DATA 8

Spring 2022

Lecture 2

Cause and Effect

Announcements

- Everyone has been assigned to a lab
  - Lab 1 is done! Lab 2 will be released on Monday
- HW 1 will be released today
  - Due next Thursday night, 01/27
  - Turn in by 11:59pm PT Wednesday for 5 **bonus points**!
- Office Hours start next week
  - 12 noon to 8 pm PT on Zoom
  - Instructor office hours will be announced next week

A Link

Regularly Eating Chocolate Is Linked to 8 Percent Lower Heart Attack Risk

By Lisa Rapaport

Reviewed: July 23, 2020

Report on a July 2020 article in the European Journal of Preventive Cardiology

https://journals.sagepub.com/doi/full/10.1177/2047487320936787

https://www.everydayhealth.com/diet-nutrition/eating-chocolate-regularly-linked-to-lower-heart-attack-risk/

Observation

- **individuals**, study subjects, participants, units
  - *336,289 US, Swedish, and Australian adults in several studies*
- **treatment**
  - *chocolate consumption*
- **outcome**
  - *heart disease*

The first question

Is there any relation between chocolate consumption and heart disease?

- **association**
  - any relation
  - link

Answer: Yes, because those who ate chocolate had less heart disease.

A Stronger Link?

Other headlines about the same article:

Chocolate is good for the heart

22 Jul 2020

European Society of Cardiology Press Release

Is eating chocolate heart-healthy? Study says 'yes'

August 26, 2020 No Comments

Family Safety and Health, National Safety Council

https://www.escardio.org/The-ESC/Press-Office/Press-releases/Chocolate-is-good-for-the-heart

https://www.safetyandhealthmagazine.com/articles/20257-is-eating-chocolate-heart-healthy-study-says-yes

The next question

Does chocolate consumption lead to a reduction in heart disease?

- **causality**

This question is often harder to answer.

"Dr. Alice Lichtenstein, an American Heart Association volunteer and professor of nutrition science and policy at Tufts University, was more skeptical of the findings."

Market Watch

https://www.marketwatch.com/story/eating-chocolate-once-a-week-can-lower-your-risk-of-heart-disease-study-2020-07-23

Association

London, early 1850's

A COURT FOR KING CHOLERA.

Illustration from *Punch* (1852)

Miasma

- **Bad smell** given off by waste and rotting matter
- **Believed to be the main source of disease**

- Believers included:
  - Florence Nightingale
  - Edwin Chadwick, Commissioner of the General Board of Health

