From lab to patient

How statistics shapes decisions in medicine

Nicola Rennie

Royal Statistical Society William Guy Lecturer 2024 - 2025

About Me

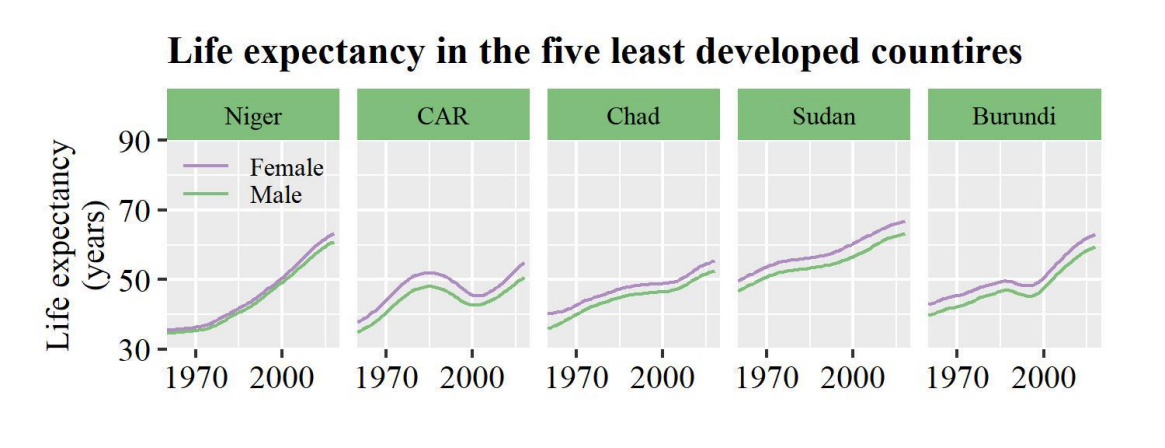
At school:

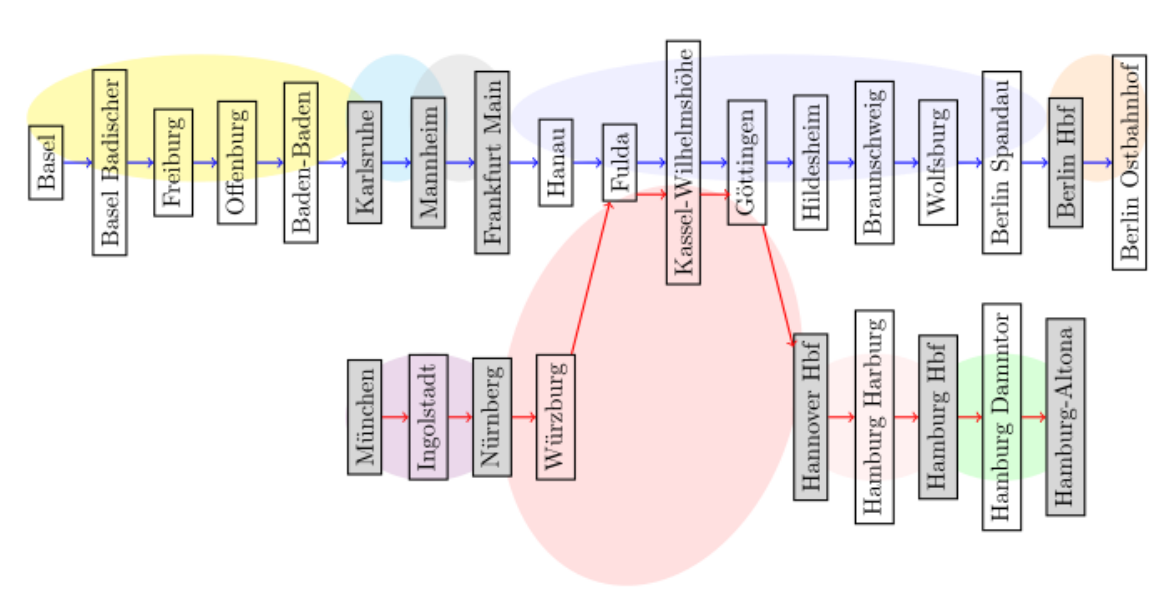
- Maths
- English
- Biology
- Chemistry
- Physics
- Art & Design
- Music

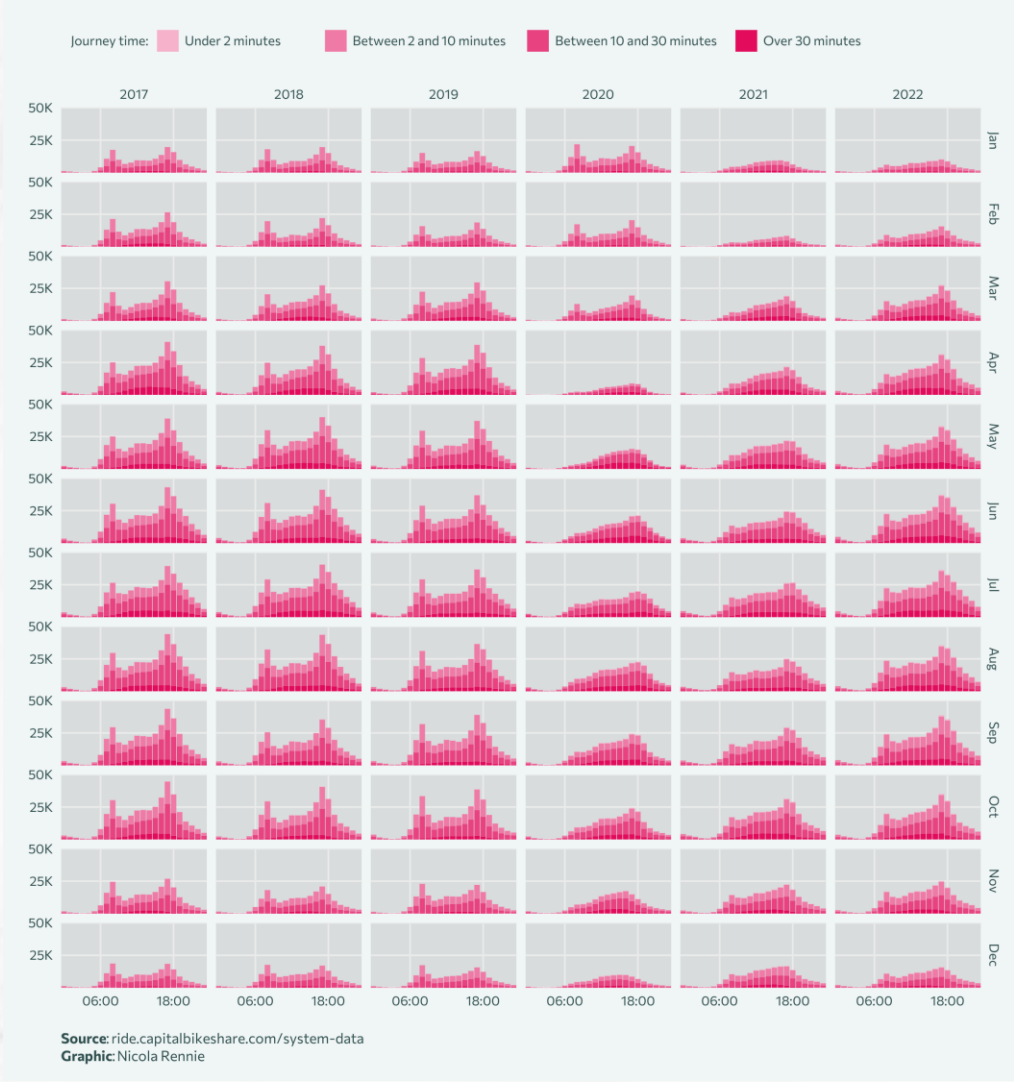
About Me

- Studied Maths at the University of St. Andrews
- Did a Masters and PhD in Statistics at Lancaster University
- Worked as a Data Scientist
- Lecturer in Health Data Science at Lancaster University

