DSC 10

Spring 2020

Lecture 3

Cause & Effect

Zoom Changes

Based on helpful feedback:

- Ignore chat if you want!
  - Everything important will be covered in lecture
  - But feel free to use chat still
- Use “raise hand” function
- Code is posted so you can follow along and experiment in real-time
- More stops for Q’s
- Zoom Bombing - might have to lock down some

https://www.dsc10.com/schedule

A Link

Coffee

Three coffees a day linked to a range of health benefits

Research based on 200 previous studies worldwide says frequent drinkers less likely to get diabetes, heart disease, dementia and some cancers

34 6

Staff and agencies

Wednesday 22 November 2017 19.54 EST

The findings supported other studies showing the health benefits of drinking coffee. Photograph: Wu Hong/EPA

Guardian UK

A Stronger Link?

eating and health

Chocolate, Chocolate, It's Good For Your Heart, Study Finds

JUNE 19, 2015 5:03 AM ET

ALLISON AUBREY

[npr.org](npr.org) (report on a study in heart.bmj.com)

Observation

- **individuals**, study subjects, participants, units
  - *European adults*
- **treatment**
  - *chocolate consumption*
- **outcome**
  - *heart disease*

The first question

Is there any relation between chocolate consumption and heart disease?

- **association**
  - any relation
  - link

An answer

Some data:

"Among those in the top tier of chocolate consumption, 12 percent developed or died of cardiovascular disease during the study, compared to 17.4 percent of those who didn't eat chocolate."

- *Howard LeWine of Harvard Health Blog, reported by npr.org*

- Yes, this points to an association (in my opinion)

The next question

Does chocolate consumption lead to a reduction in heart disease?

- **causality**

This question is often harder to answer.

“[The study] doesn’t prove a cause-and-effect relationship between chocolate and reduced risk of heart disease and stroke.”

- *JoAnn Manson, chief of Preventive Medicine at Brigham and Women’s Hospital, Boston*

Association

London, early 1850's

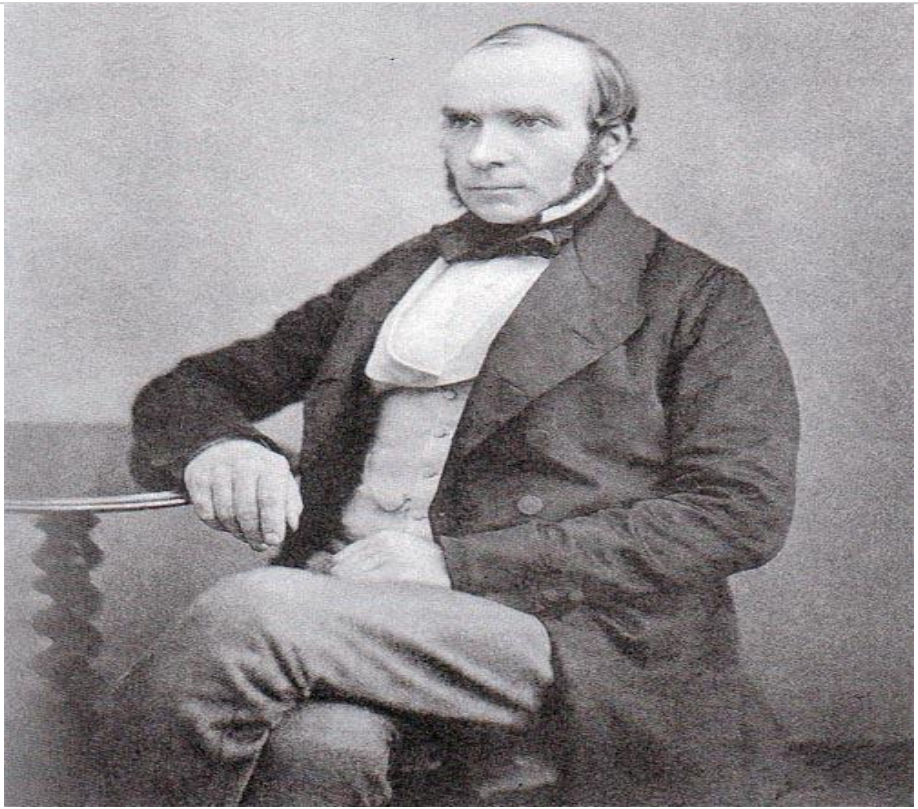
A COURT FOR KING CHOLERA.