Suggested Remedies

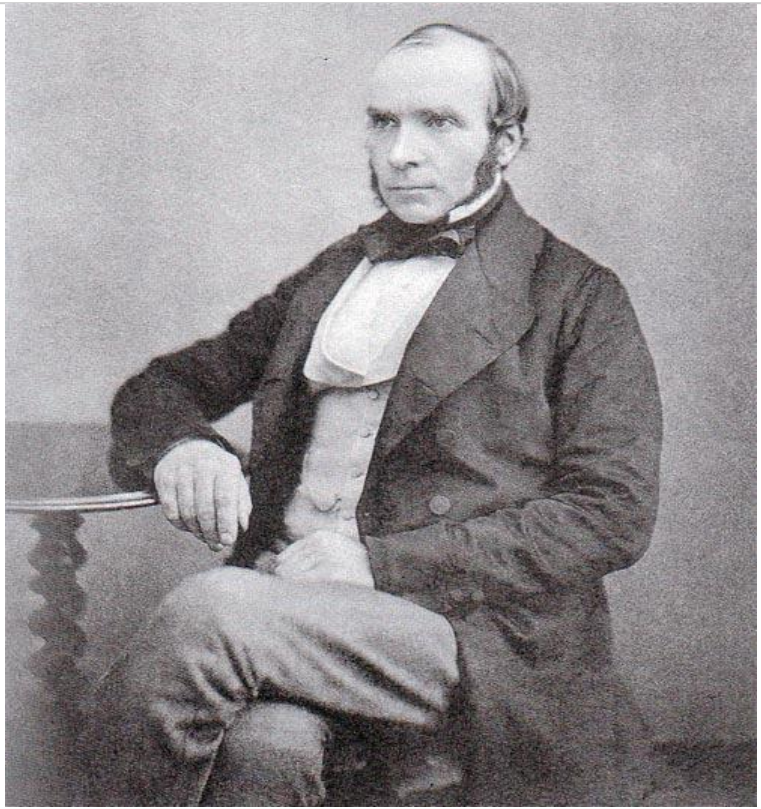
Cholera, around 1850

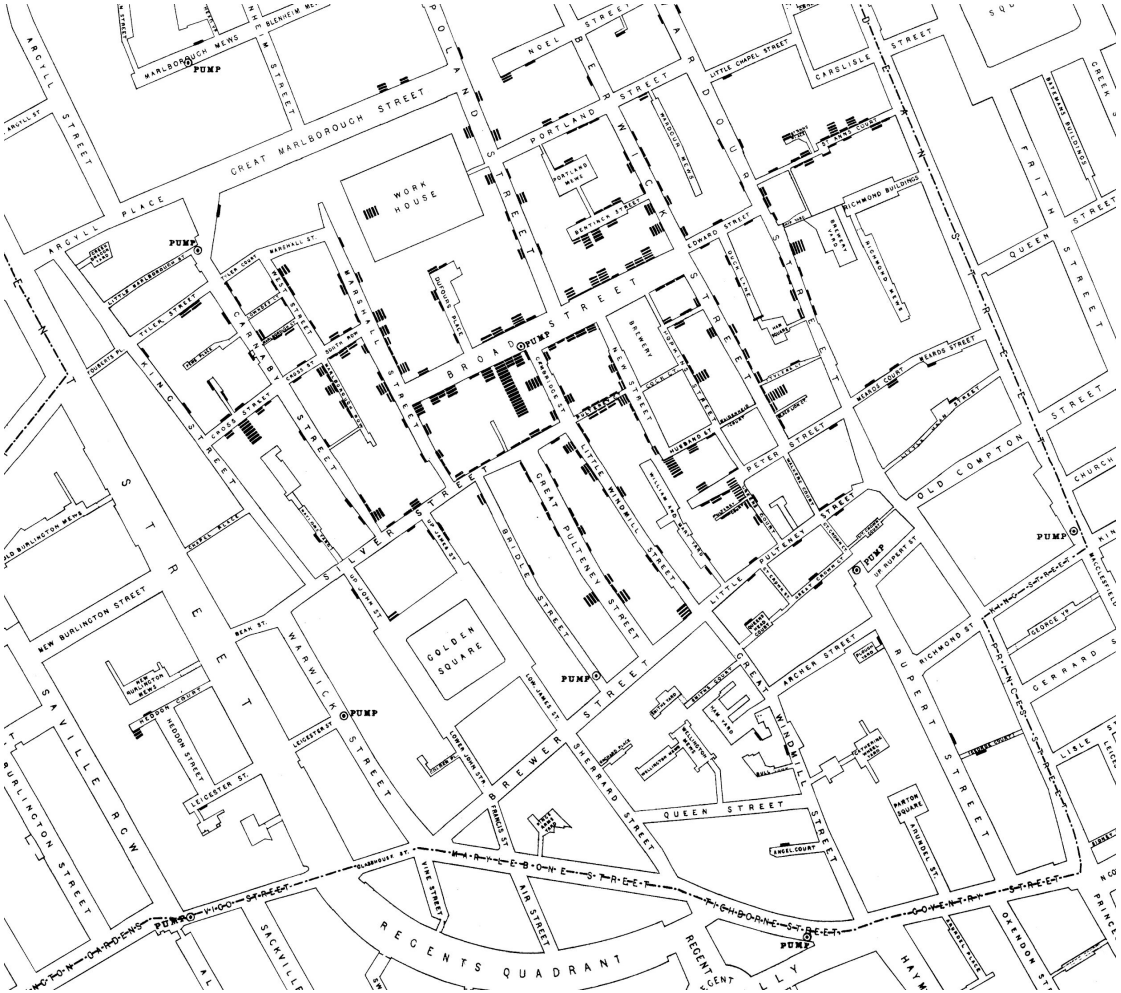
- “fly to clene air”
- “A pocket full o’posies”
- Fire off barrels of gunpowder
- Fetch clean air from the top of the Eiffel Tower in Paris

Covid19, 2020

- Inject disinfectant
- Sunlight
- Hydroxychloroquine
- Take 6 deep breaths, then cough while covering mouth
- Cannabis, cocaine, mangoes, onion, garlic, drinking water every 15 minutes, tea, eating ice cream, avoiding ice cream

