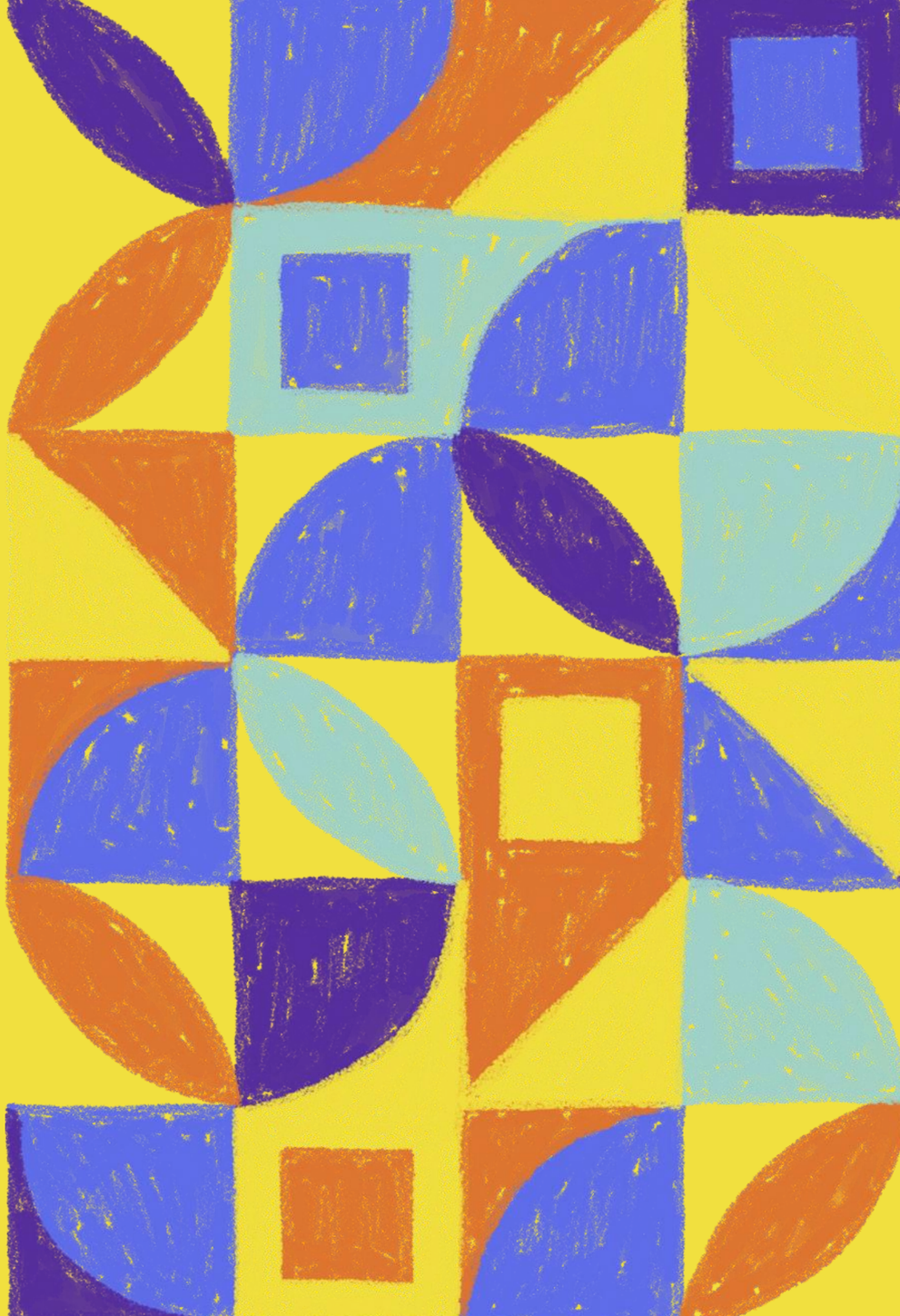
Florence Nightingale Day

10 January 2024

Nicola Rennie



CHICAS
centre for
health informatics,
computing, and statistics

Hello!

I’m Nicola, a Lecturer in Health Data Science at Lancaster University.

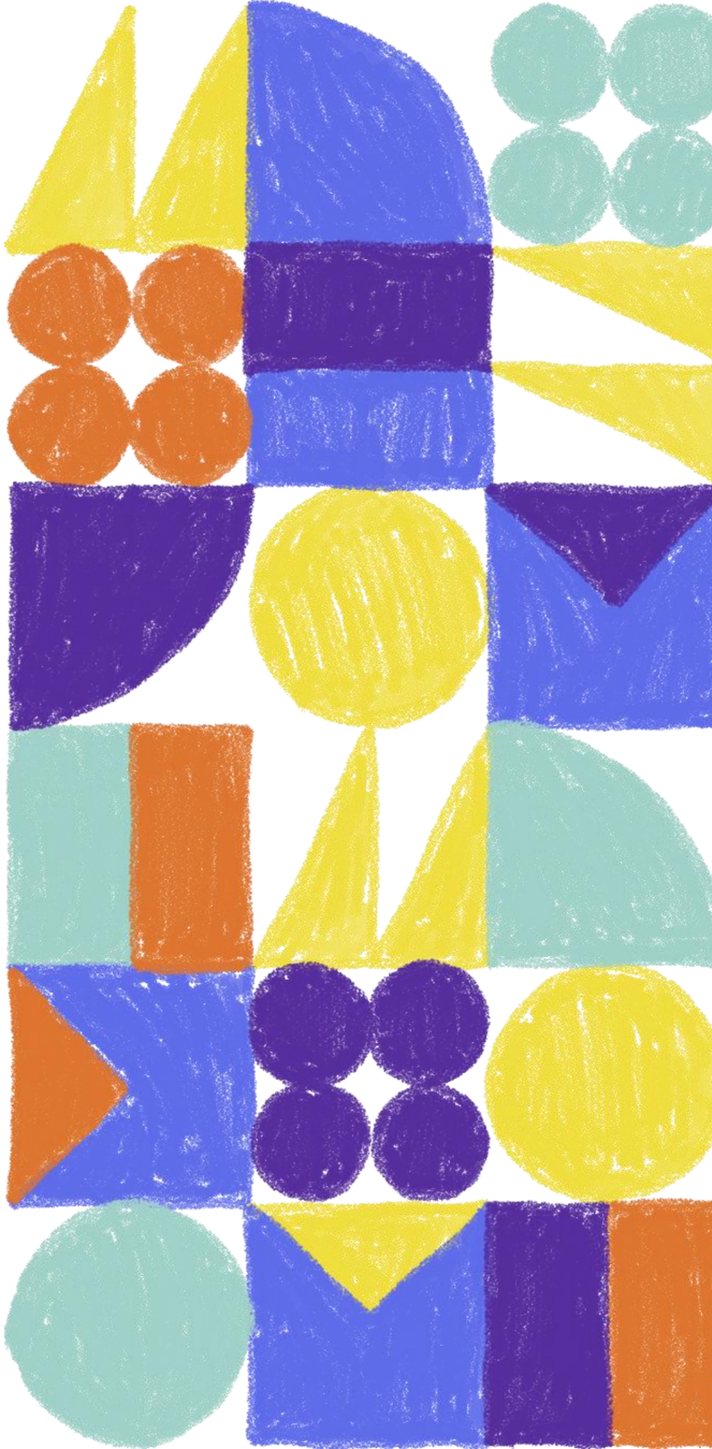
What’s this talk about?