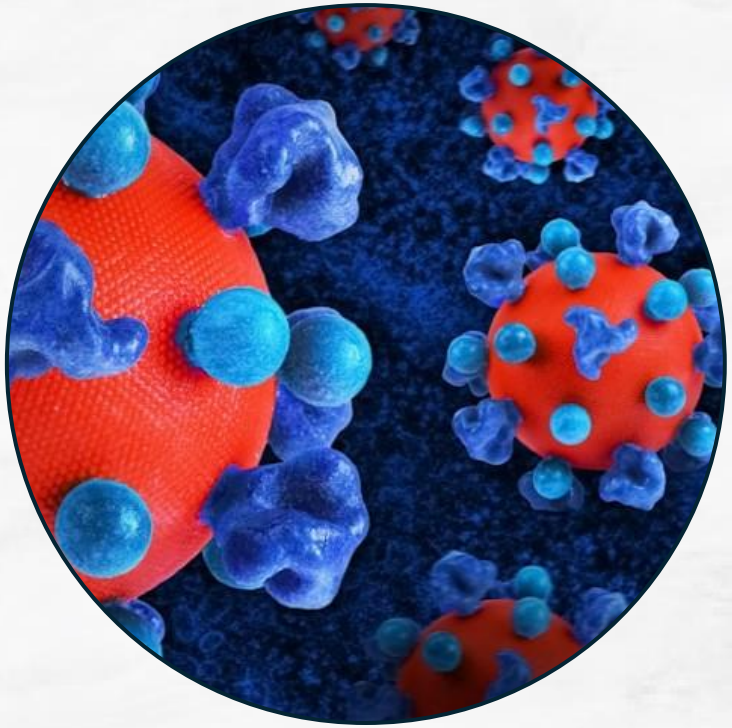
Some of the work I've done

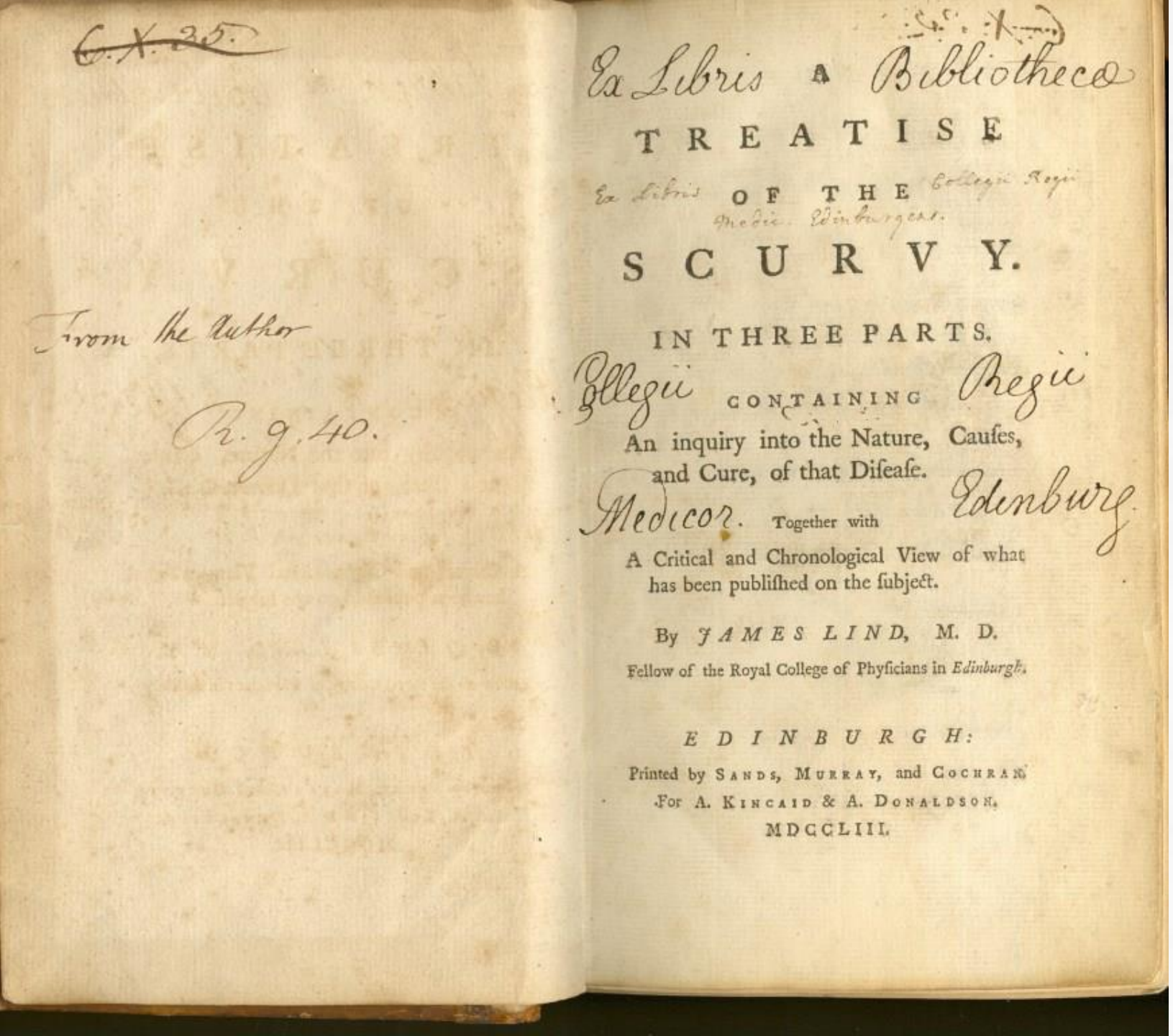






Statistics in medicine





One of the first clinical trials happened in 1747.

A disease called scurvy was a huge problem for sailors.

12 patients with scurvy on a ship and gave them each one of 6 possible treatments.

Sailors whose daily diet included citrus fruits recovered, but the others still had symptoms.

Citrus fruits (containing vitamin C) could cure scurvy.