John Snow, 1813-1858





GREAT MARLBOROUGH STREET
ARGYLL STREET
ARGYLL PLACE
MARLBOROUGH MENS
PUMP
WORK HOUSE
POLAND STREET
NOEL STREET
BERWICK STREET
PORTLAND STREET
PORTLAND MEWS
BENTINCK STREET
WARDOUR MEWS
LITTLE CHAPEL STREET
CARLISLE STREET
ST. ANNS COURT
RICHMOND BUILDINGS
RICHMOND MEWS
EDWARD STREET
BREWERY YARD
FRITH STREET
QUEEN STREET
BATEMANS BUILDINGS
BROAD STREET
MARSHALL STREET
MARSHALL ST.
TYLER STREET
TYLER COURT
CARNABY STREET
KING STREET
CROSS STREET
SOUTH ROW
CARNABY ST.
QUEBEC PLACE
BREWERY
NEW STREET
TOPPER STREET
HUSBAND ST.
PETER STREET
MEARDS COURT
MEARDS STREET
OLD COMPTON STREET
CHURCH
LITTLE WINDMILL STREET
WILLIAM AND MARY YARD
GREAT PULTENEY STREET
BRIDLE STREET
LITTLE PULTENEY STREET
UP RUPERT ST.
SILVER STREET
UP JAMES ST.
UP JOHN ST.
GOLDEN SQUARE
LOW JAMES ST.
LOWER JOHN STR.
FRANCIS ST.
BREWER STREET
SHERRARD STREET
ARCHER STREET
GREAT WINDMILL STREET
RUPERT STREET
RICHMOND ST.
GEORGE YR.
GERRARD
PRINCES STREET
LISLE
NEW BURLINGTON STREET
NEW BURLINGTON MEWS
HEDDON COURT
HEDDON STREET
LEICESTER ST.
LEICESTER ST.
WARWICK STREET
SAVILLE ROW
BURLINGTON STREET
QUEEN STREET
PARTON SQUARE
ARUNDEL ST.
SHEEL COURT
MARYLEBONE STREET
TICHBORNE STREET
COVENTRY STREET
VIGO STREET
VINE STREET
AIR STREET
REGENTS QUADRANT
SACKVILLE
OXENDON ST.

MARLBOROUGH MEWS
PUMP
GREAT MARLBOROUGH STREET
WORK HOUSE
PORTLAND STREET
PORTLAND MEWS
BENTINCK STREET
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LITTLE CHAPEL STREET
NOEL STREET
BERWICK STREET
EDWARD STREET
DUCK LANE
BREWERY YARD
MARSHALL ST.
TYLER COURT
WEST STREET
MARSHALL STREET
DUFOURS PLACE
BROAD STREET
PUMP
CAMBRIDGE ST
NEW STREET
BREWERY
HOPKINS STREET
COCK CT
HUSBAND ST
PETER STREET
WALKERS COURT
LITTLE PULTENEY STREET
GREAT CROWN CT
QUEENS HEAD COURT
WILLIAM AND MARY YARD
LITTLE WINDMILL STREET
GREAT PULTENEY STREET
BRIDLE STREET
SILVER STREET
UP JAMES ST
UP JOHN ST
CHAPEL PLACE
BEAK ST.
CROSS STREET
CROSS ST
SOUTH ROW
MARLBOROUGH ROW
CARNABY STREET
TYLER STREET
KING STREET
MARLBOROUGH ST
PEMS PLACE
LOWNDES CT
MARLBOROUGH CT

John Snow

John Snow

4.2 ★★★★☆ 1,191 reviews · $

Pub

Directions | Save | Nearby | Send to your phone | Share

Dark-wood saloon bar serving Yorkshire ales, named after doctor who traced London cholera outbreak.

