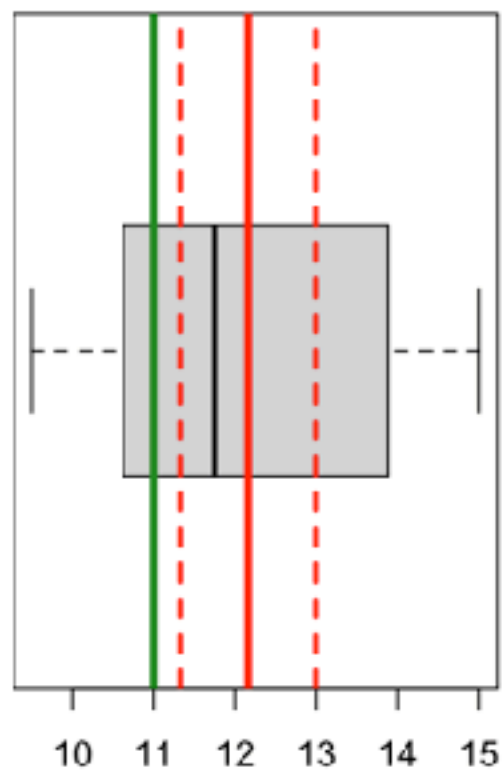
```
# formula:
mean(heart)
```

[1] 12.162

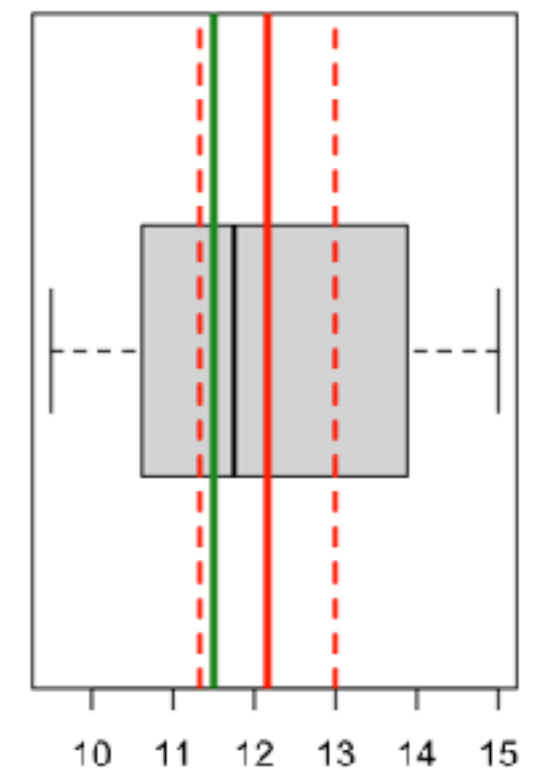
```
# boxplot
par(mfrow = c(1, 2))
# compare with 11
boxplot(heart, horizontal = T, main = 'Compare with mean = 11')
abline(v = mean(heart), col = 'red', lwd = 3)
abline(v = c(ci_lower, ci_upper), col = 'red', lwd = 2,
       lty = 'dashed')
abline(v = 11, col = 'forestgreen', lwd = 3)

# compare with 11.5
boxplot(heart, horizontal = T, main = 'Compare with mean = 11.5')
abline(v = mean(heart), col = 'red', lwd = 3)
abline(v = c(ci_lower, ci_upper), col = 'red', lwd = 2,
       lty = 'dashed')
abline(v = 11.5, col = 'forestgreen', lwd = 3)
```