- How do we know that a medicine will work?
- How do we know how much of that medicine to give patients?
- How do we know it is safe to give patients?
- What are the side effects of the medicine?
- Does it work equally well for all patients?

How do we know Covid vaccines are safe?

15 February 2022

Coronavirus

GETTY IMAGES

By Michelle Roberts

Health editor, BBC News online

Blood pressure is measured using a blood pressure monitor.

High blood pressure can increase risk of other, more serious, health conditions.

How do we know if a treatment works?

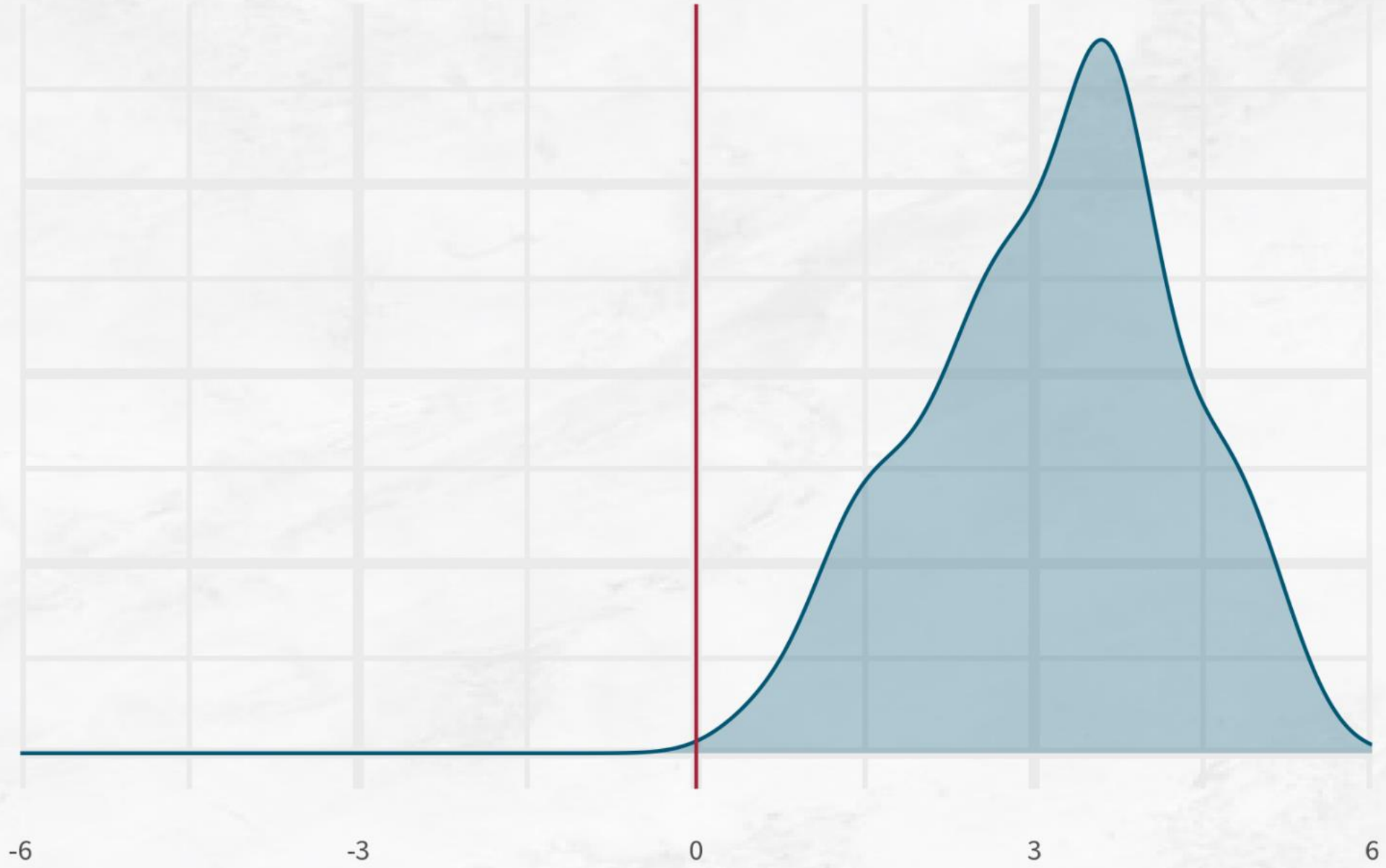
What do we measure?