✓ Dine-in · ✗ Takeout

39 Broadwick St, Carnaby, London W1F 9QJ, United Kingdom

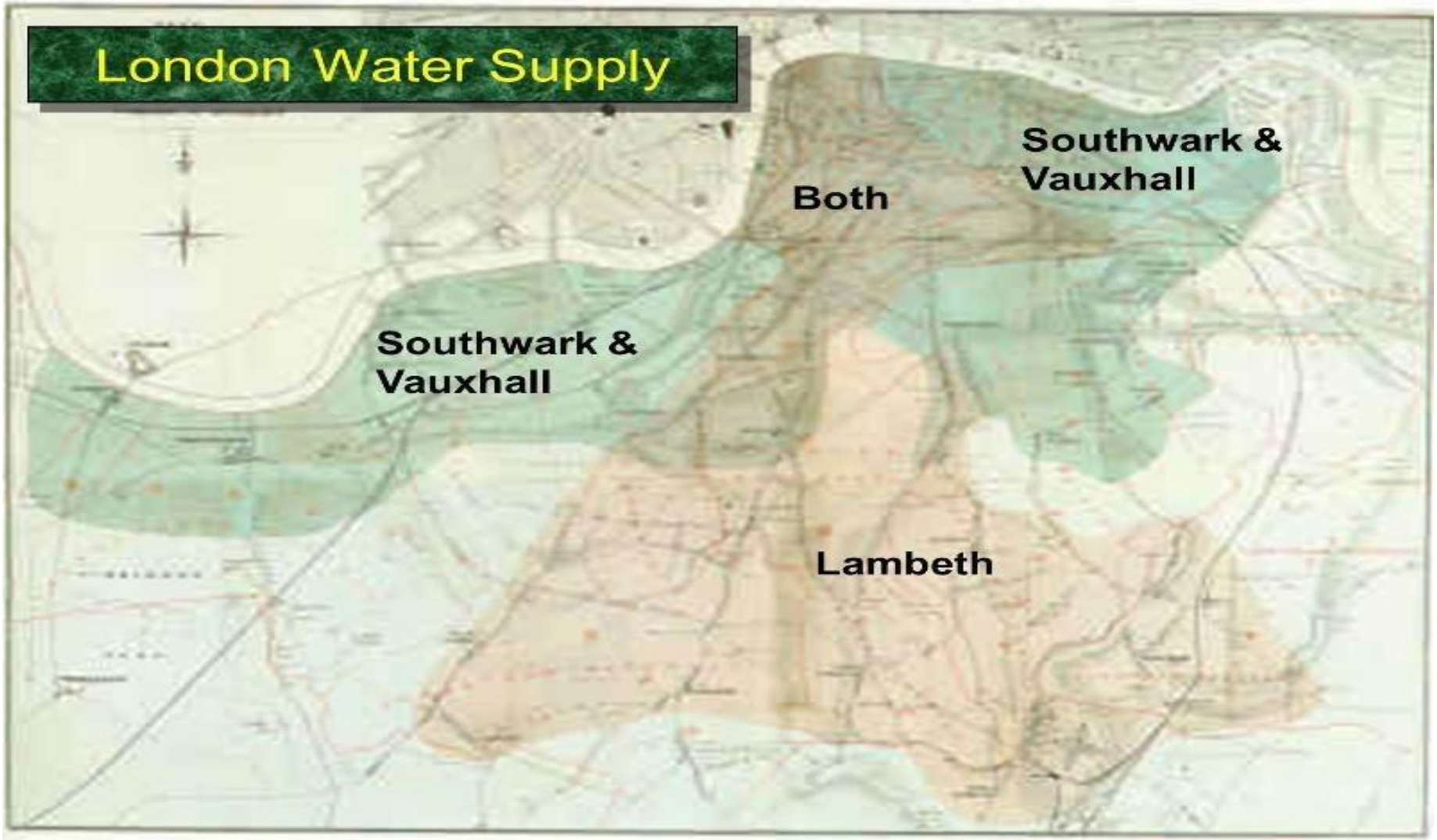
Closed. Opens at 12:00 PM

Health & safety: Mask required · Staff required to disinfect surfaces between visits

m.facebook.com

JOHN SNOW
JOHN SNOW

Causation


London Water Supply
Southwark &
Vauxhall
Both
Southwark &
Vauxhall
Lambeth

Comparison

- **treatment group**
- **control group**
  - does not receive the treatment

Snow's "Grand Experiment"

"… there is no difference whatever in the houses or the people receiving the supply of the two Water Companies, or in any of the physical conditions with which they are surrounded …"

- The two groups were *similar except for the treatment*.

Snow's table

Supply Area	Number of houses	Cholera deaths	Deaths per 10,000 houses
S&V	40,046	1,263	315
Lambeth	26,107	98	37
Rest of London	256,423	1,422	59

Key to establishing causality

If the treatment and control groups are *similar apart from the treatment,* then differences between the outcomes in the two groups can be ascribed to the treatment.

