Introduction to Biostatistics

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What is Biostatistics?

Math?

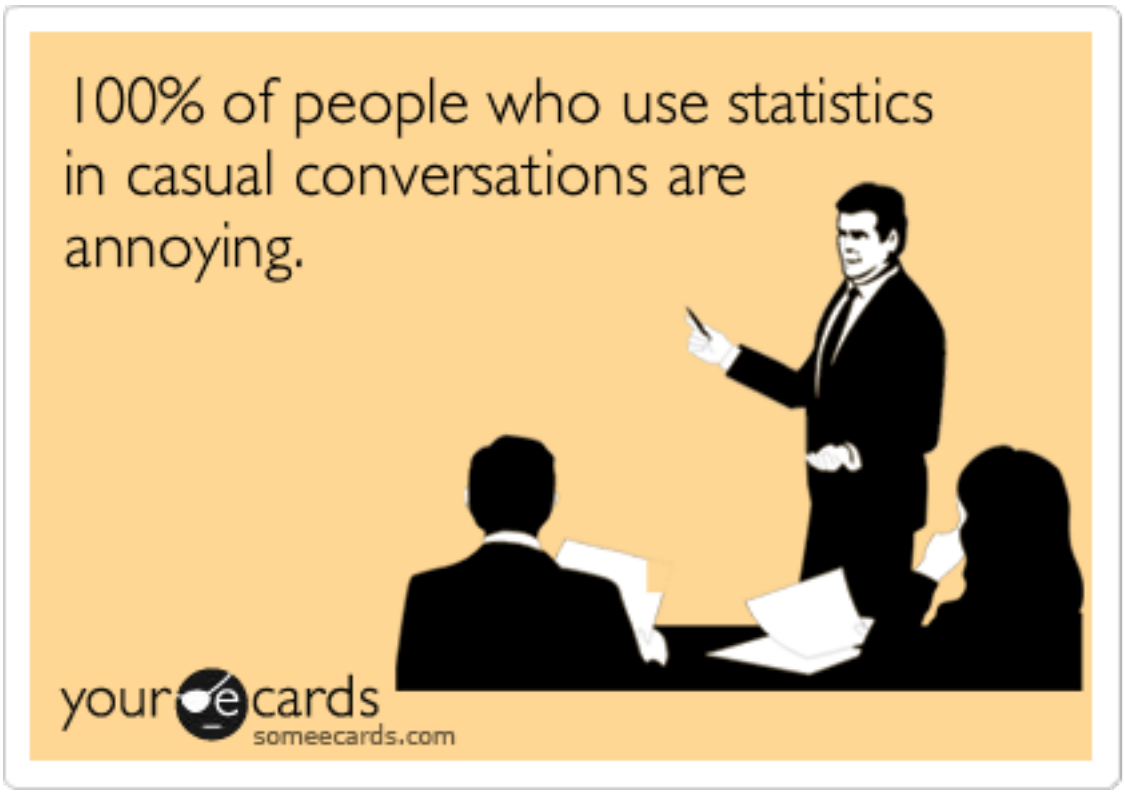
$$t = \frac{(\overline{X}_1 - \overline{X}_2) - (\mu_1 - \mu_2)}{S_{\overline{X}_1 - \overline{X}_2}} = \frac{\overline{X}_1 - \overline{X}_2}{S_{\overline{X}_1 - \overline{X}_2}}$$

$$S_{\overline{X}_1 - \overline{X}_2} = \sqrt{\frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}\left[\frac{1}{N_1} + \frac{1}{N_2}\right]}$$

Source

Graphs?

Source



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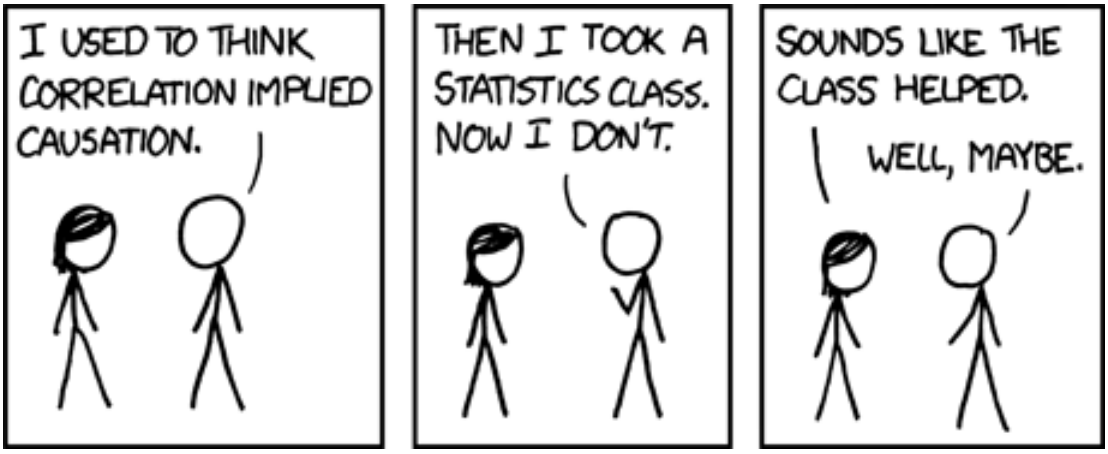