Compare with mean = 11



Compare with mean = 11.5



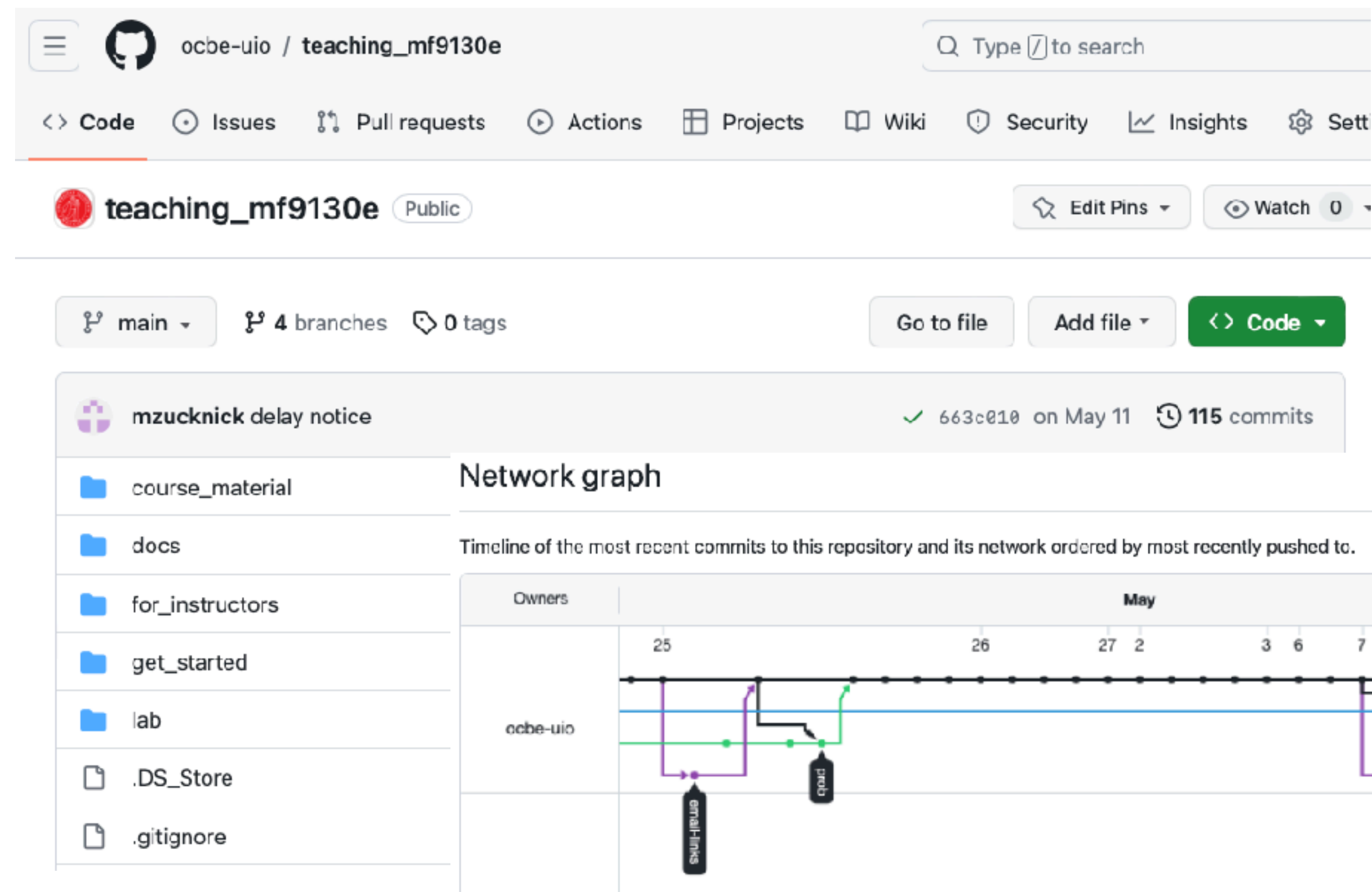
Learn by **verification**
formula vs preset function/pkg

Learn by **visualization**

Extremely useful for teaching
statistical concepts: summary
statistics, p-values, t-tests etc

Change I: course website

R + Quarto + GitHub



For instructors

Reproducible and reusable

Rendered output, avoid errors (e.g. wrong digits)

Collaboration and version control

Fast to deploy site (GitHub Pages)

Change II: Guided R Lab Sessions

Help students as much as possible

One live coding demo per day

an complete example of data analysis (**data** import, **EDA**, tests, interpret)