Confounding

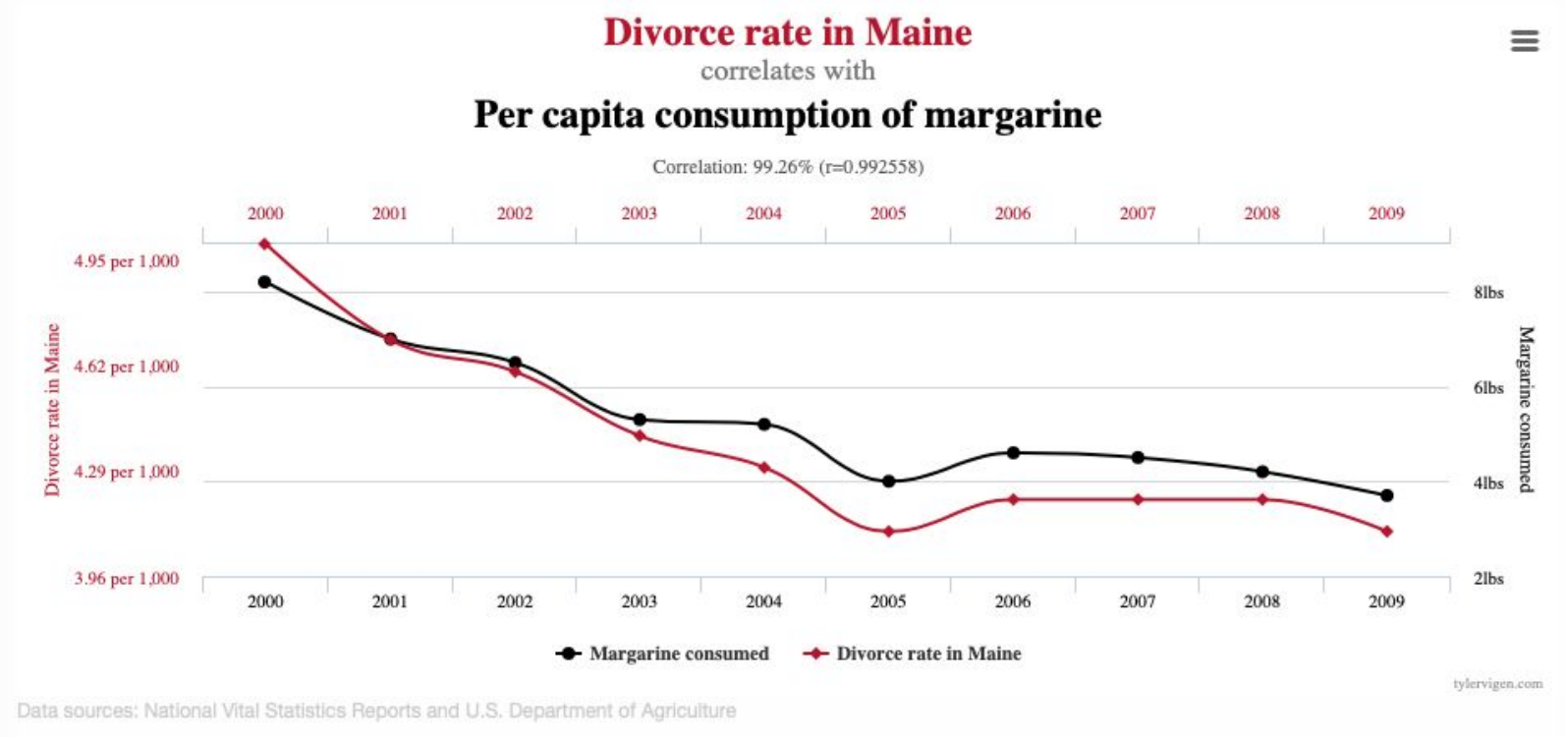
Trouble

If the treatment and control groups have systematic differences other than the treatment, then it might be difficult to identify causality.

Such differences are often present in **observational studies.**

When they lead researchers astray, they are called confounding factors.