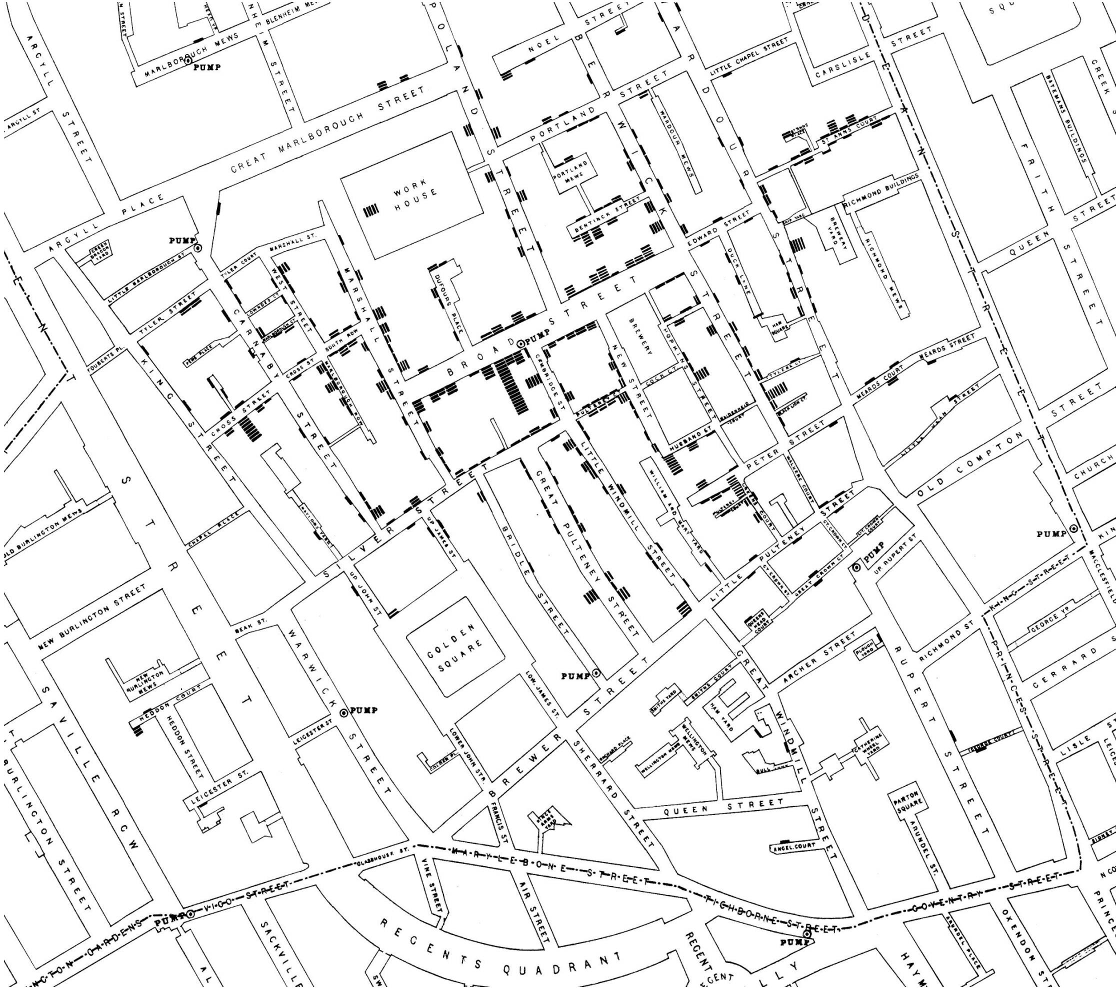
Illustration from *Punch* (1852).