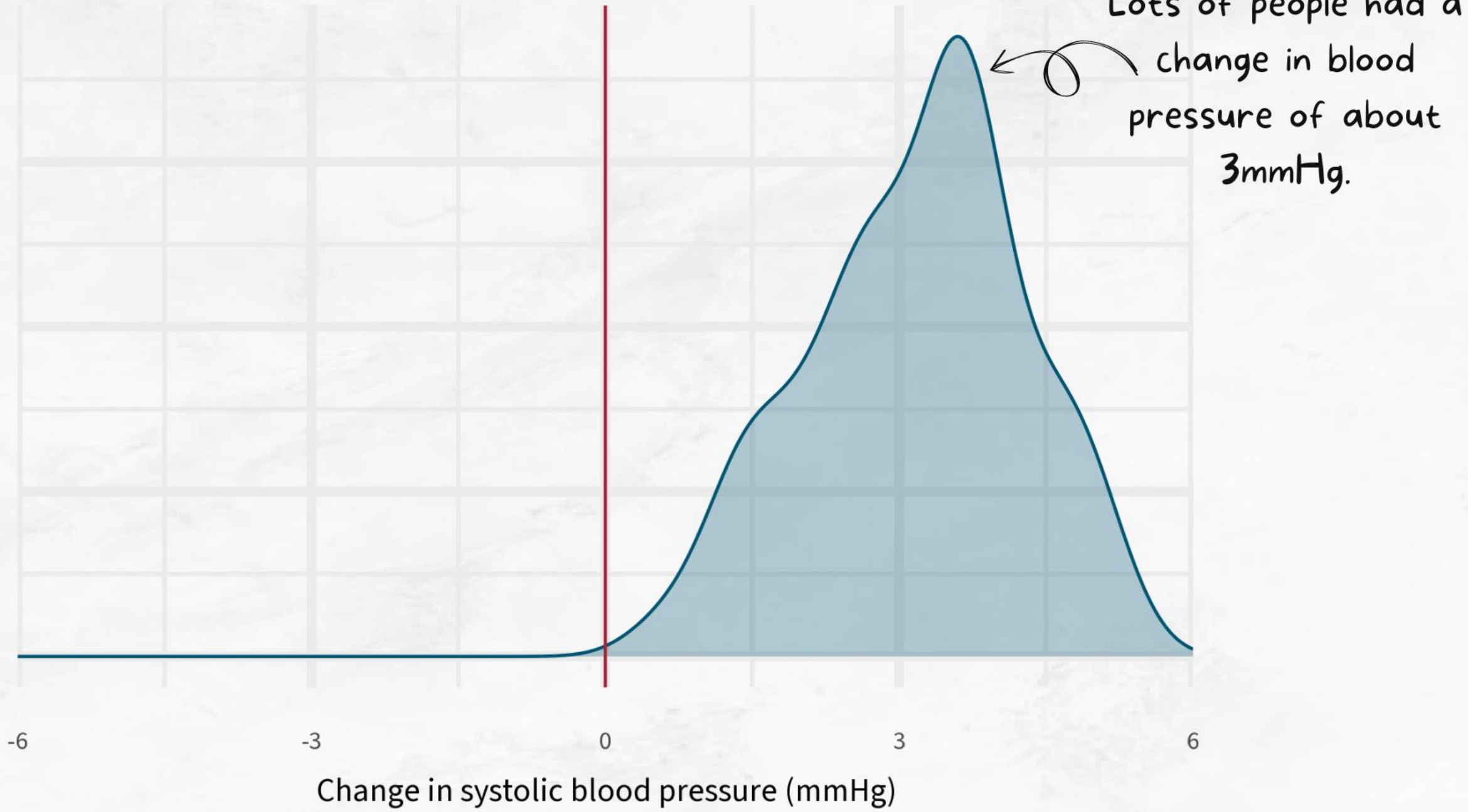
Blood pressure **before** treatment

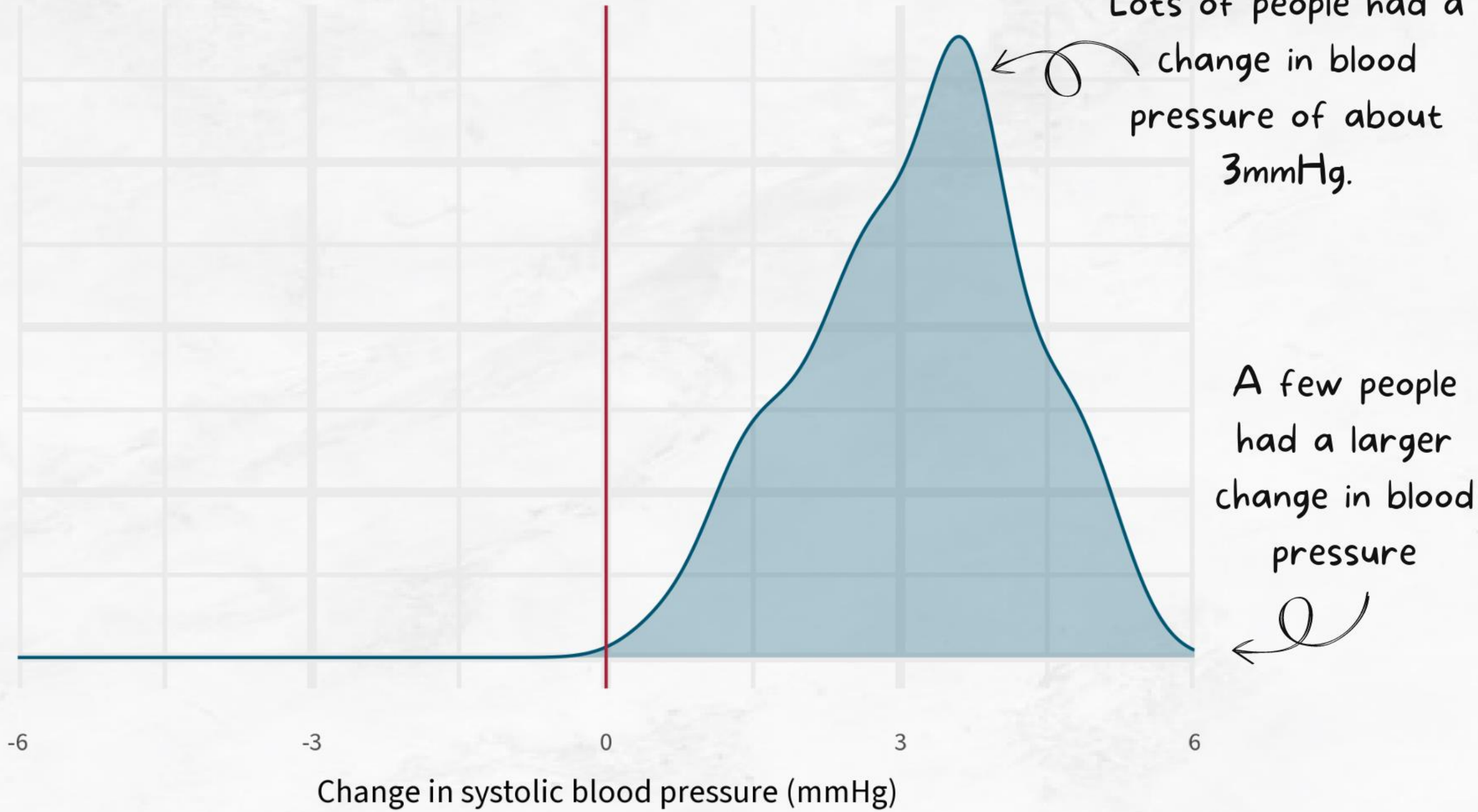
Treatment

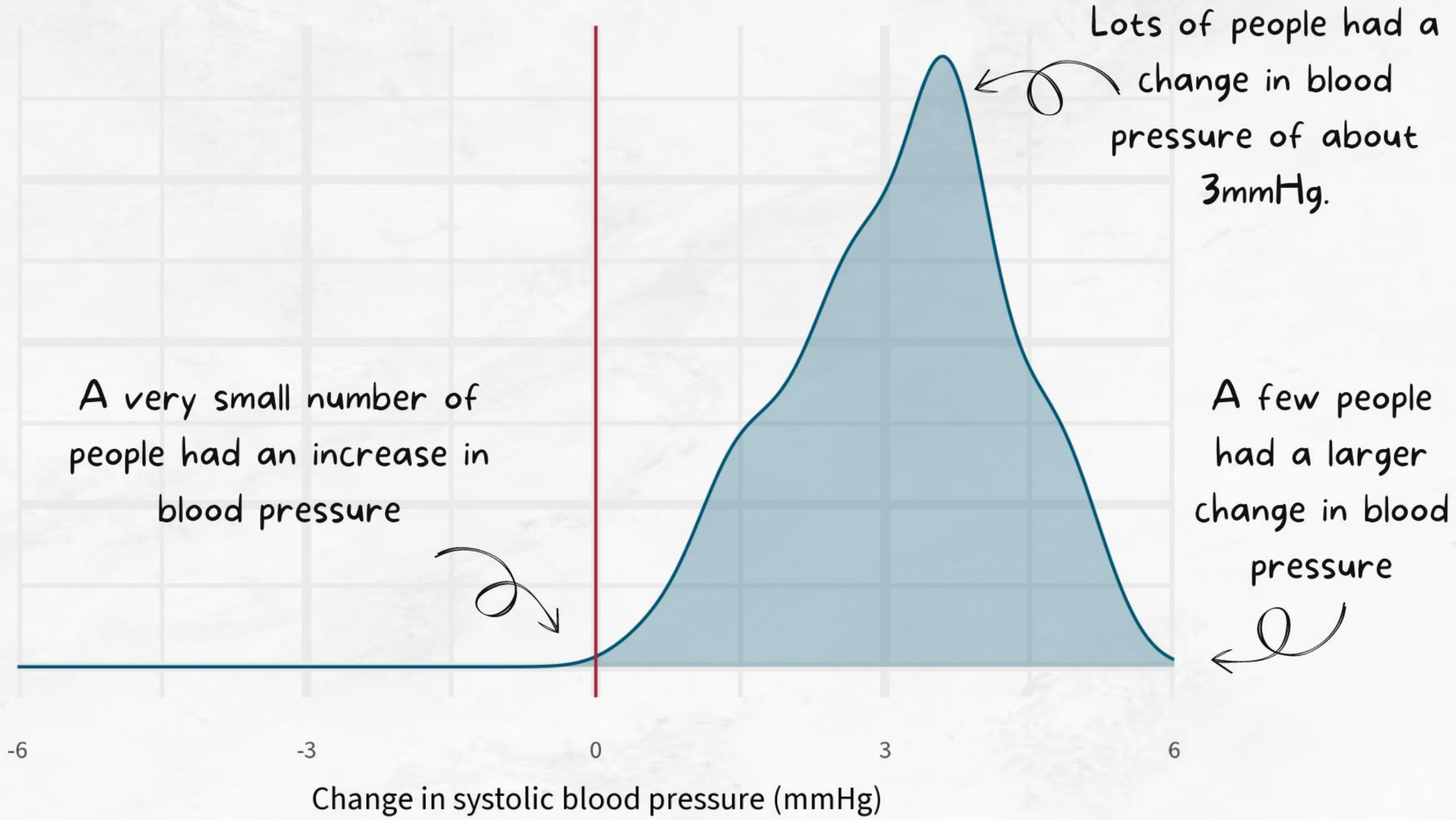
Blood pressure **after** treatment

Difference = before - after


-6
-3
0
3
6
Change in systolic blood pressure (mmHg)


Lots of people had a change in blood pressure of about 3mmHg.
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)


Lots of people had a change in blood pressure of about 3mmHg.
A few people had a larger change in blood pressure
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)


Lots of people had a change in blood pressure of about 3mmHg.
A very small number of people had an increase in blood pressure
A few people had a larger change in blood pressure
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)

How many times do we test a medicine?

How many people do we need?

More certain → More people

Bigger variation → More people

Smaller change → More people

How do we decide who gets which treatment?