How I got here

My mathematics and statistics journey

What I do now

Using data science to improve health outcomes



My mathematics and statistics journey

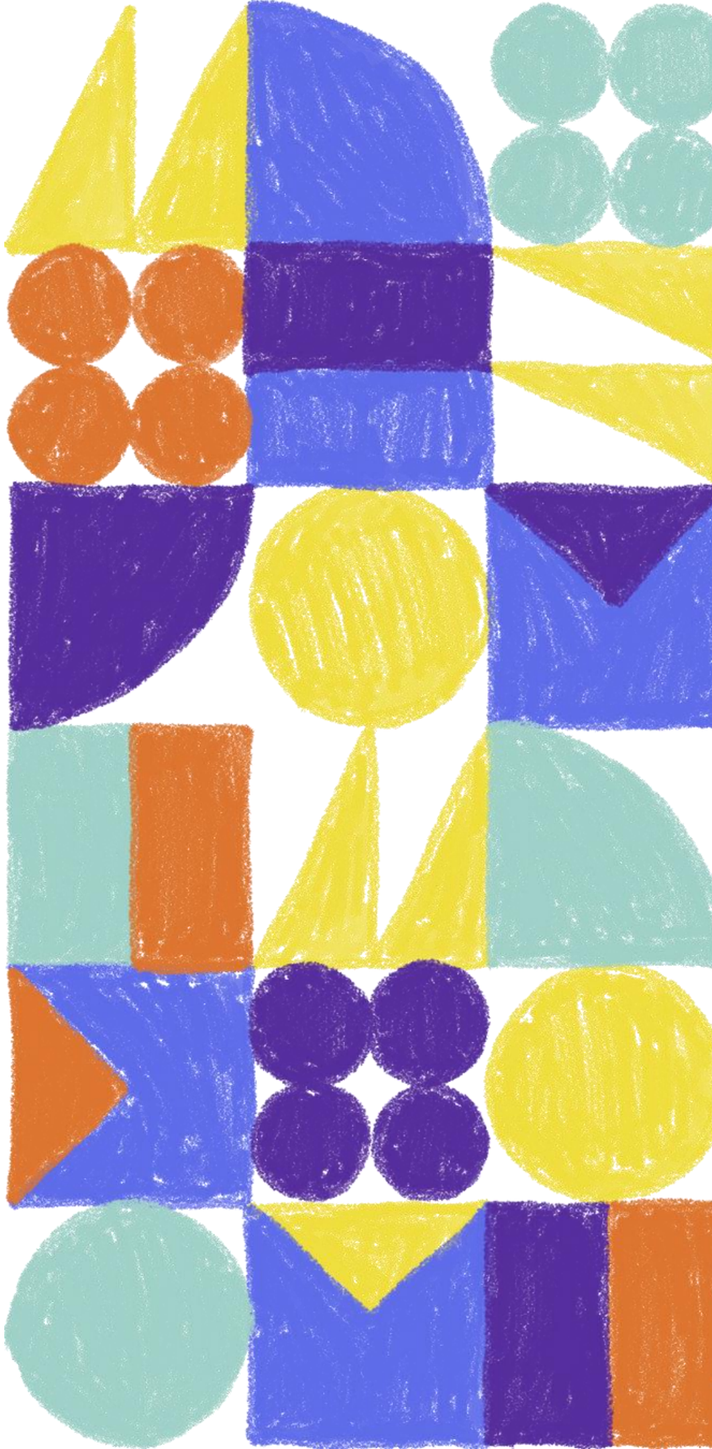
School

Maths was my best subject at school

Starting from primary school

Art and music were my favourite subjects

Creativity and maths go hand-in-hand



University: undergraduate

Studied Mathematics at St Andrews

Enjoyed statistics courses with applications to real-world data

Maths opens the door to many careers

But I still didn’t know what I wanted to do

University: postgraduate

Joined STOR-I at Lancaster University

MSc and PhD in Statistics and Operational Research

Collaboration with industry

Working with Deutsche Bahn to model railway demand

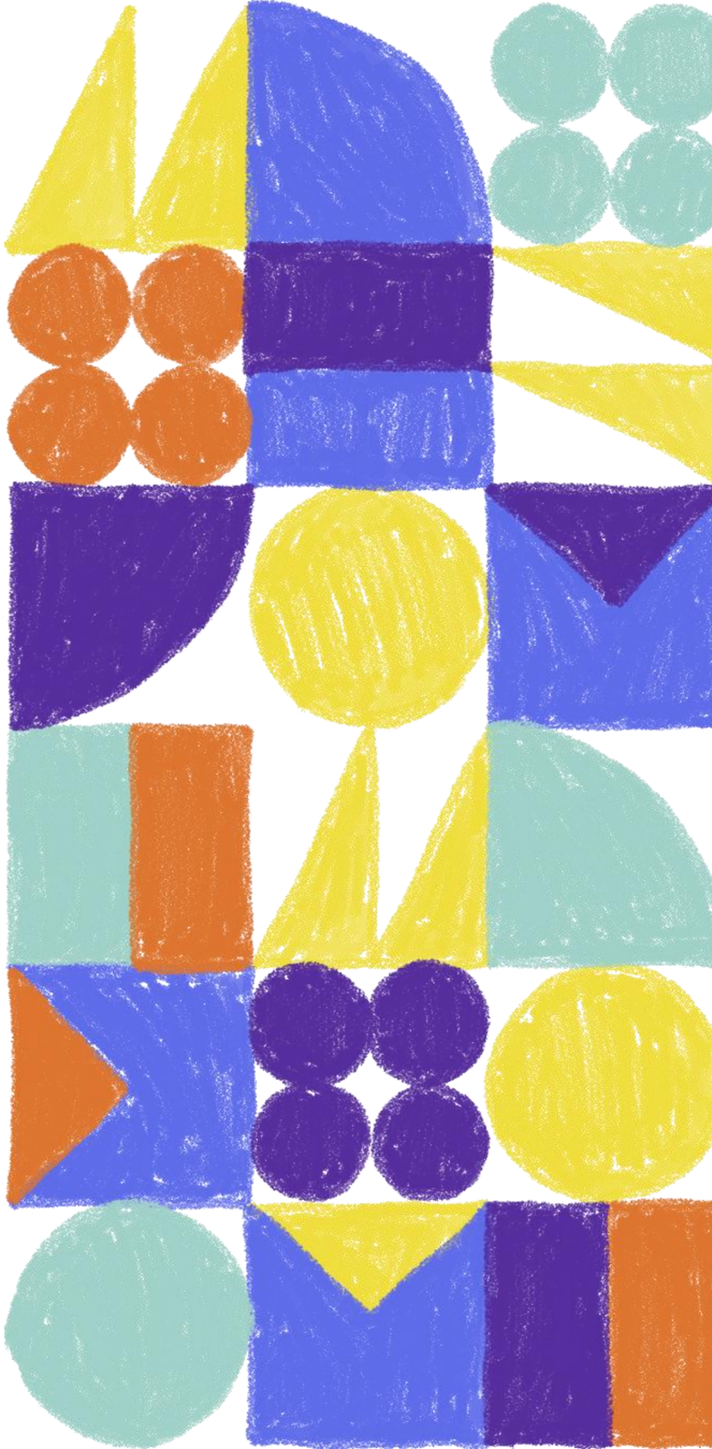
A “proper” job...

Data science consultancy

Solving problems with a wide range of companies

Running training courses

Teaching people about programming and statistics



Lecturer

Lecturer in Health Data Science

Teaching and supervising epidemiology, data science, and medical students

Collaborating with the NHS

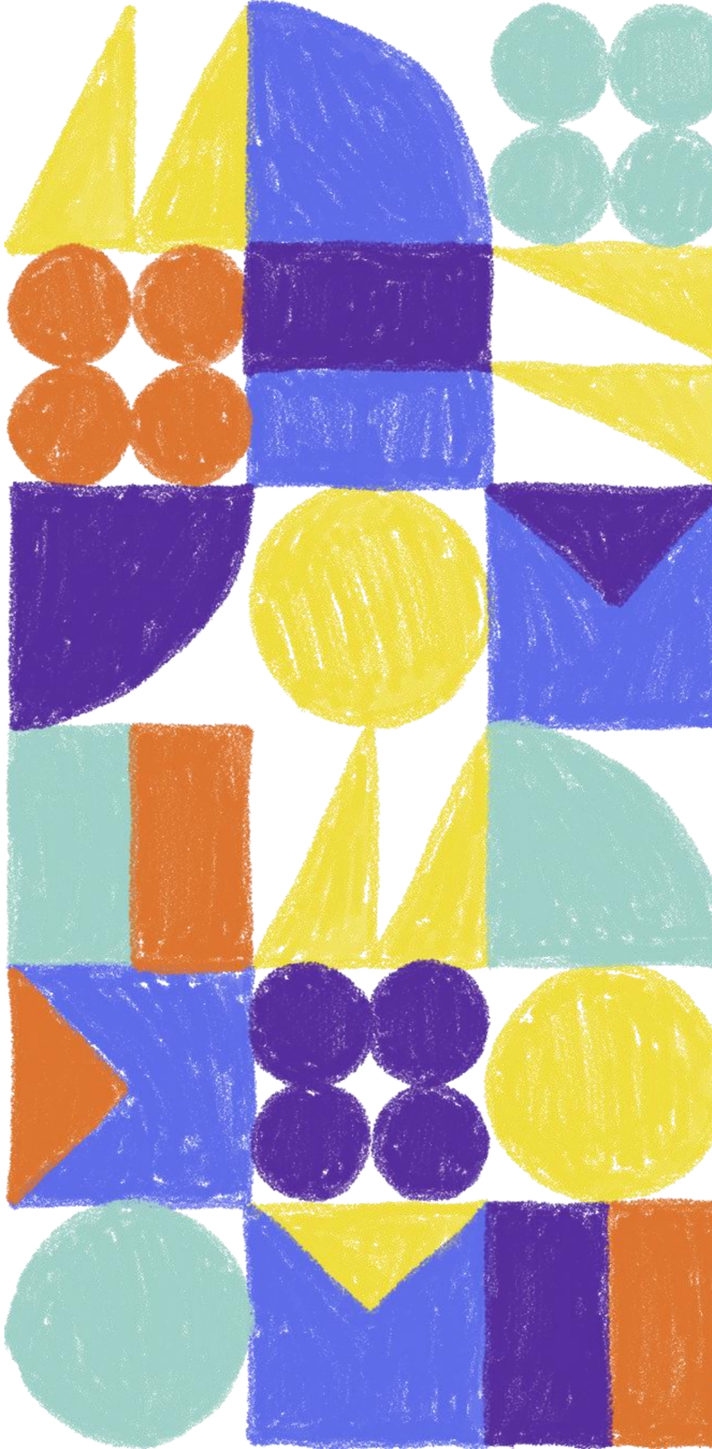
Working on data with local NHS trusts and developing software

Building communities

Organising R-Ladies meetups and delivering workshops

Why I like my job

- I feel like I’m doing something useful
- I work with an amazing group of people
- I get to do lots of different, interesting things



Using data science to improve health outcomes

Can you detect a heart murmur?

Using statistics to aid diagnosis

Heart murmurs

What are heart murmurs?

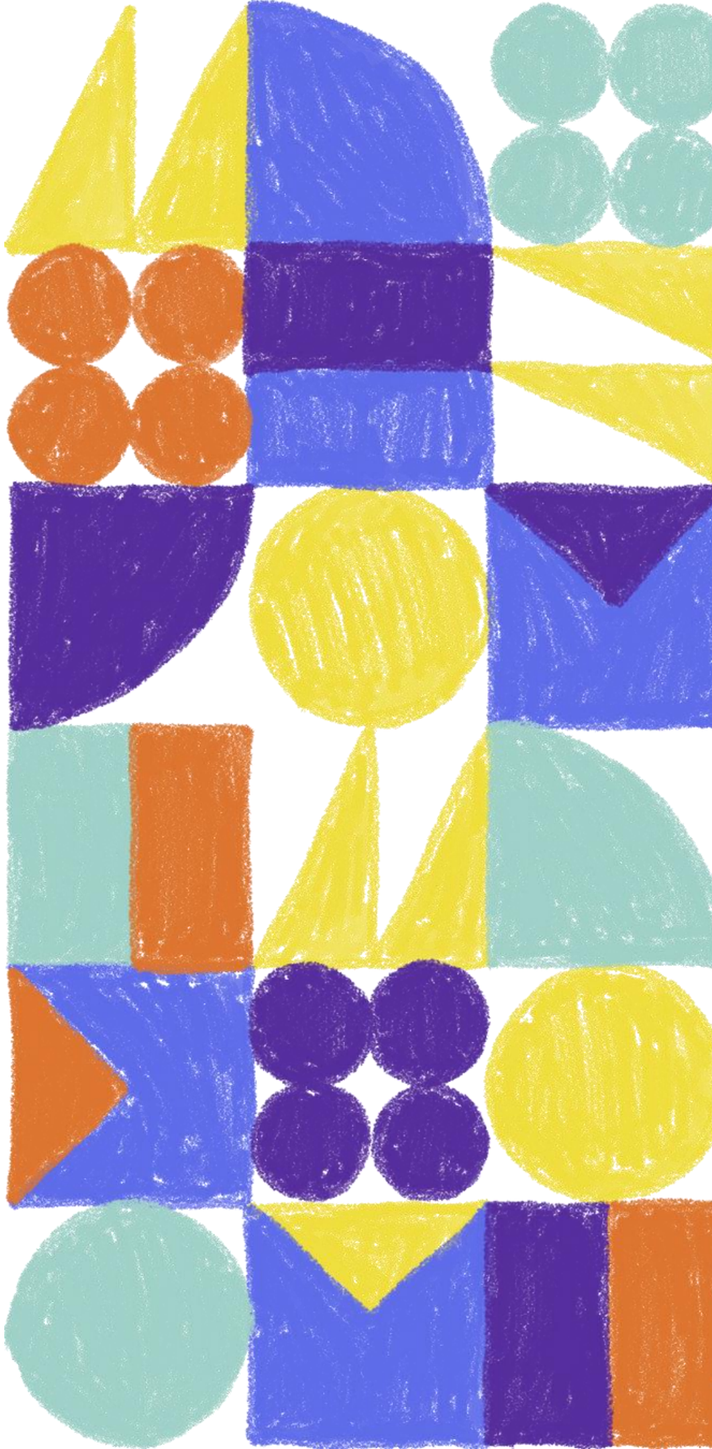
A heart murmur is an extra, unusual sound in your heartbeat.