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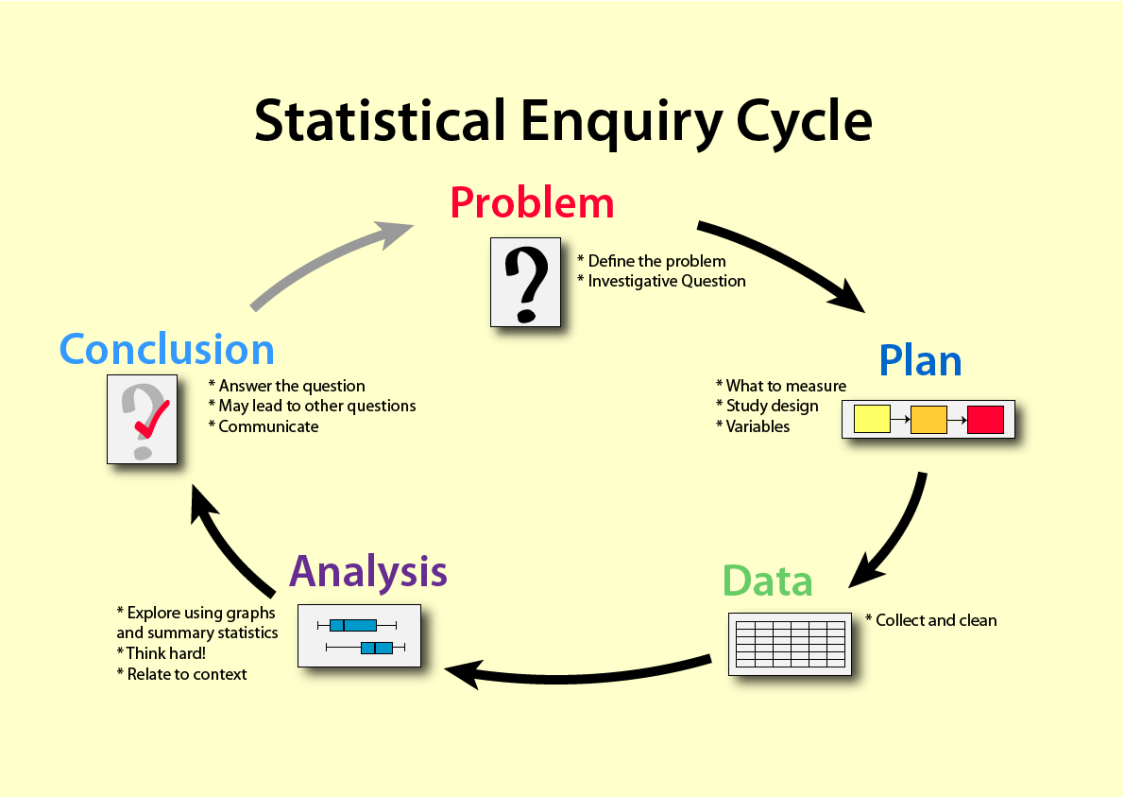