Everybody gets new treatment

Half of people get
new treatment

Half of people
get no treatment

Half of people get new treatment

Half of people get current treatment

"Coin flip" 1

"Coin flip" 1

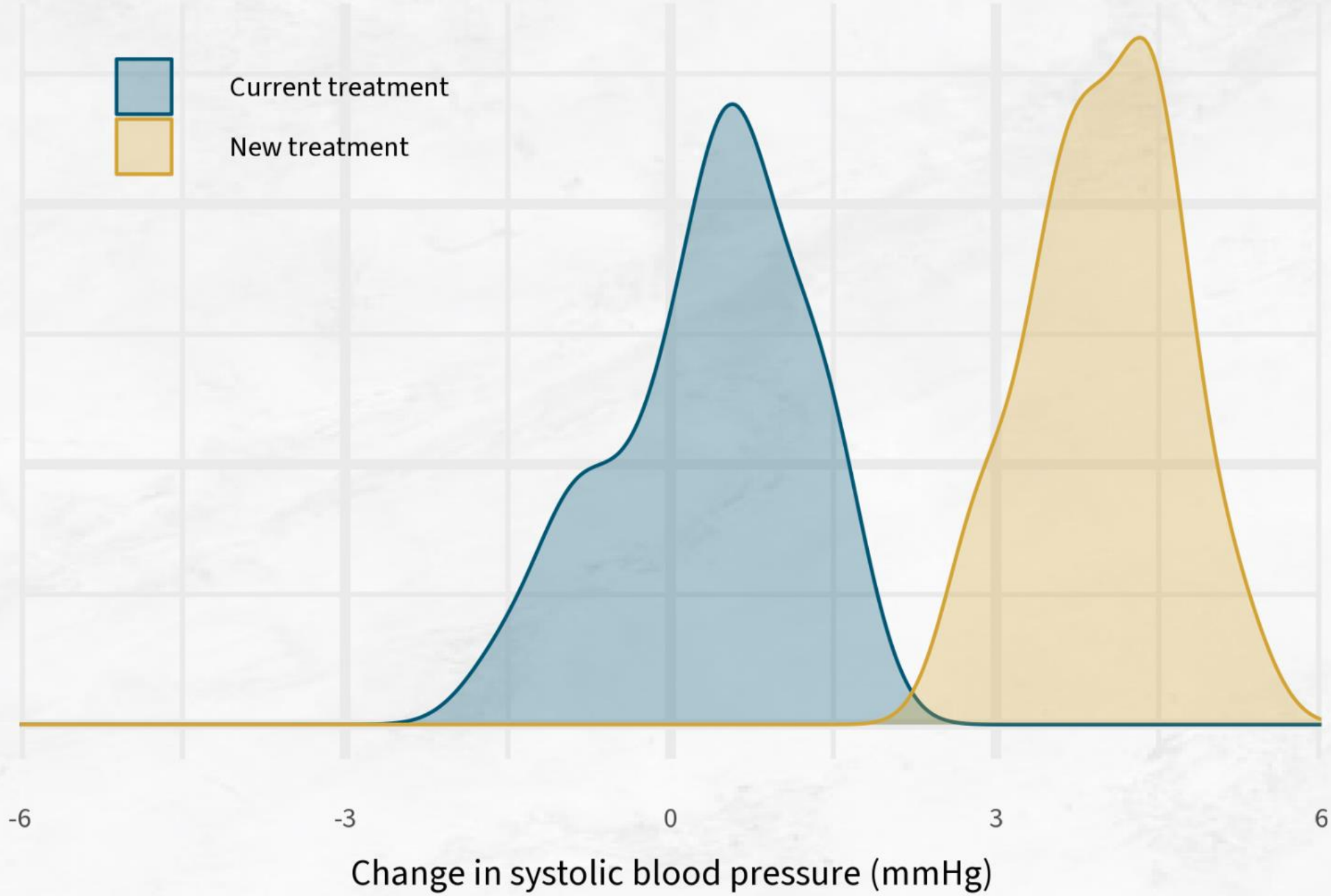
"Coin flip" 2

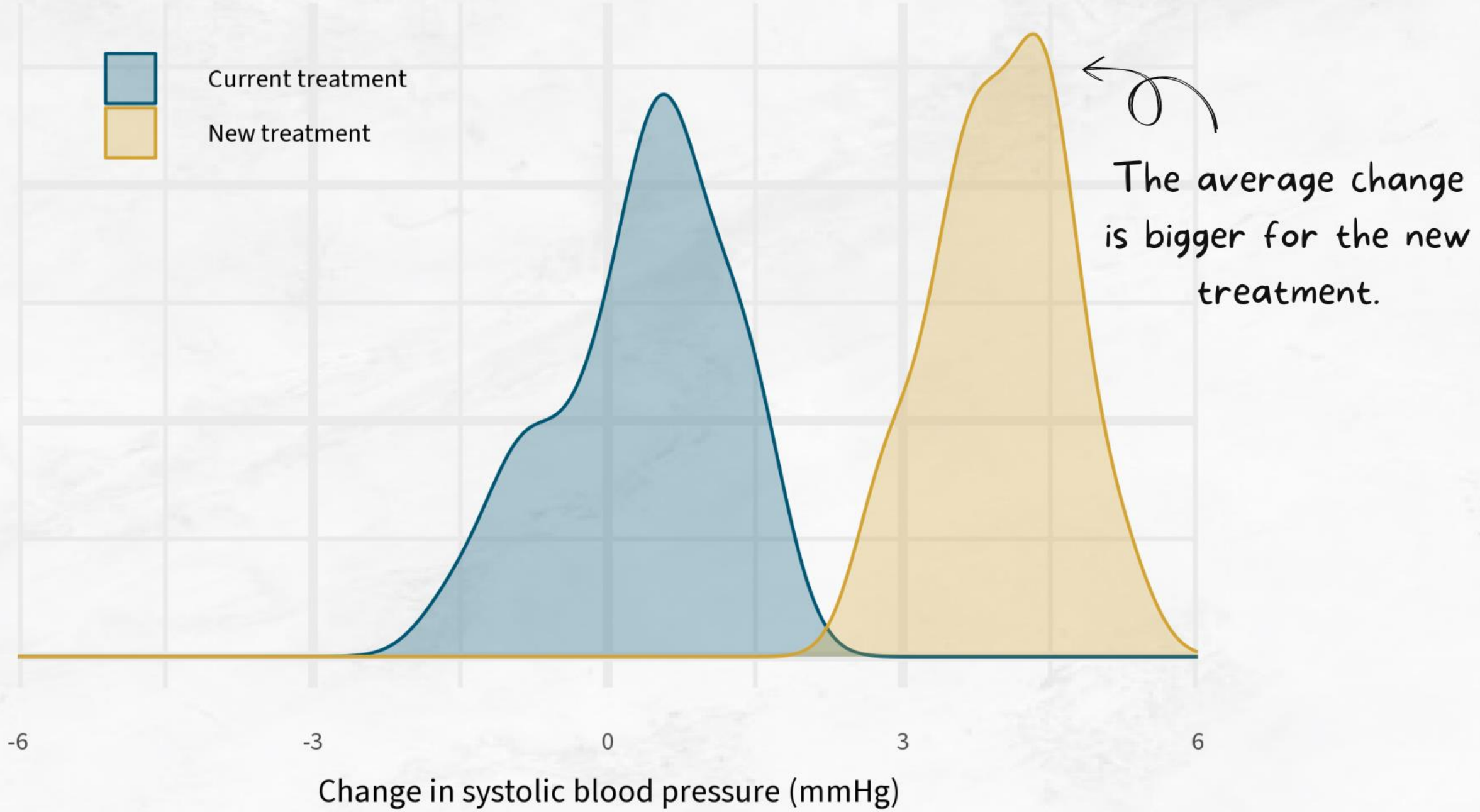
"Coin flip" 1

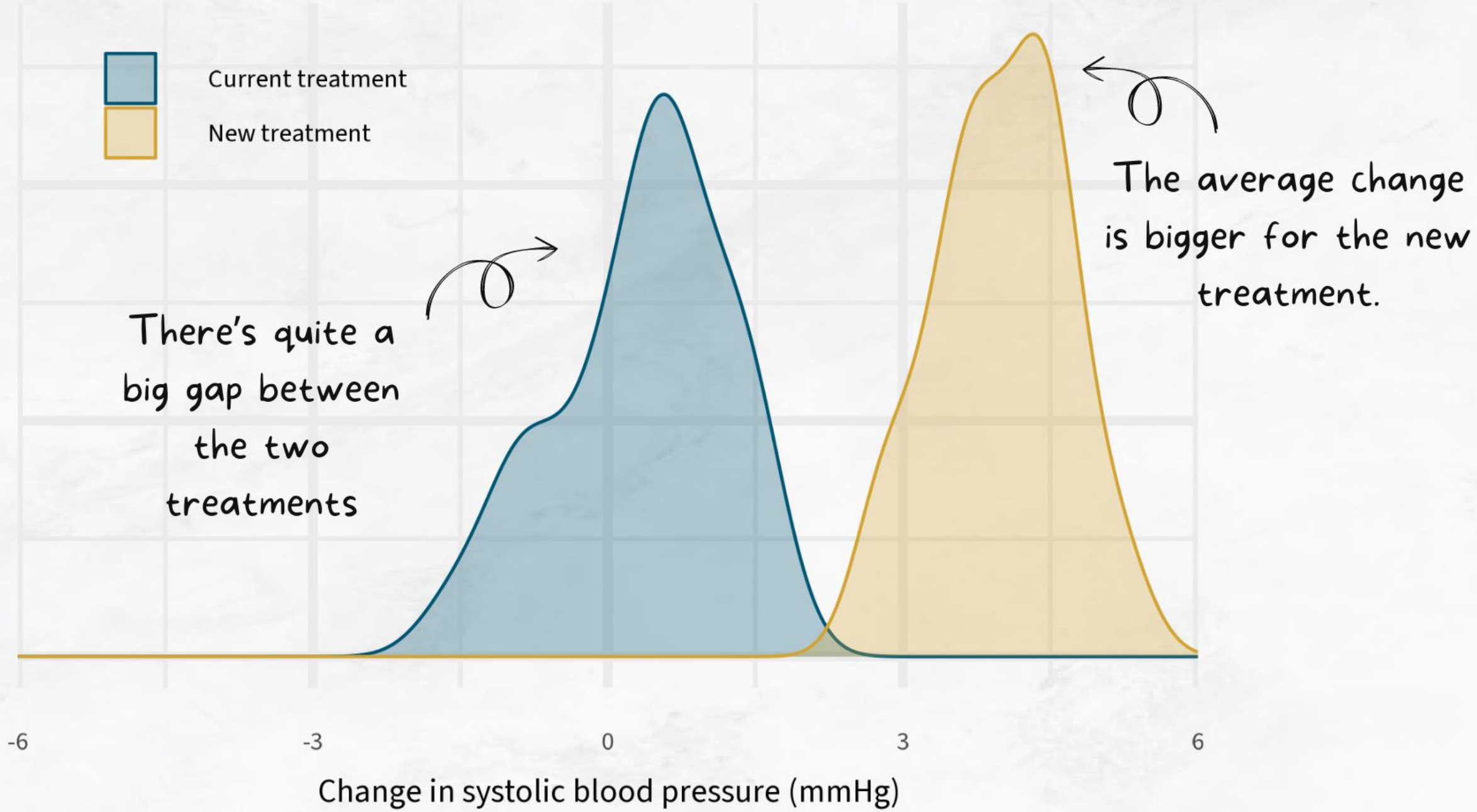