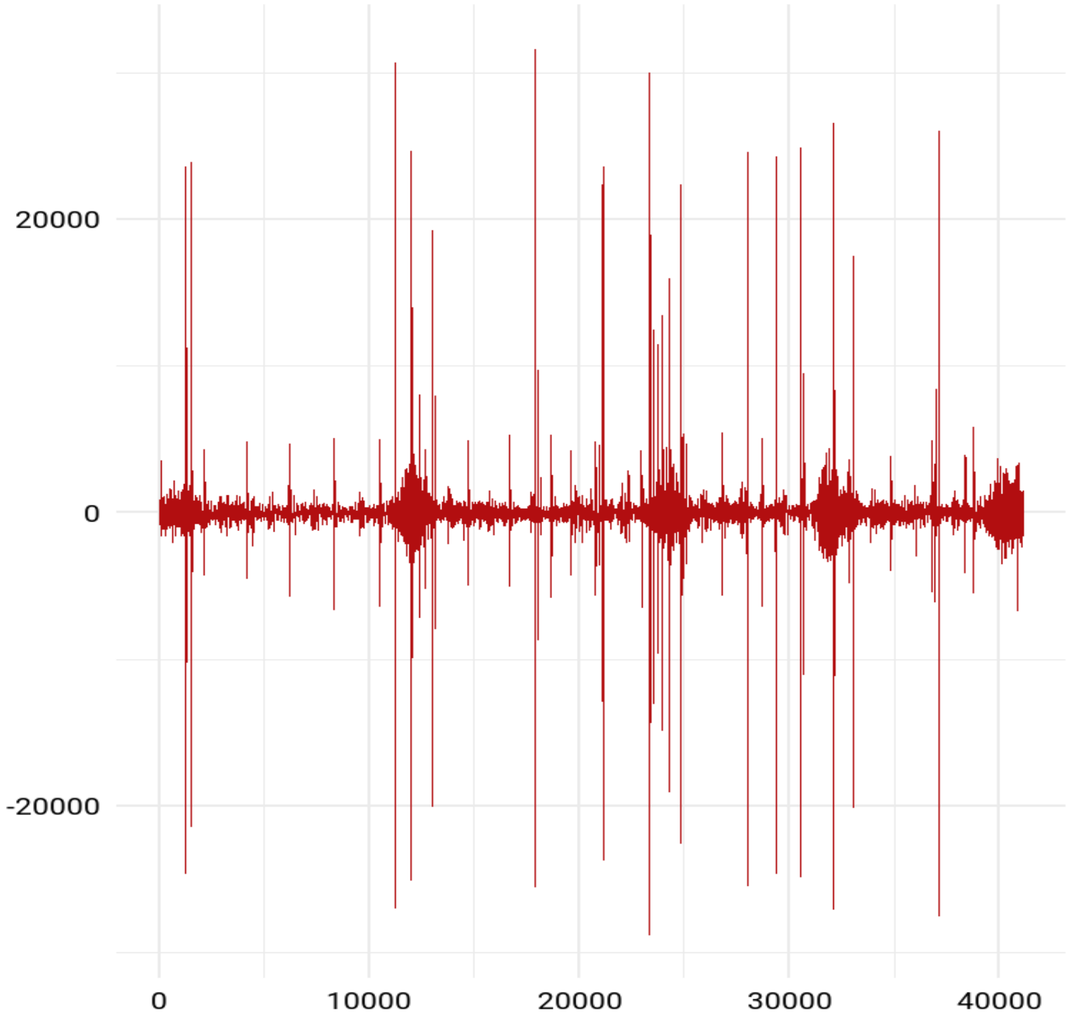
Are they dangerous?

There are different types of heart murmurs. Some are more dangerous than others.

How are they diagnosed?

Heart murmurs can be diagnosed with a PCG (phonocardiogram).

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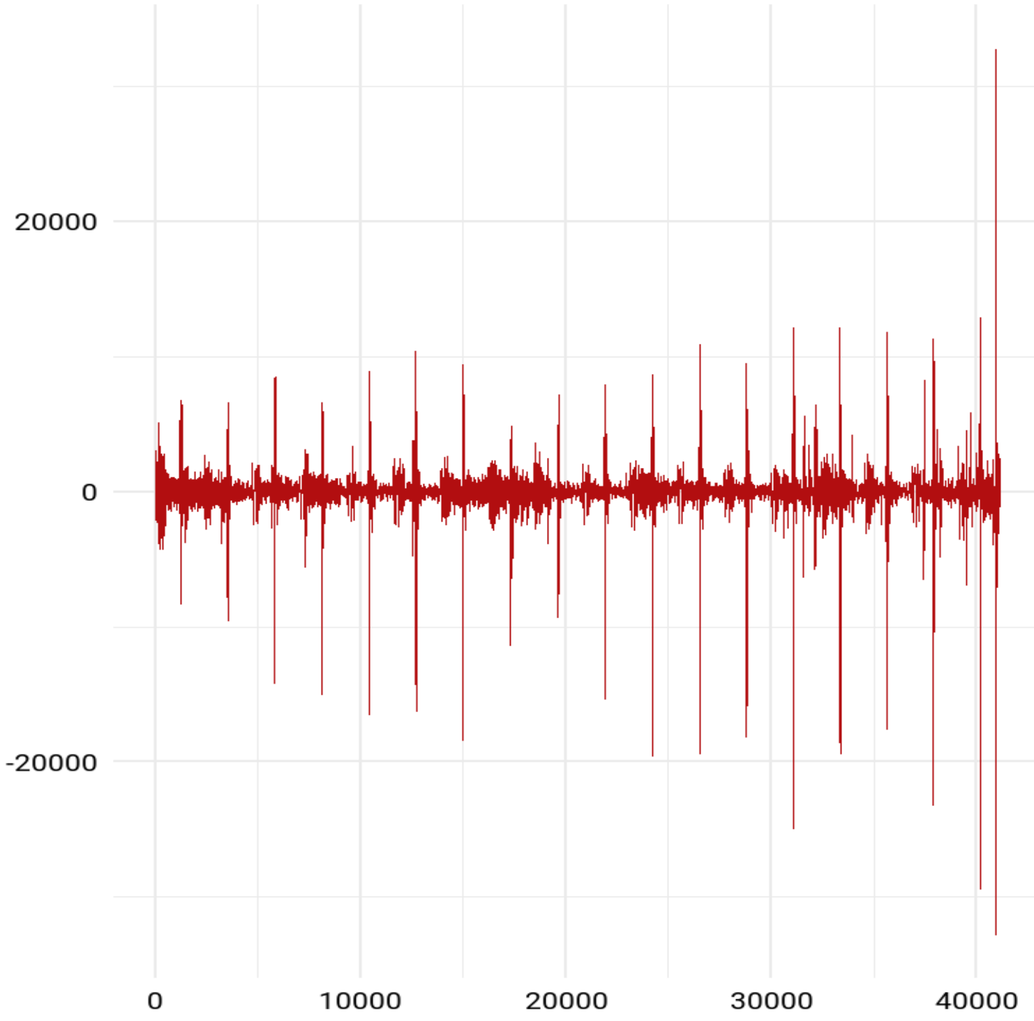
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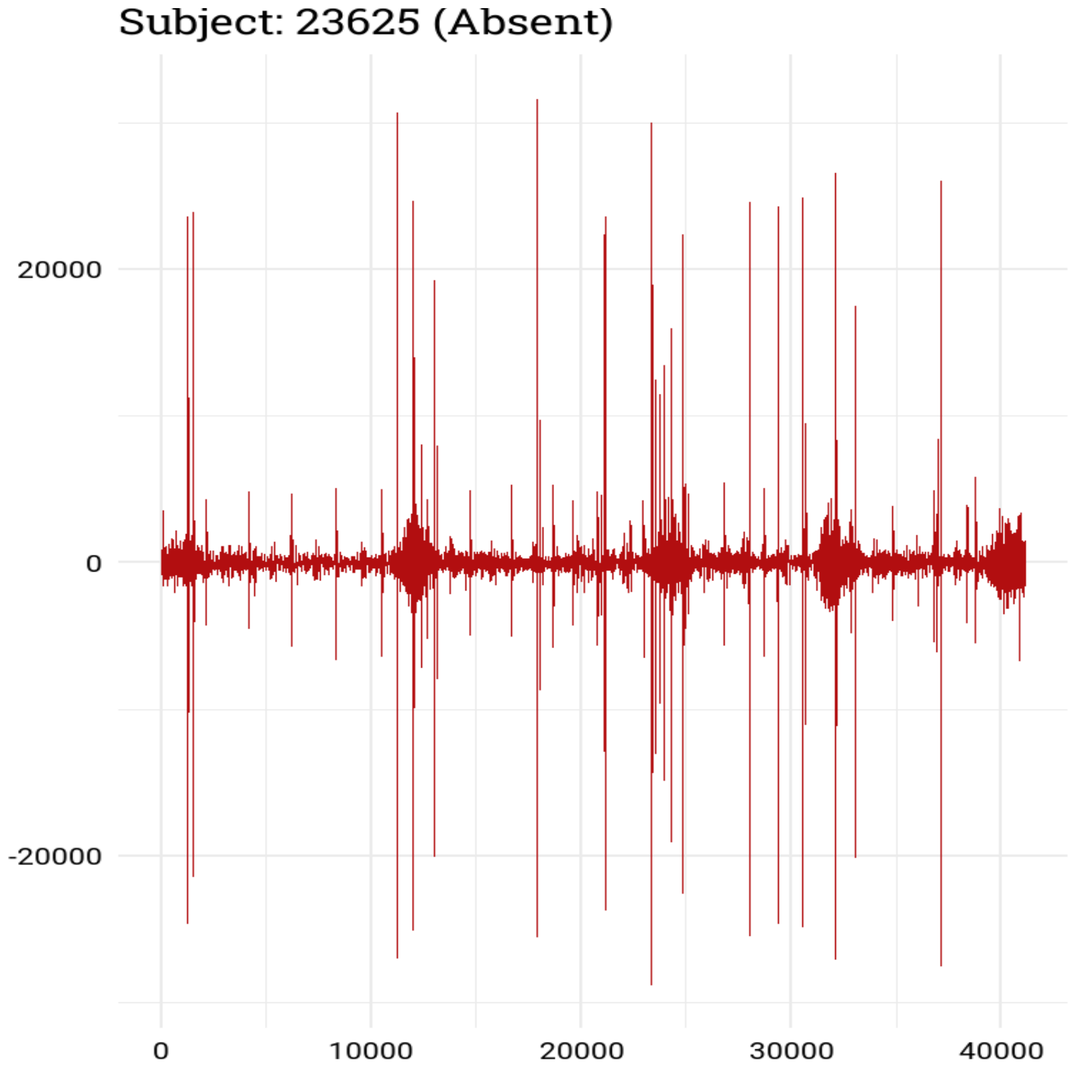
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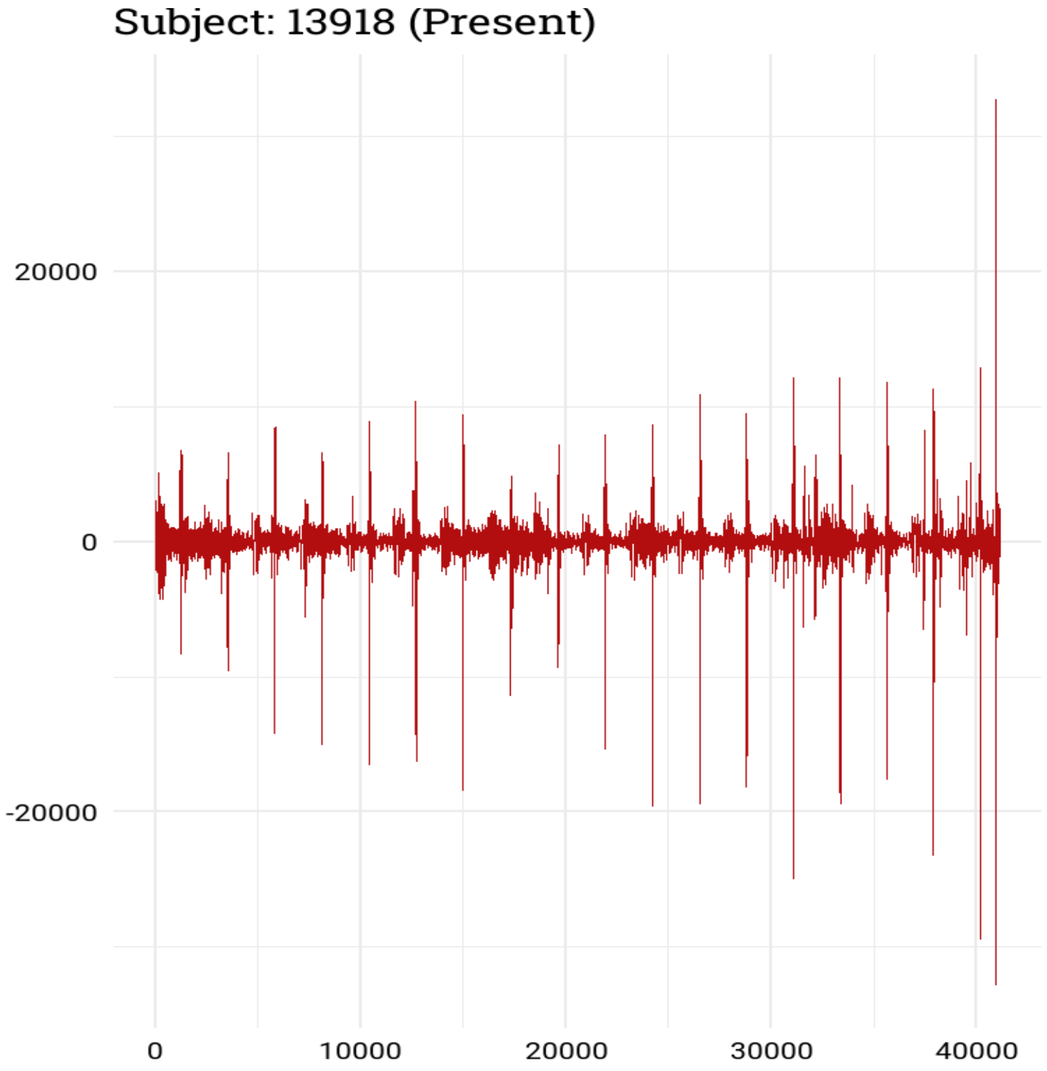
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Aim