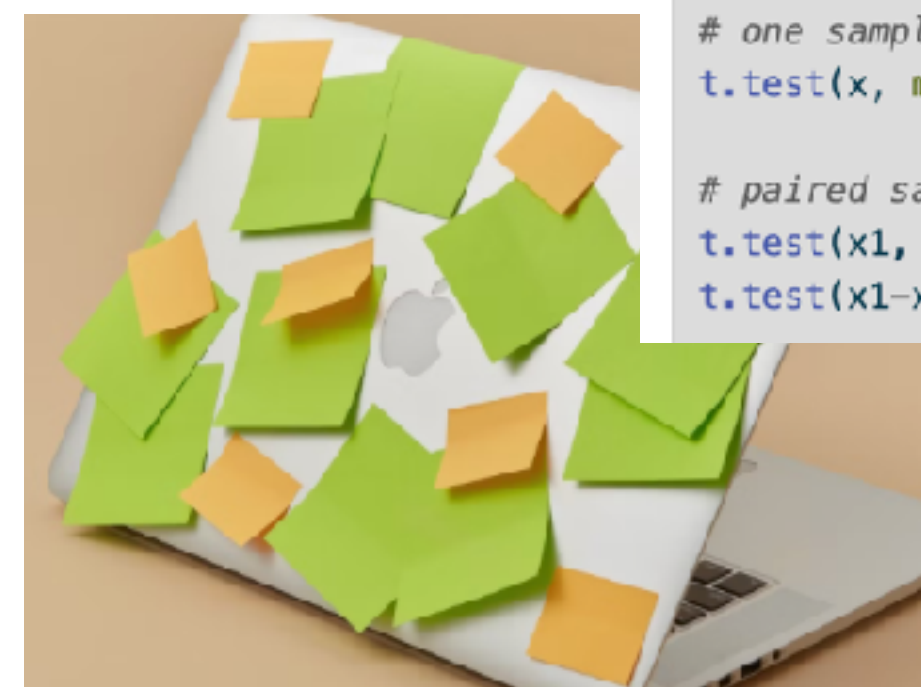
The Carpentries way

Sticky notes to flag problems from students who need help during class, w/o delaying the whole class

Give sufficient time to practice and troubleshoot

(Depends on **helper** capacity)

Cheatsheet for future reference



Visualisation

We let **x**, **y** be two continuous variables, and **z** be categorical. To create **histogram**, **boxplot**, **scatterplot**, you can use the following commands,

```
hist(x) # histogram
boxplot(x) # boxplot
boxplot(x ~ z, data = data) # boxplot for two variables, where z is categorical
plot(x,y) # scatter plot of x, y
```

Hypothesis tests

t-test

```
# one sample (default tests against 0, conf.level 0.95)
t.test(x)

# one sample
t.test(x, mu = your_value, conf.level = 0.95)

# paired samples
t.test(x1, x2, paired = T, conf.level = 0.95)
t.test(x1-x2, conf.level = 0.95) # equivalent to one sample
```


How did it go?

Challenges for instructors

Limited general IT skills– biggest challenge on day 1
(“**where did I download my data?**”)

First-time programmer (“**R is not user-friendly**”)

Diverse background and interests, cannot cover all

By the end of day 4, **every one** can

- load a dataset, extract the target variable
- make a histogram, carry out a t-test

Students find the **interactive (live demo) lab sessions** particularly helpful

Generally **positive** feedback, more **confidence** and interests in statistics

Did you miss some contents in this course?

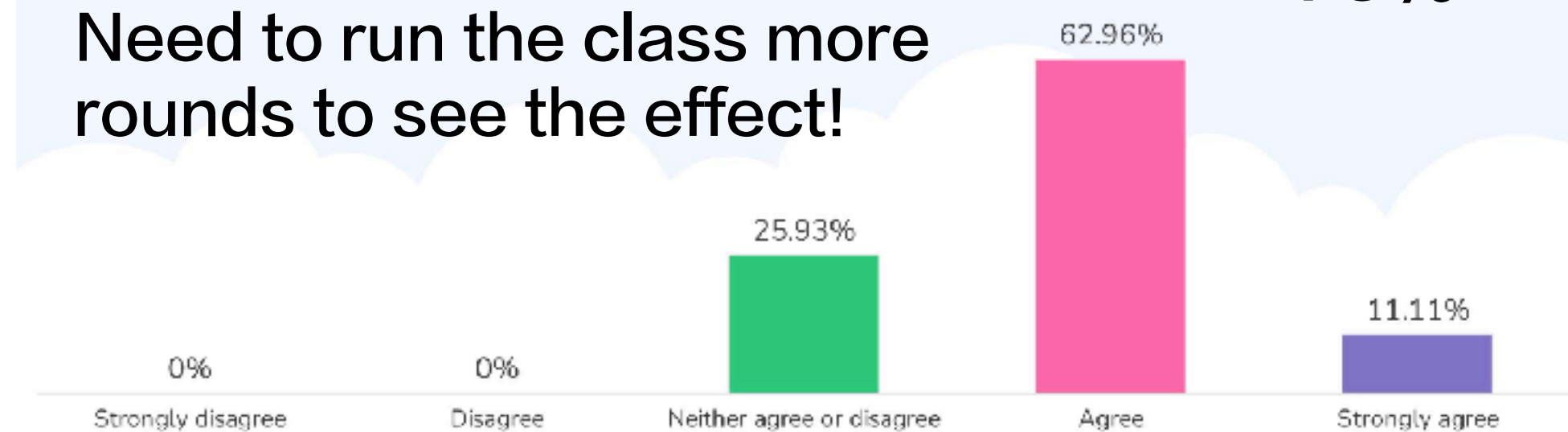


Anova
mixed models
cox reg
ggplot

You know how to apply the statistical concepts discussed in the course to your own research

Need to run the class more rounds to see the effect!

~ 75%



Summary



Informal demo session: 3pm

MF9130E course website

https://ocbe-uio.github.io/teaching_mf9130e/

qtwAcademic

an R package to get you started building a quarto website, tailored for academics



Please check out my [website](#) for more :)

Let' s chat!

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