Example of Confounding



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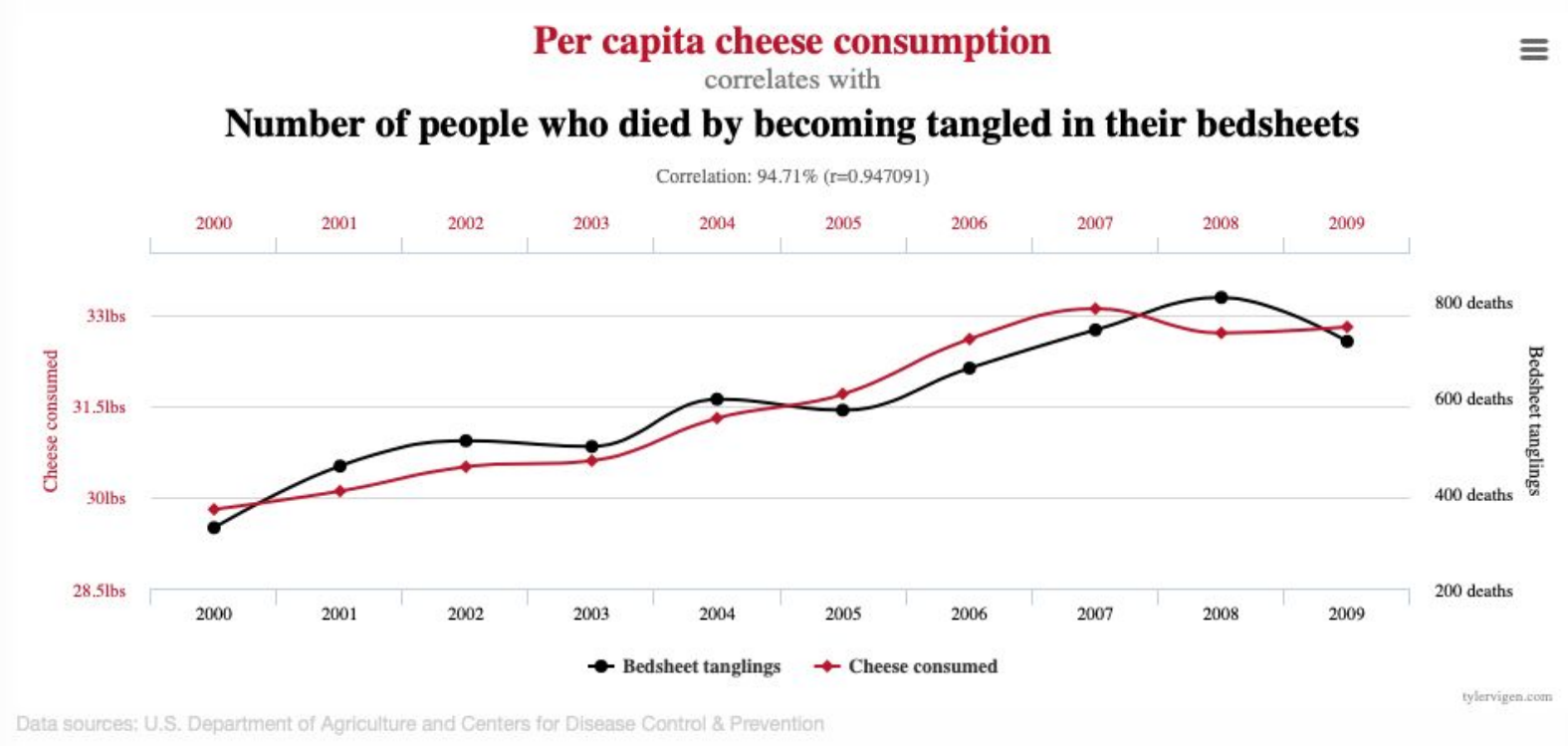
Source: Correlations