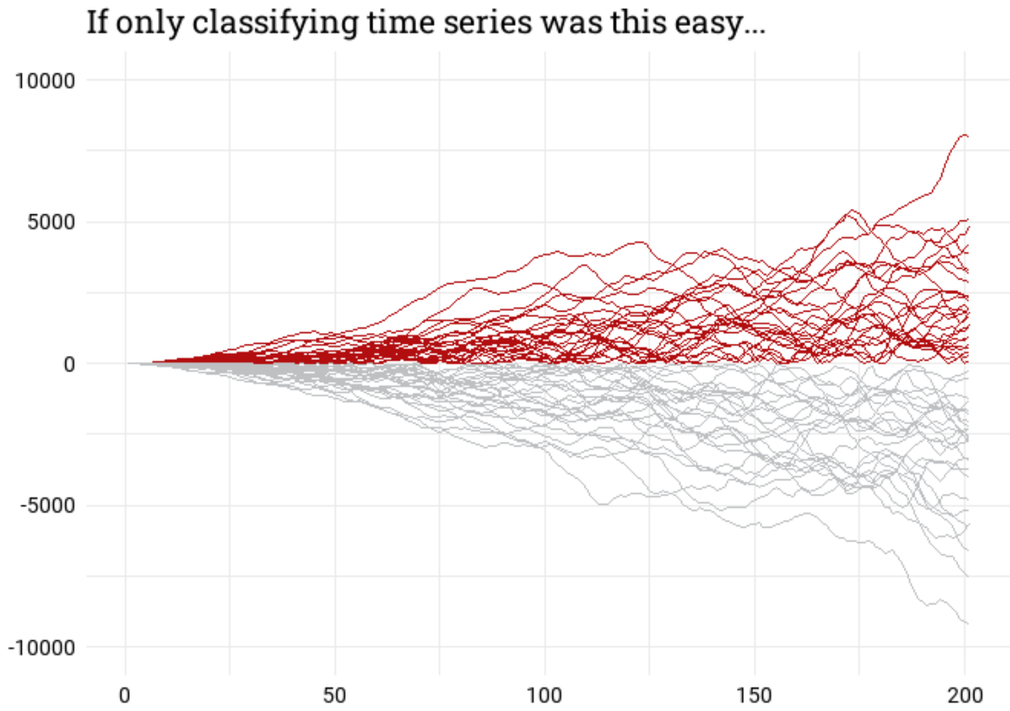
Group phonocardiogram signals

Two groups: heart murmur and no heart murmur

Challenge

Data is very noisy

There are around 40,000 observations every 10 seconds.



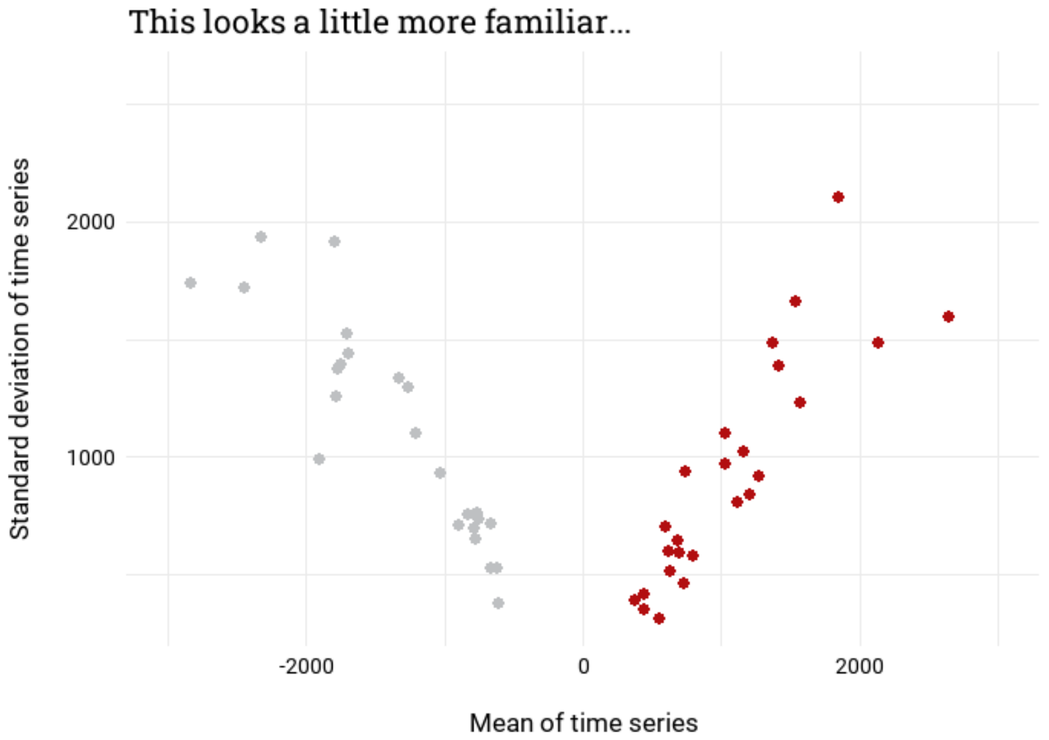
Method

Calculate *features* of the PCG signals

For example, measures of averages or variability.

Group new features instead

Two groups: heart murmur and no heart murmur.



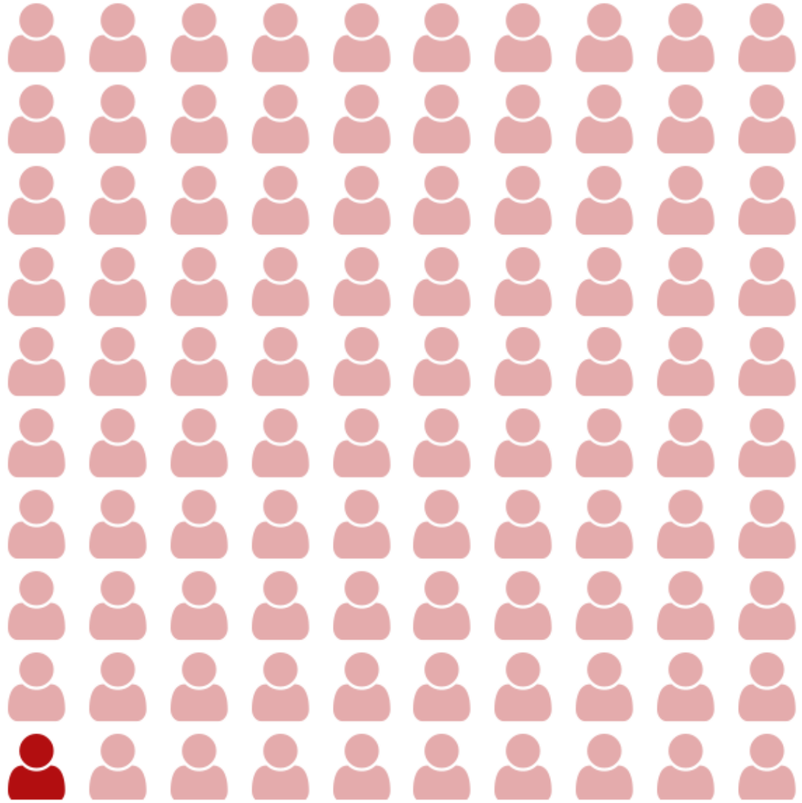
What’s next?