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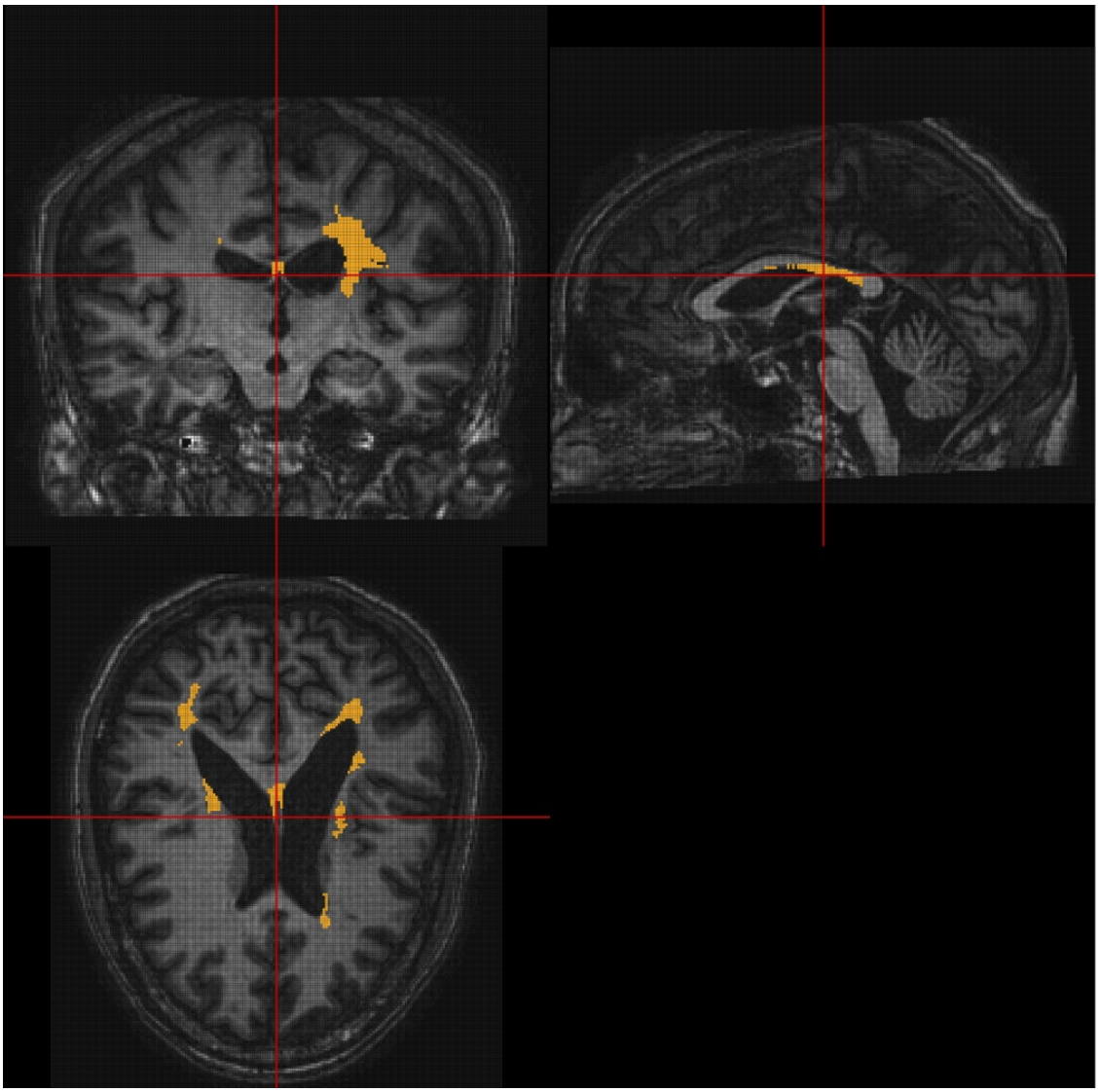
Biostatistics

- Theoretical mathematics: building blocks for other researchers
- Applied math: use math to solve a problem like building an estimator
- Biostatistics; using stats with biological data

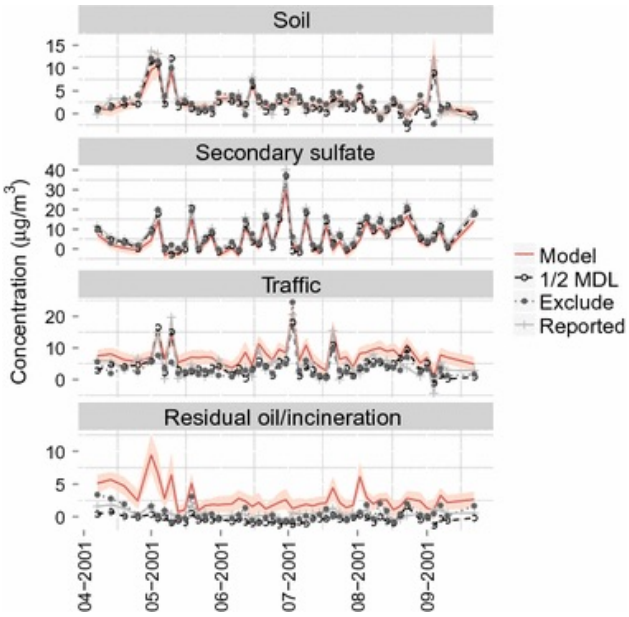
Brain imaging



Check out this interactive visualization!