One More



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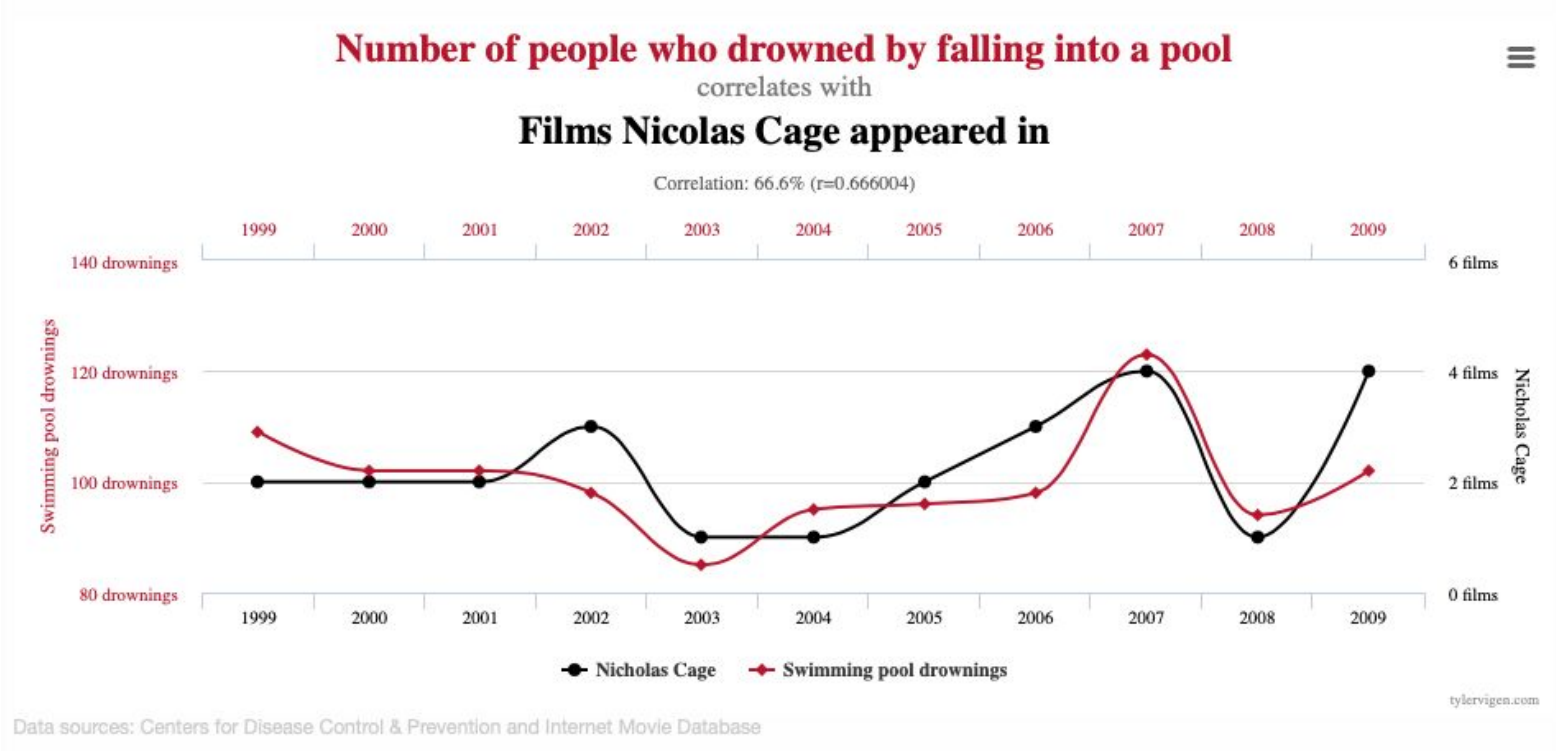
Spurious Correlations