Improving predictions

Current methodology sometimes misses people who have heart murmurs.

Detect different types of heart murmur

Some heart murmurs are easier to detect than others. Some are more important to detect than others.



Evaluating NHS services

Collaborating with local NHS Trusts in Lancashire

Collaboration with NHS Trusts

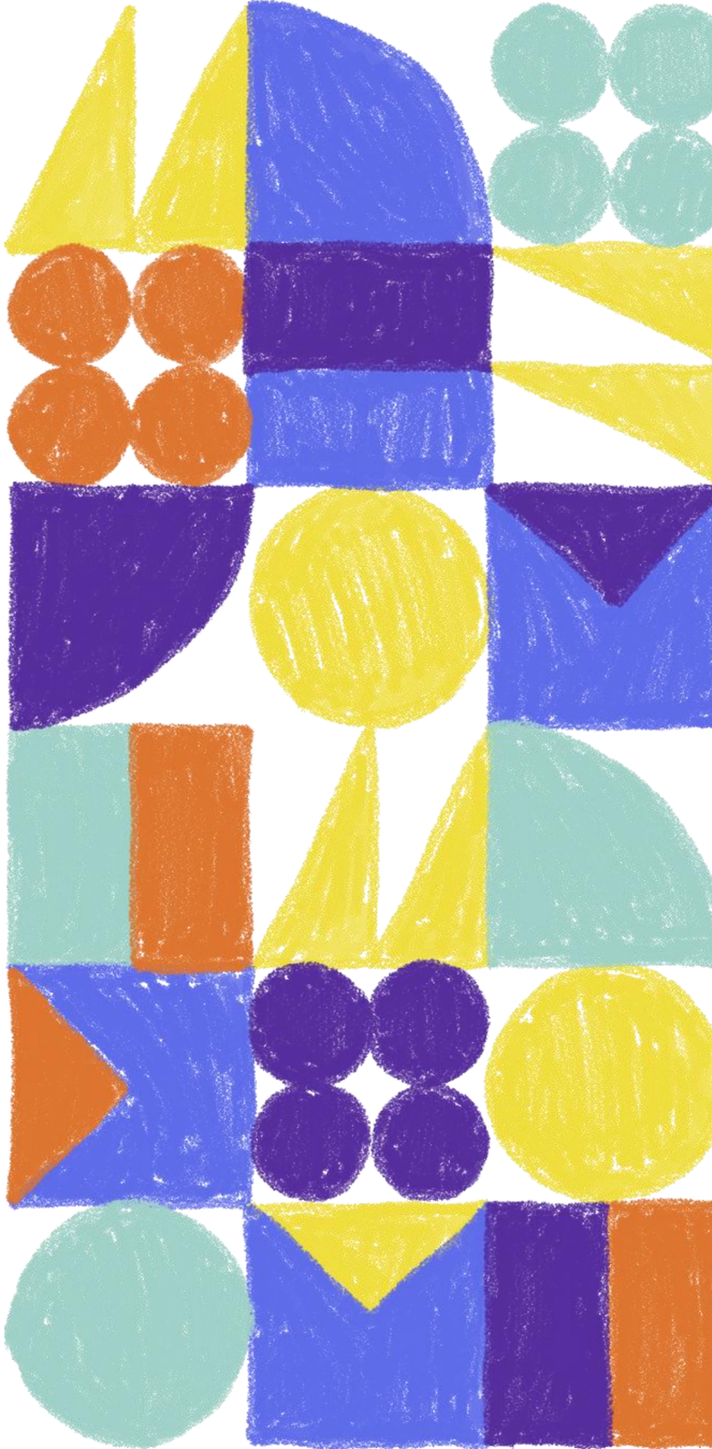
NHS
Lancashire & South Cumbria
NHS Foundation Trust

NHS
University Hospitals of Morecambe Bay
NHS Foundation Trust

NHS
Lancashire Teaching Hospitals
NHS Foundation Trust

Research questions

- What affects how long someone stays in hospital?
- How many beds are required?
- How do patients move through different NHS services?
- How can we link different data sources?



NHS Data

Data from many sources

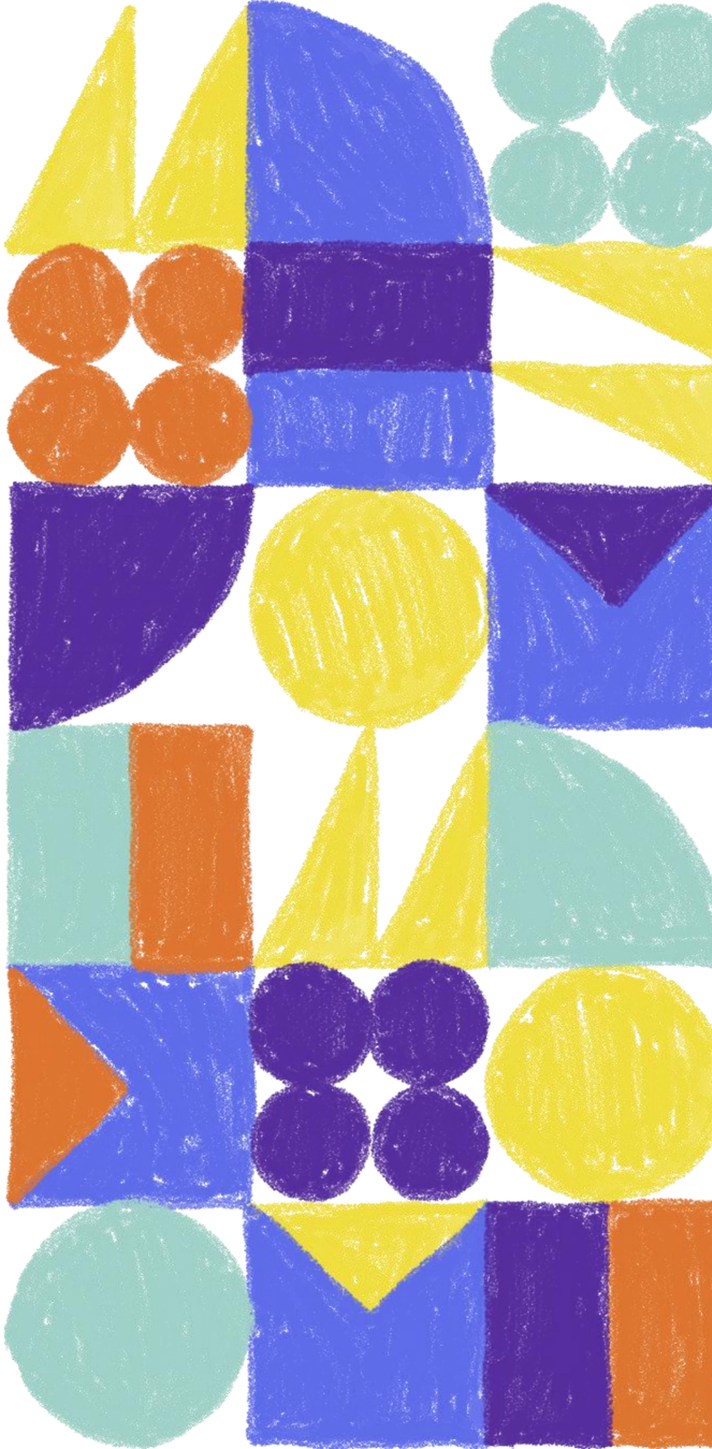
The NHS collect a lot of data from different sources including primary care (e.g. GP), secondary care (e.g. hospital), and operational data.

Data in many formats

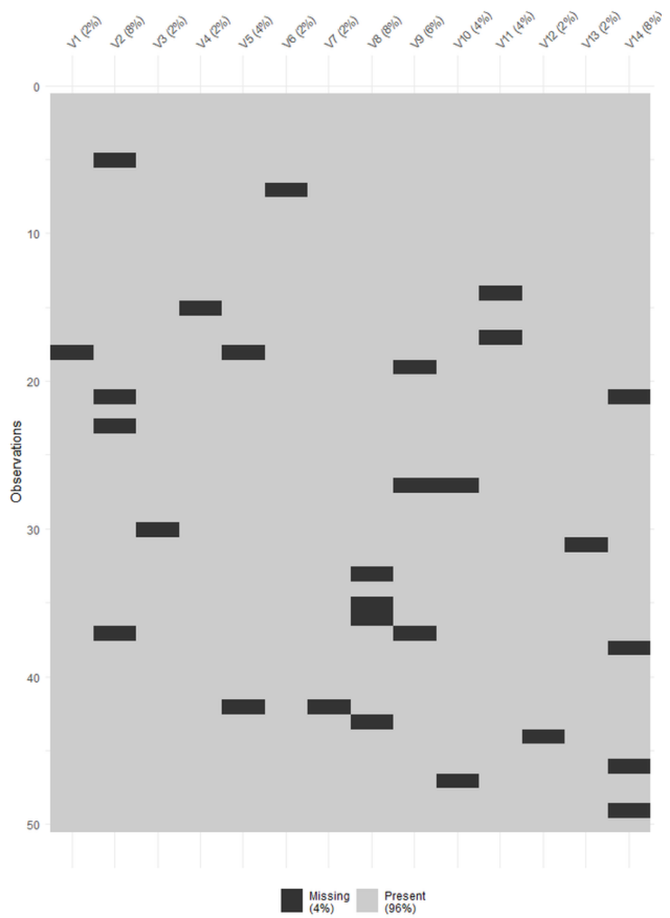
Data can be in the form of spreadsheets, letters from doctors to patients, scan images, and may other things!