Source

Environmental Statistics



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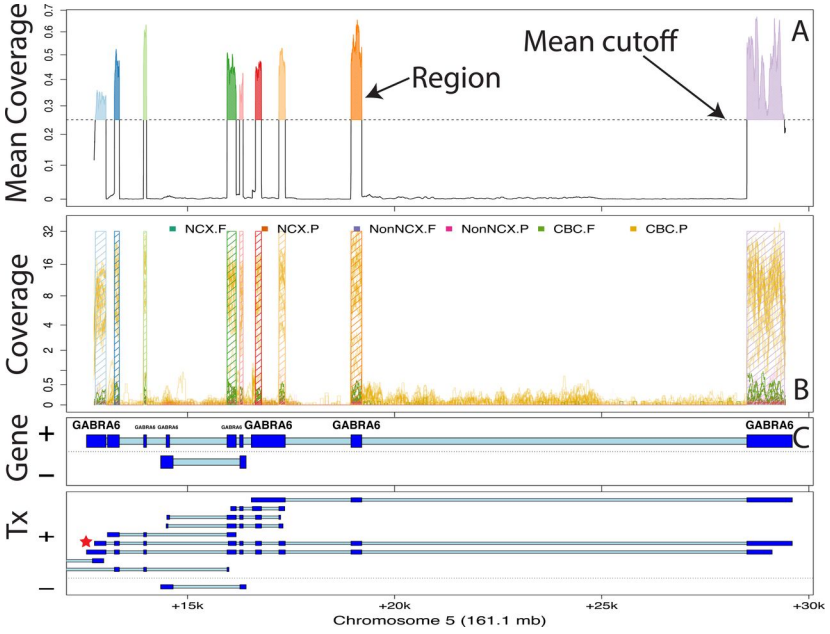
Genomics



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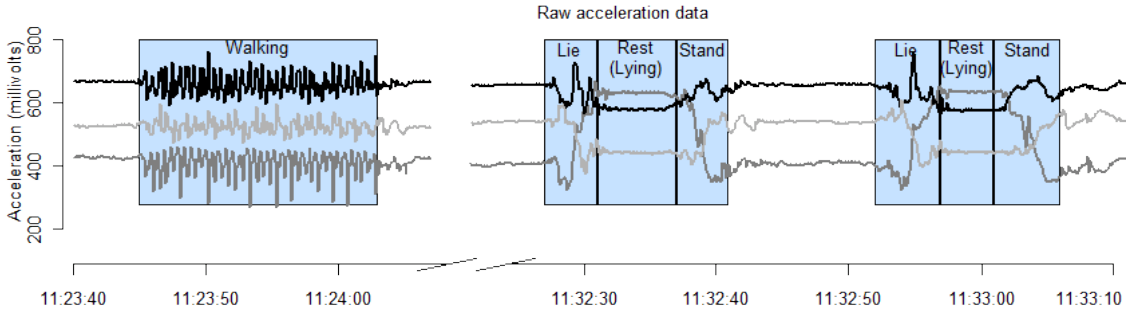
Activity trackers



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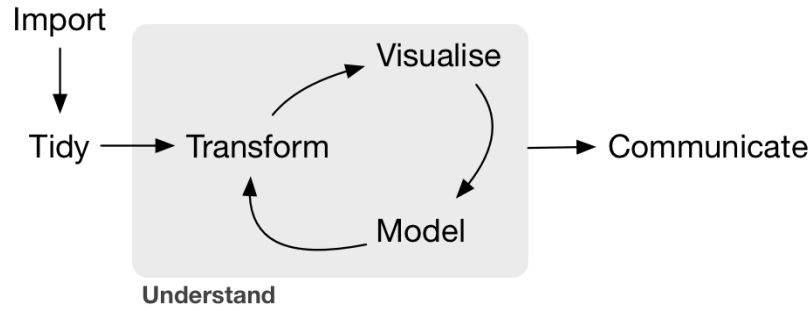
Data Science overview



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Cleaning data

Source

One type of clean data: tidy data

from Wickham's *Tidy Data*

In **tidy data**:

1. Each variable forms a column.
2. Each observation forms a row.
3. Each type of observational unit forms a table.

messy

	treatmenta	treatmentb
John Smith	—	2
Jane Doe	16	11
Mary Johnson	3	1

	John Smith	Jane Doe	Mary Johnson
treatmenta	—	16	3
treatmentb	2	11	1

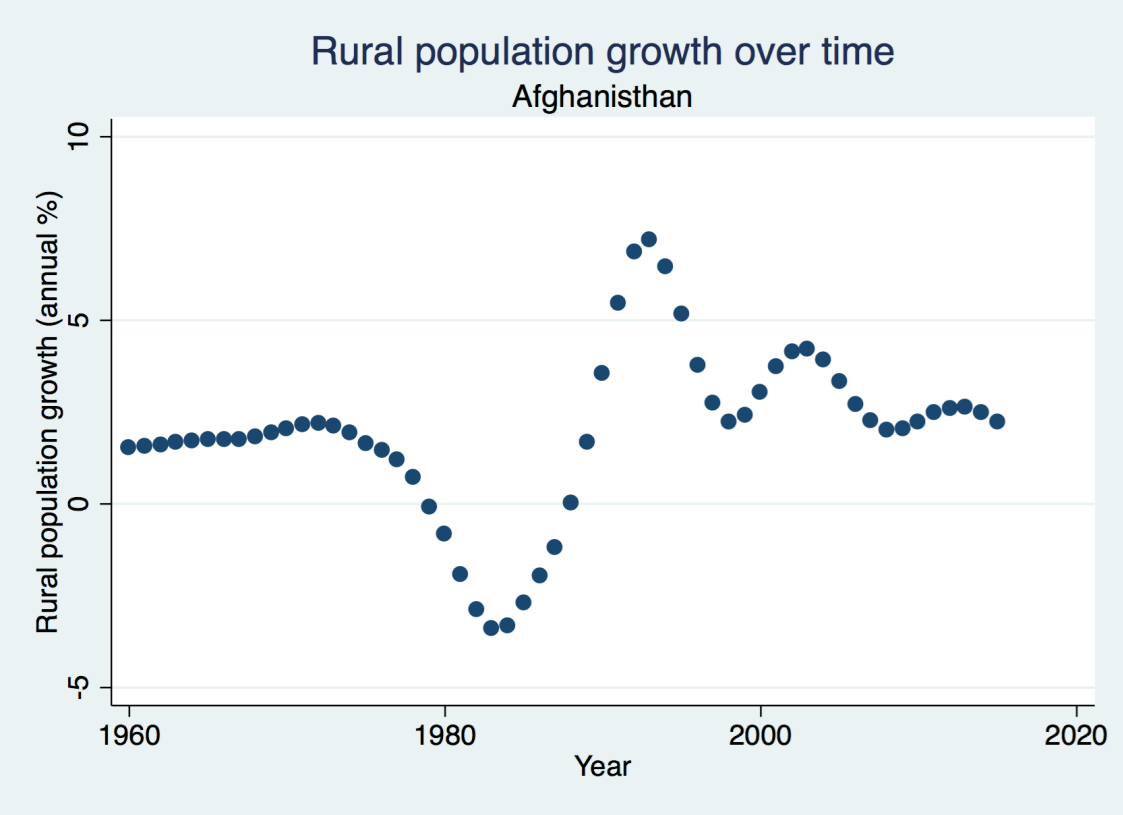
tidy

name	trt	result
John Smith	a	—
Jane Doe	a	16
Mary Johnson	a	3
John Smith	b	2
Jane Doe	b	11
Mary Johnson	b	1

Source

You'll learn Stata

```
use afg_worldbank_2016.dta
twoway (scatter SPRURTOTLZG Year), /*
    */ title(Rural population growth over time) /*
    */ subtitle(Afghanisthan)
```



Modern biostatistician

- Participates in the experimental design, that is the *question* the team wants to answer
- Is a full participant in the research
- Learns how to *clean* data
- Models the data given the question of interest
- Contributes in interpreting the data and suggesting the next steps

Communicating results

- Understand the main concepts so you can explain them: means understanding why we chose a particular method
- Proper graphics
- Interpretation of the results

Dr. McGready

Lets take a look at how John McGready introduces biostatistics

- Open lecture 1 of the course *Statistical Reasoning I*

Exercise

Divide in two teams and come up with a 2 minute overview of Biostatistics. Imagine that you will record a 2 minute video to get students excited about your Biostatistics course.

Jeff Leek Data Analysis intro

Source

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