Another One



Data 8, UC Berkeley

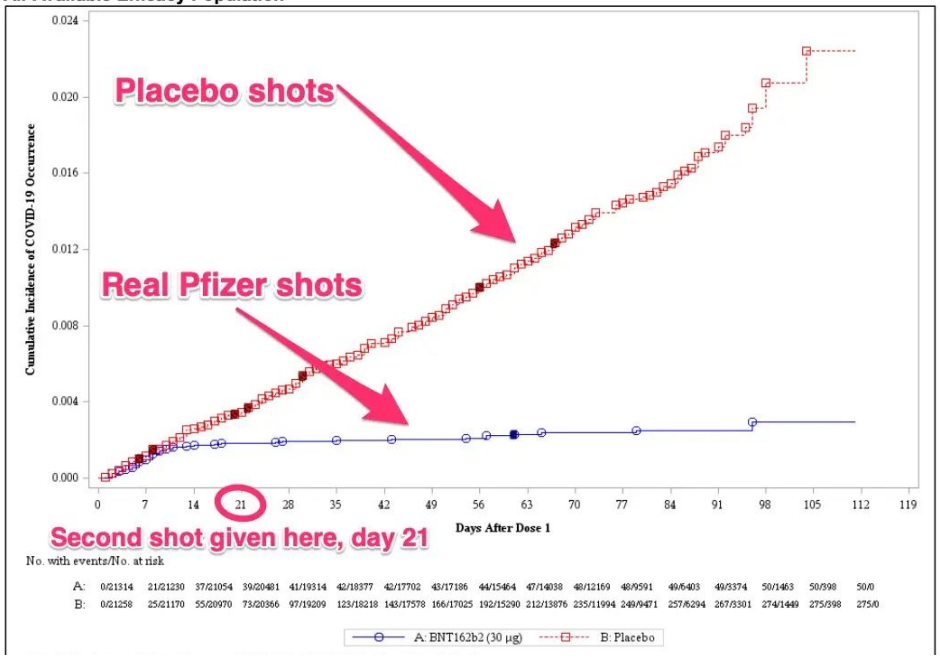
Spurious Correlations

Randomize!

- If you assign individuals to treatment and control **at random,** then the two groups are likely to be similar apart from the treatment.
- You can account – mathematically – for variability in the assignment.
- **Randomized Controlled Experiment**

Recent Example

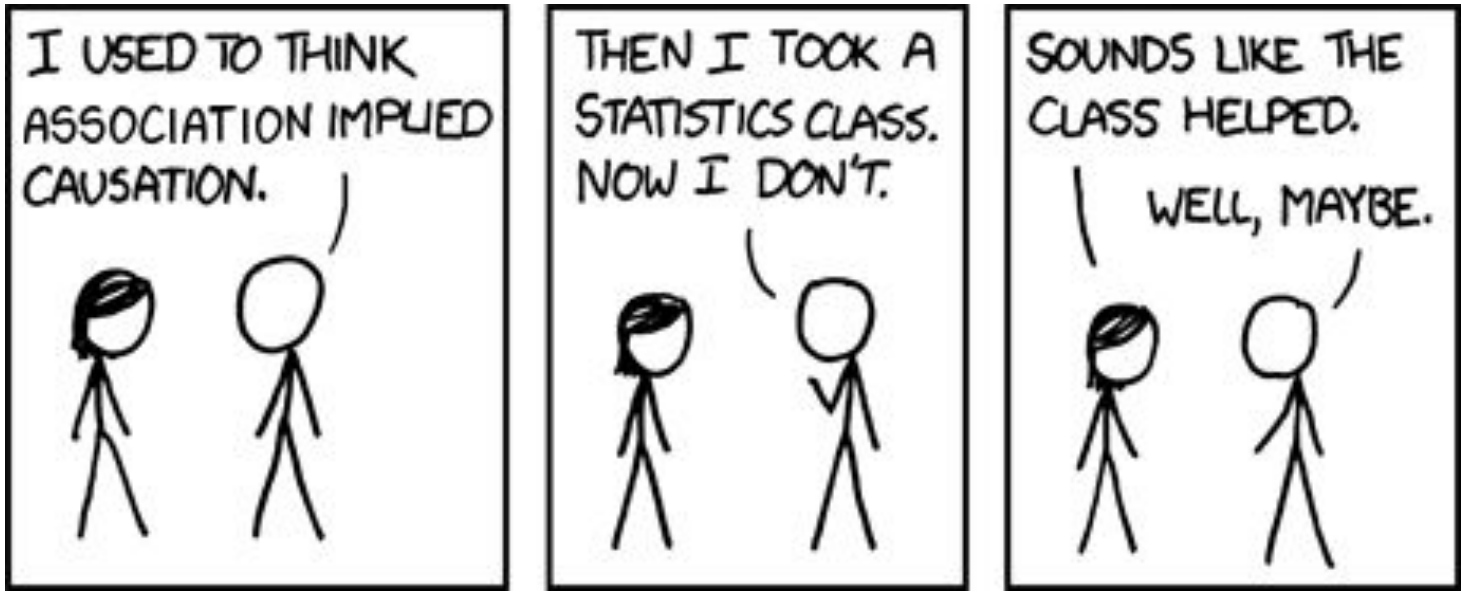
Figure 2. Cumulative Incidence Curves for the First COVID-19 Occurrence After Dose 1, Dose 1 All-Available Efficacy Population



Careful ...

Regardless of what the dictionary says,
in probability theory

Random ≠ Haphazard


I USED TO THINK ASSOCIATION IMPLIED CAUSATION.
THEN I TOOK A STATISTICS CLASS. NOW I DON'T.
SOUNDS LIKE THE CLASS HELPED.
WELL, MAYBE.

xkcd