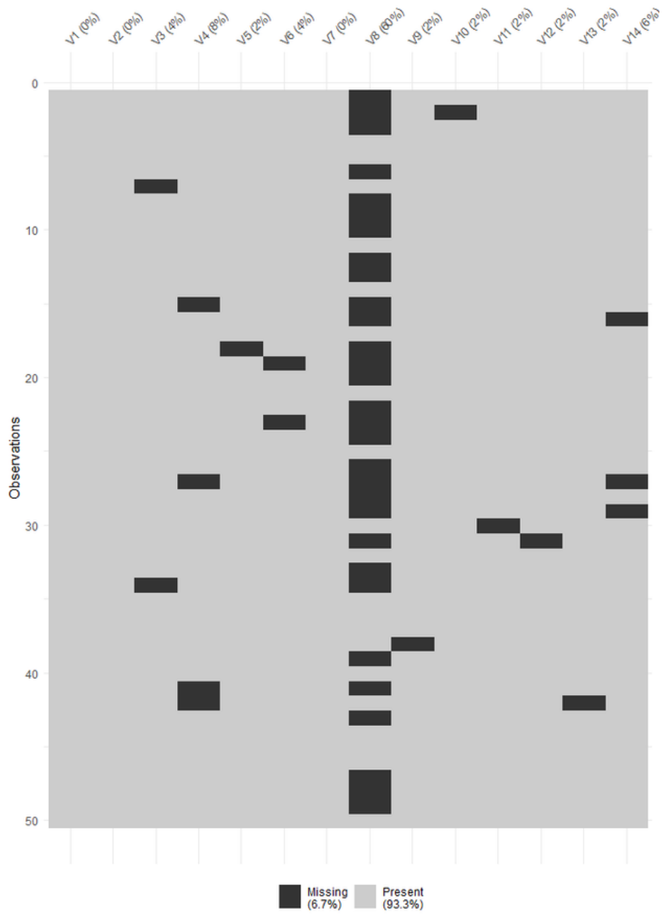
Data quality issues

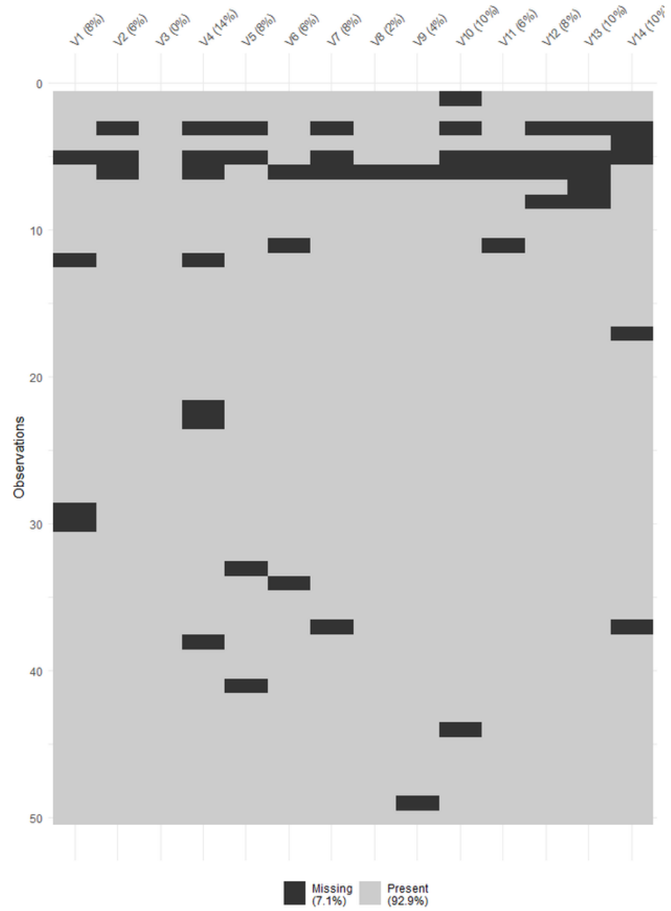
Data can sometimes be incomplete, inaccurate, and duplicated.

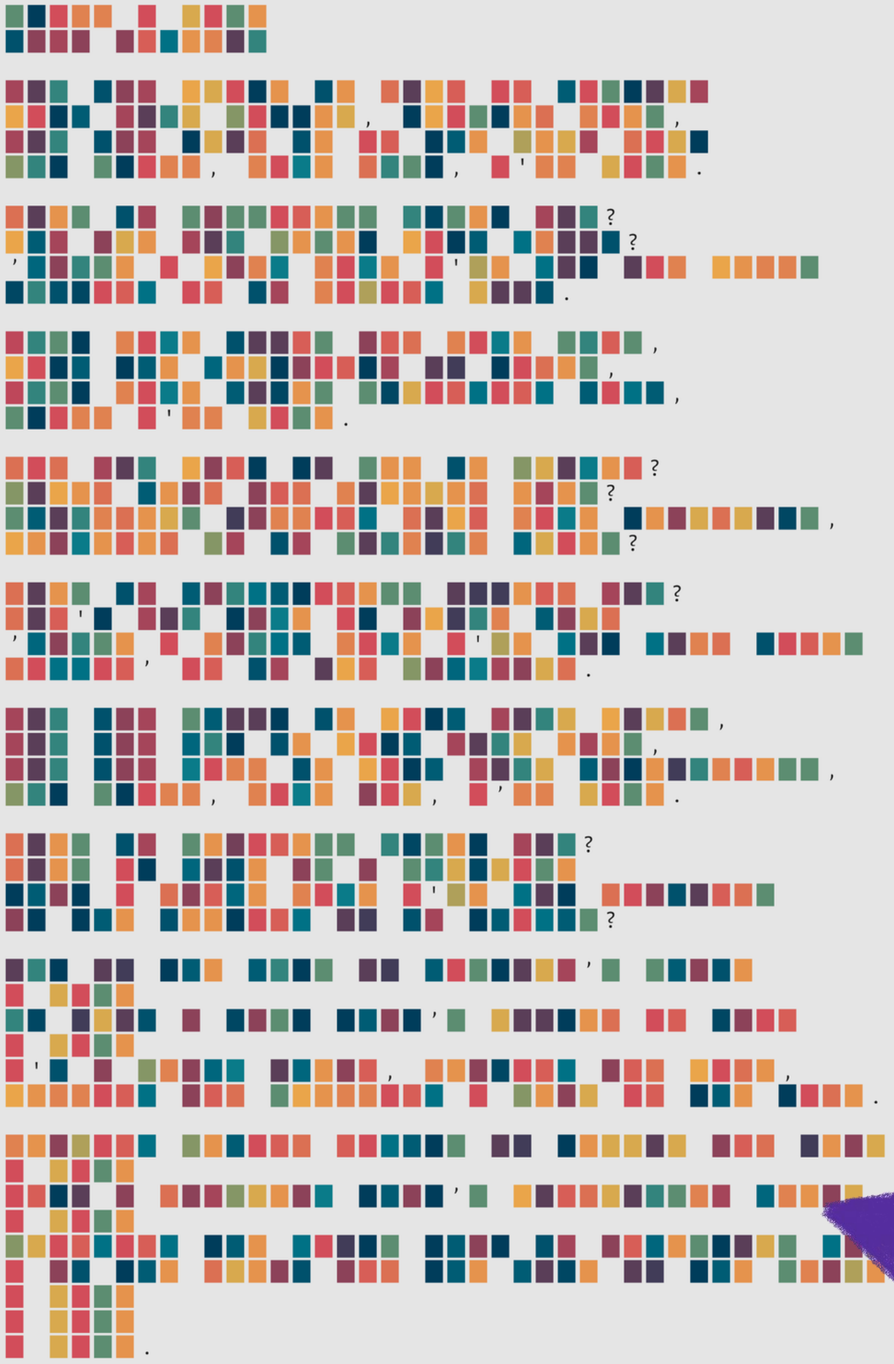


Dealing with missing data









Data visualisation

How do we effectively communicate information?

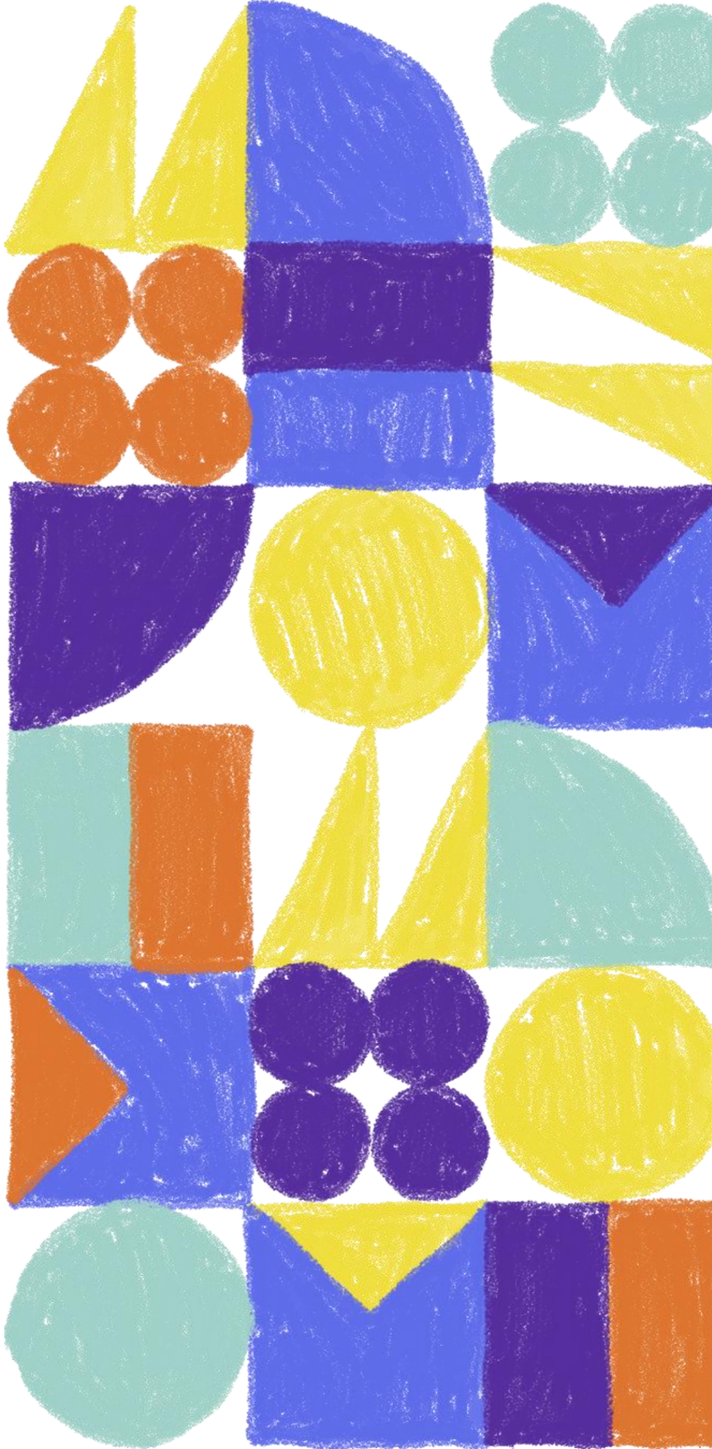
Why visualise data?