"Coin flip" 2

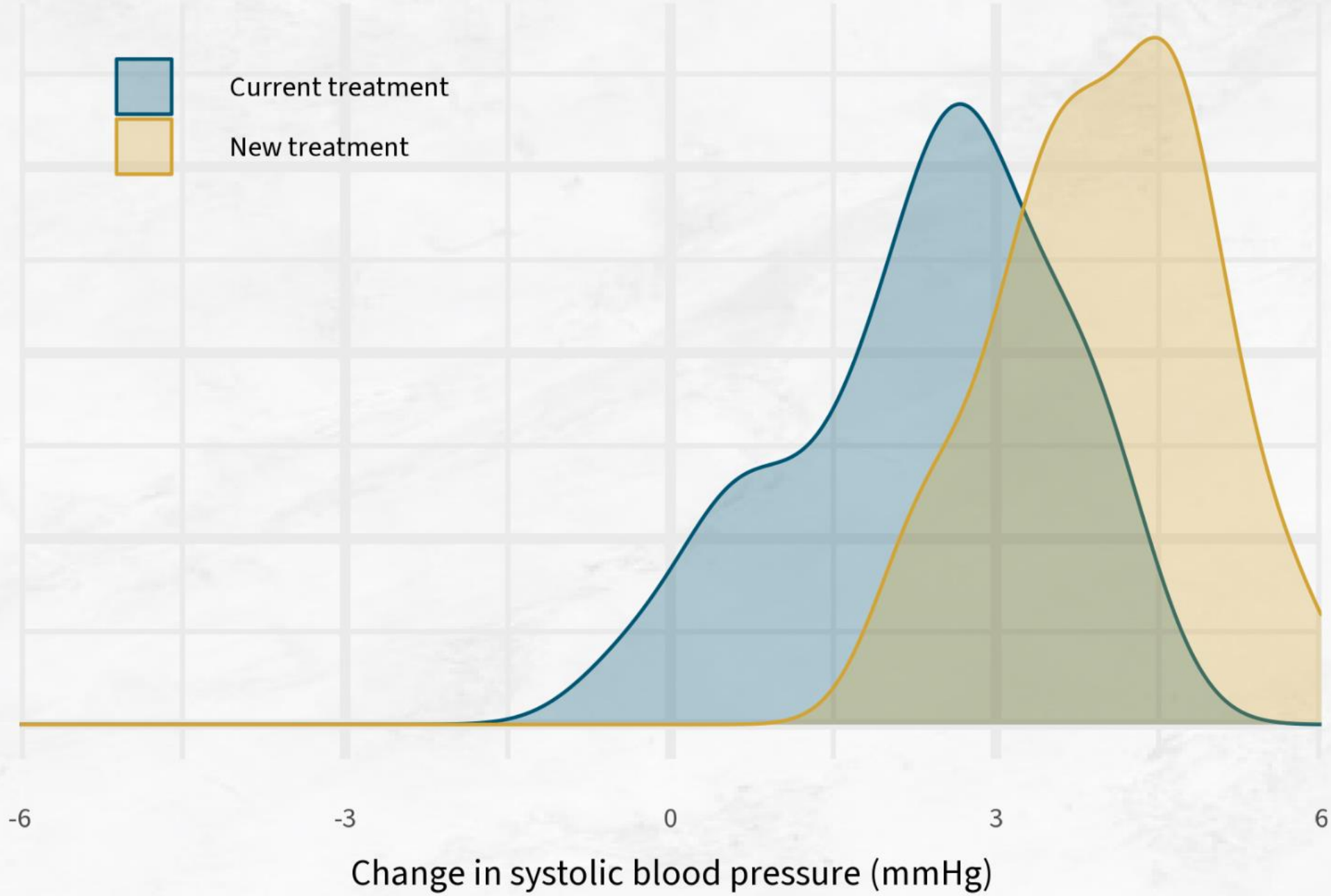
"Coin flip" 3

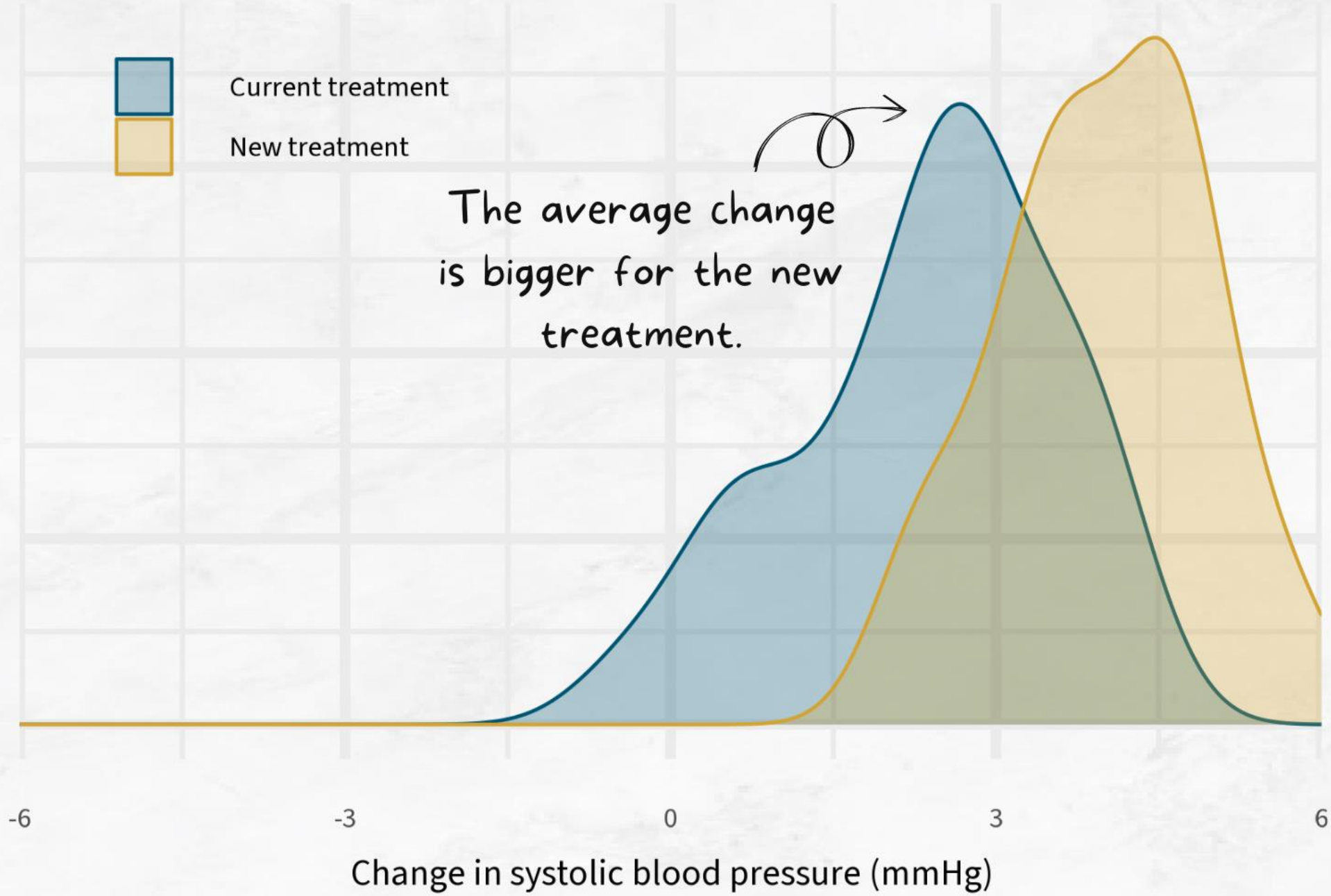
How do we compare two treatments?