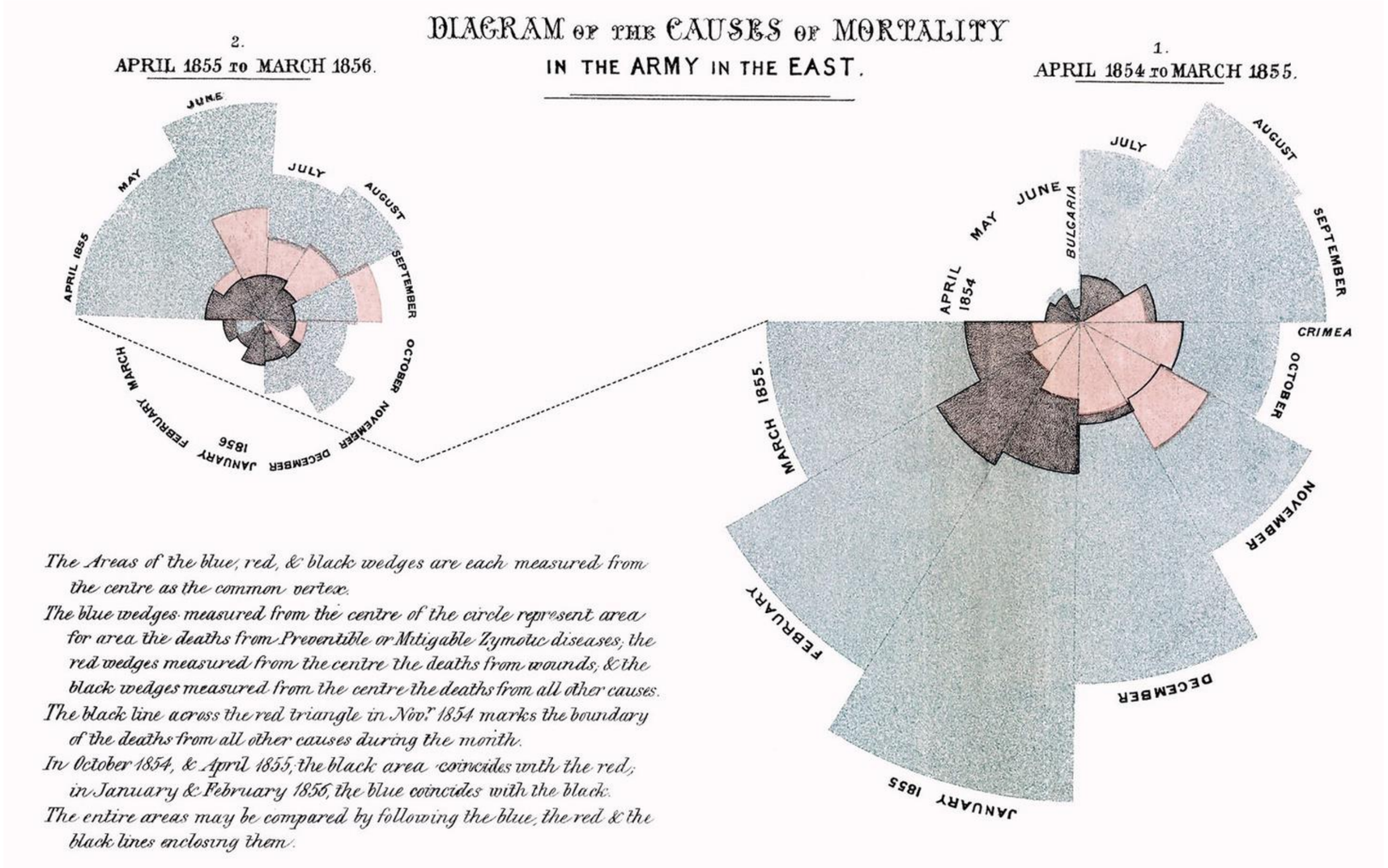
Exploratoring data

Identifying data issues and modelling approaches.

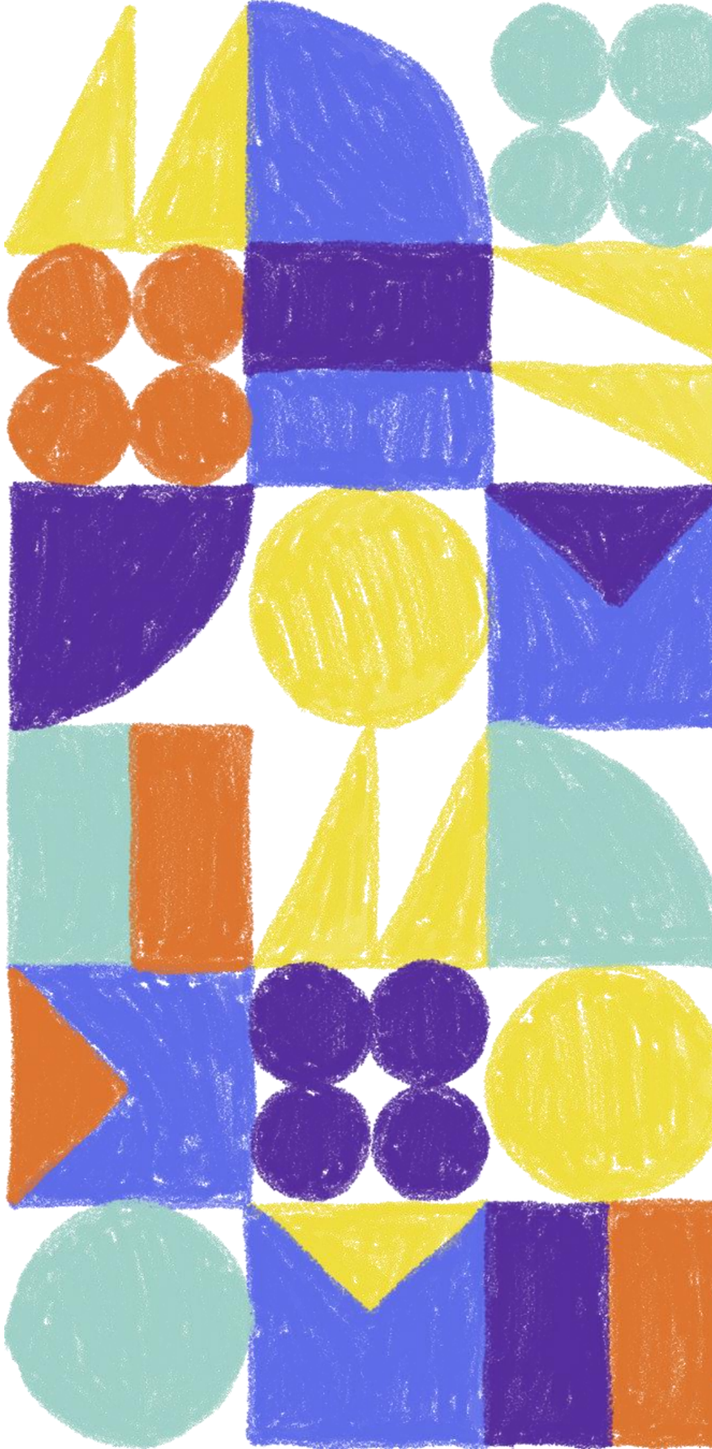
Communicating insights

Telling stories with data.

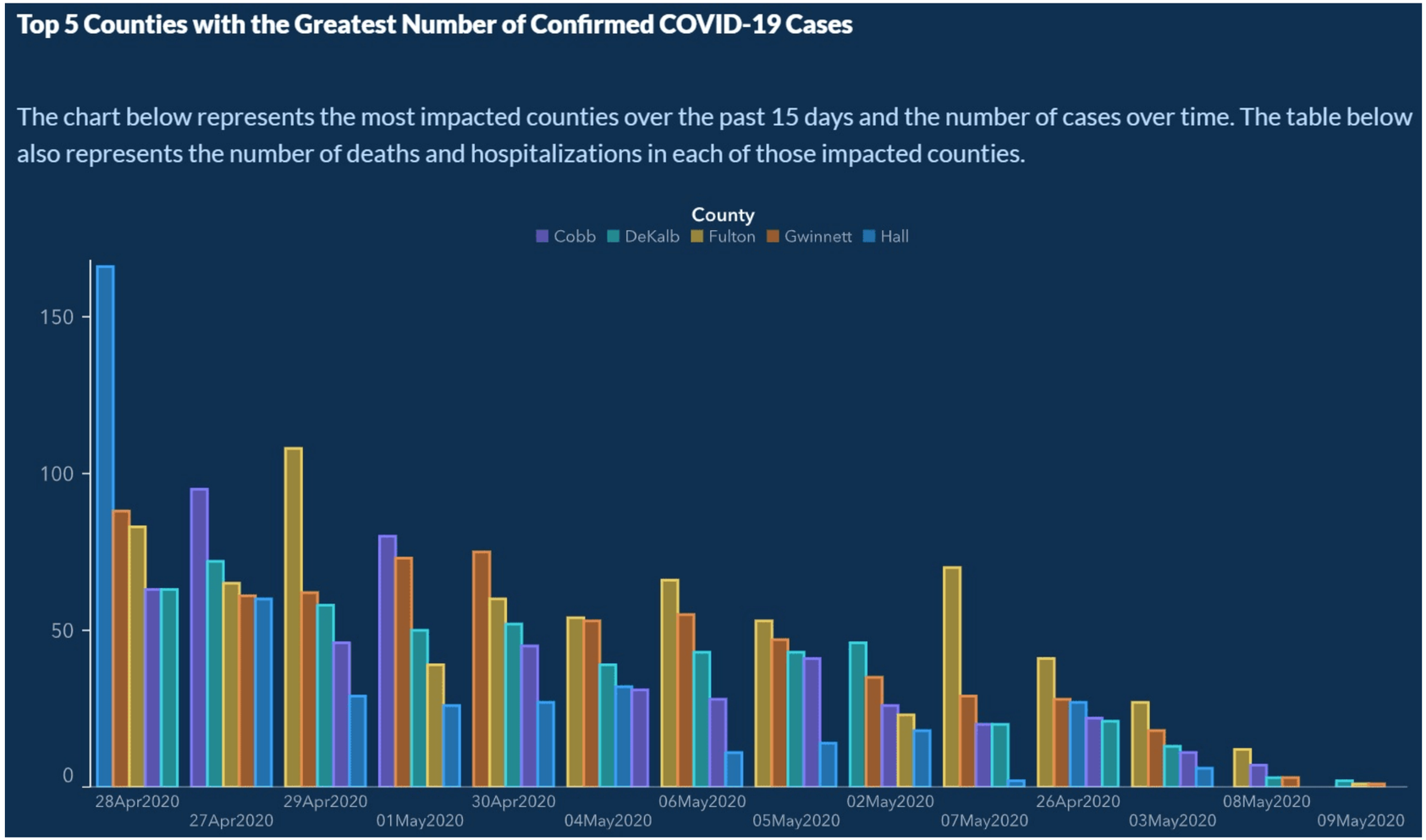




Florence Nightingale's *Rose Diagram*.1859.



Not all data visualisations are *good* data visualisations...



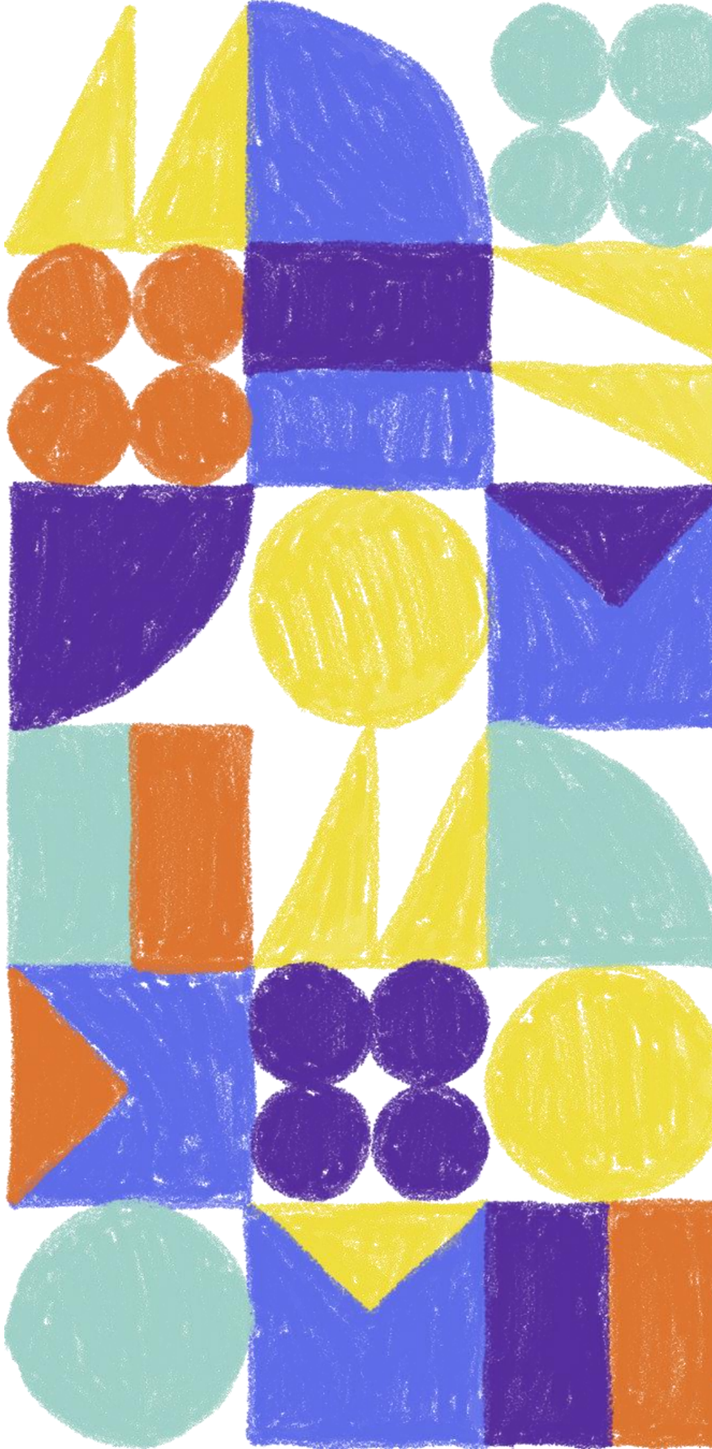
How do we help people make better charts?

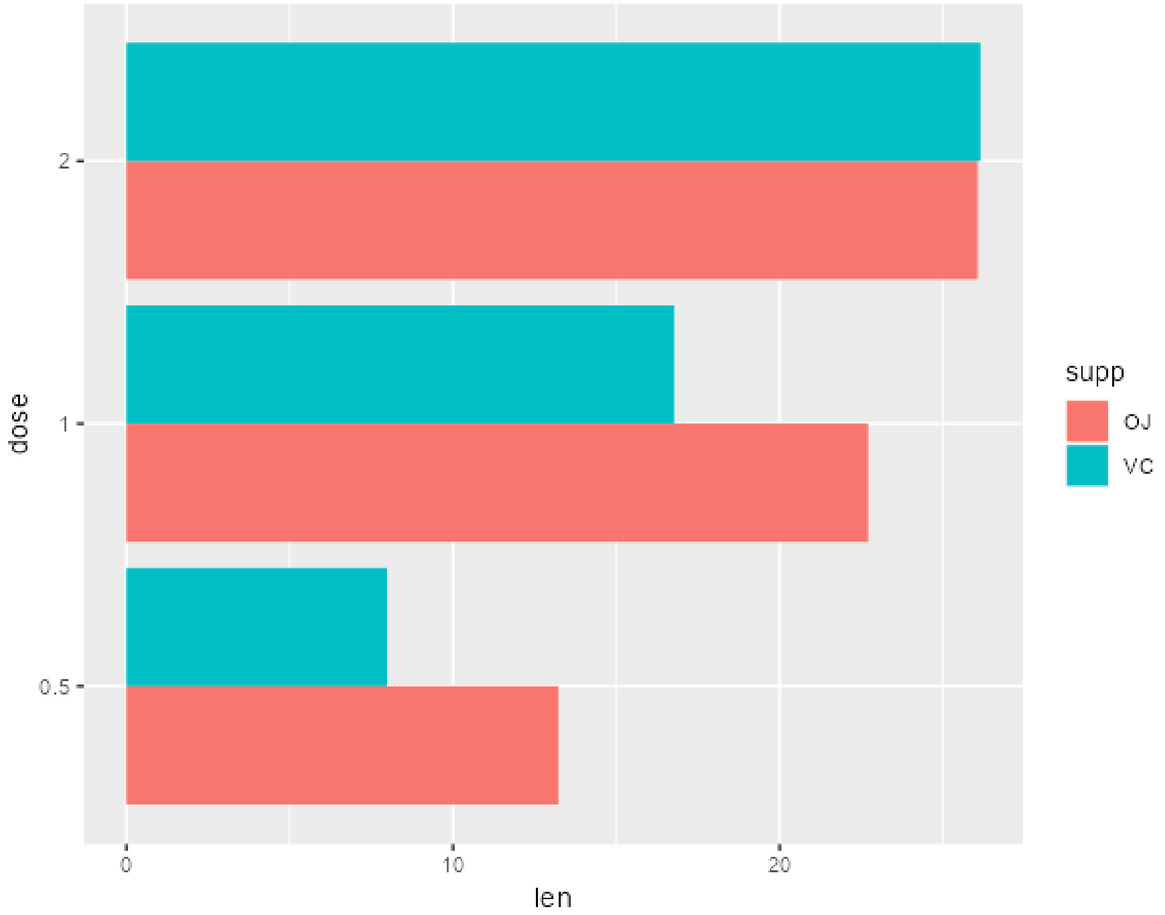
Develop data visualisation guidance

Project with the Royal Statistical Society to develop and publish a website.

Build software to do it for them

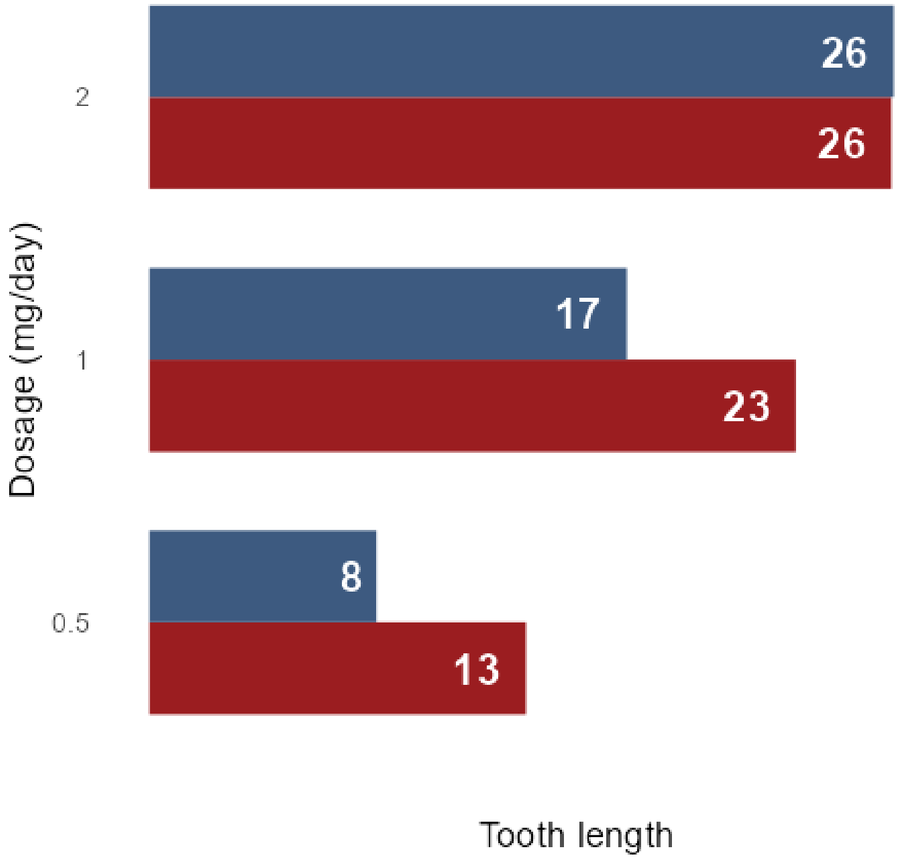
Create better default settings for charts.





Tooth Growth

Each of 60 guinea pigs received one of three dose levels of vitamin C (0.5, 1, and 2 mg/day) by one of two delivery methods: **orange juice** or **ascorbic acid**.



Introduction
How to use this guide
The guide
Why we visualise data
Principles and elements of visualisations
Choosing a visualisation type
Styling for accessibility
Styling for RSS publications
References and resources
About the authors
Join us at RSS Conference
Terms and conditions

Best Practices for Data Visualisation

Insights, advice, and examples (with code) to make data outputs more readable, accessible, and impactful

Coming to the RSS Conference this September? Find out more about our conference session and how to become a guide contributor!

Statistics is "the science of collecting, analyzing, presenting, and interpreting data" (Williams, Anderson, and Sweeney 2023). Presentation of data is a key means to support and guide interpretation and subsequent decision making. Techniques exist for effective display. This is what this guide is all about.

Good data visualisation requires appreciation and careful consideration of the technical aspects of data presentation. But it also involves a creative element. Authorial choices are made about the "story" we want to tell, and design decisions are driven by the need to convey that story most effectively to our audience. Software systems use default settings for most graphical elements. However, each visualisation has its own story to tell, and so we must actively consider and choose settings for the visualisation under construction.

This guide covers both aspects of data visualisation: the art and the science. It is written primarily for contributors to Royal Statistical Society publications – chiefly, *Significance* magazine, the *Journal of the Royal Statistical Society Series A*, and Real World Data Science – but we trust you will find the information and advice within to be of broad relevance and use to any data visualisation task.

Whenever I am infuriated, I revenge myself with a new diagram.

Florence Nightingale

n.rennie@lancaster.ac.uk