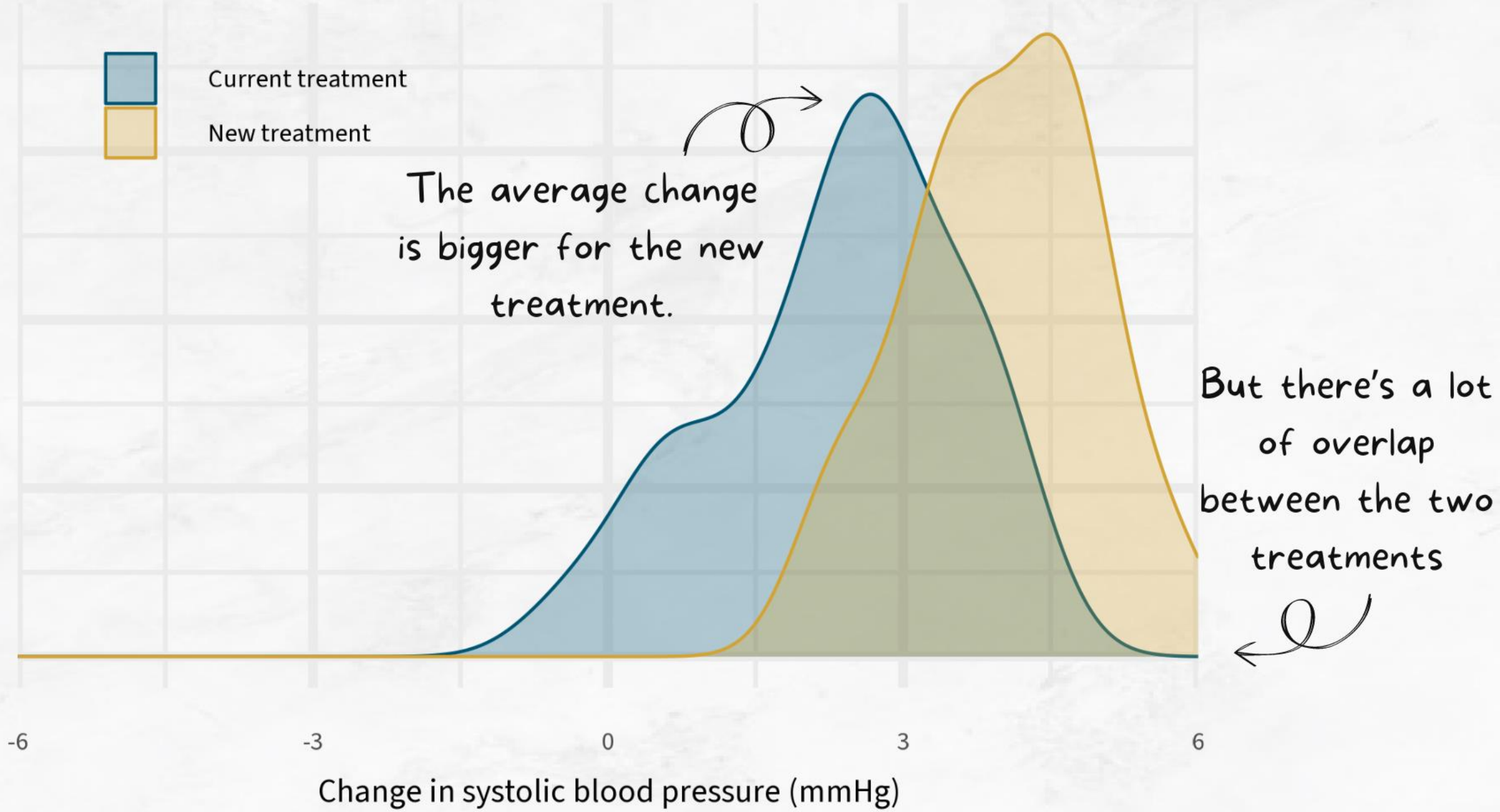

Current treatment
New treatment
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)


Current treatment
New treatment
The average change is bigger for the new treatment.
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)


Current treatment
New treatment
There's quite a big gap between the two treatments
The average change is bigger for the new treatment.
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)

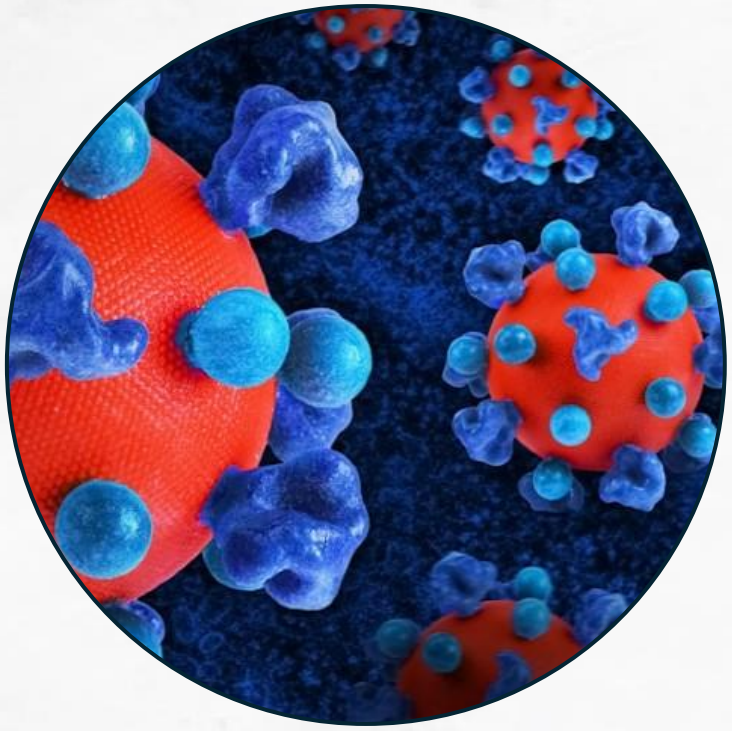

Current treatment
New treatment
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)


Current treatment
New treatment
The average change is bigger for the new treatment.
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)


Current treatment
New treatment
The average change is bigger for the new treatment.
But there's a lot of overlap between the two treatments
-6
-3
0
3
6
Change in systolic blood pressure (mmHg)

Summary

- A career in medicine, doesn't always mean being a doctor or nurse.
- Statistics and data careers mean you can work in lots of different fields.
- You can make a difference with data.



Questions?

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