Miasmas, miasmatism, miasmatists

- **Bad smells** given off by waste and rotting matter
- **Believed to be the main source of disease**
- Suggested remedies:
  - “fly to clene air”
  - “a pocket full o’posies”
  - “fire off barrels of gunpowder”
- Staunch believers:
- Florence Nightingale
  Edwin Chadwick, Commissioner of the General Board of Health

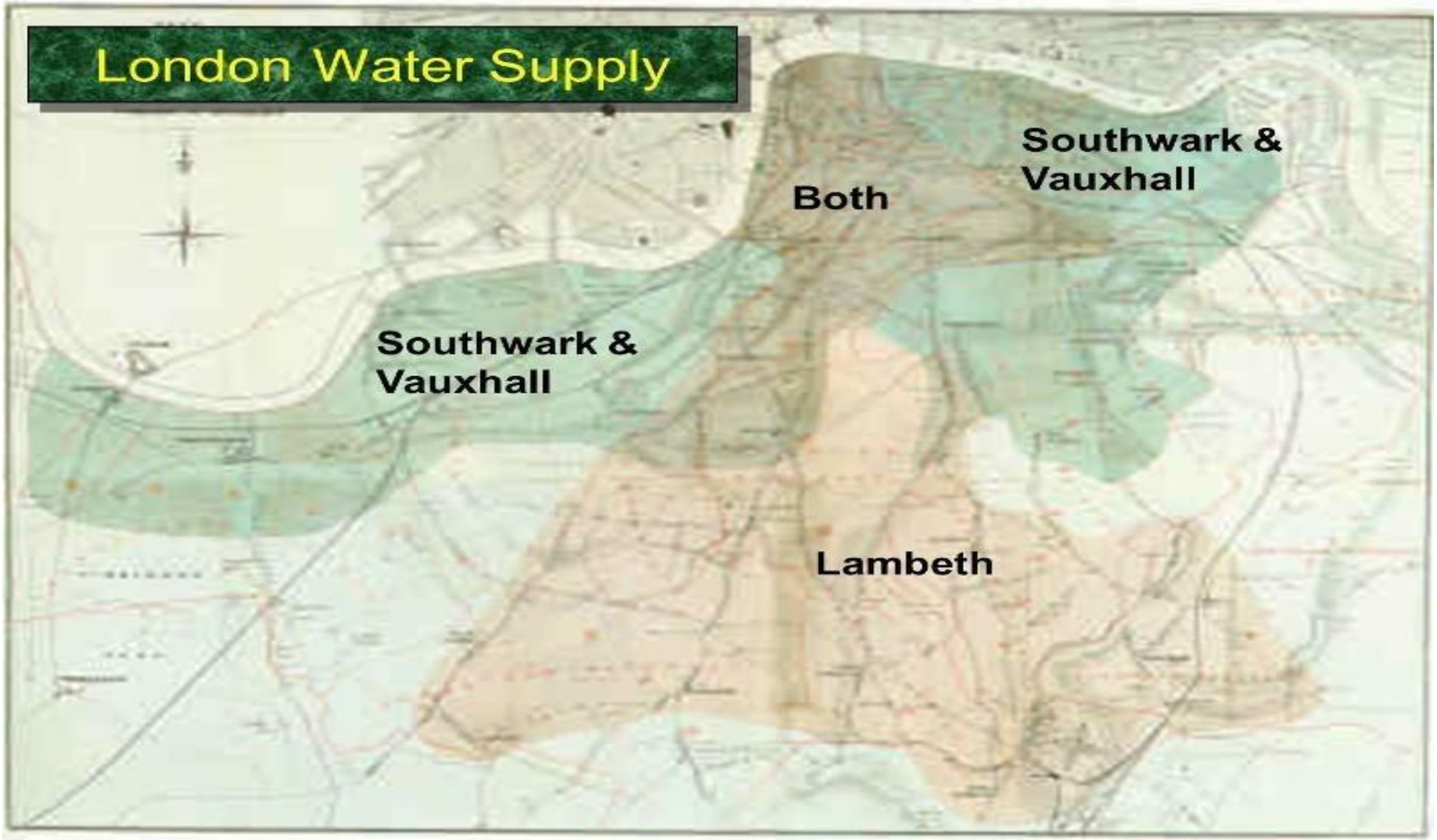
John Snow, 1813-1858





MARLBOROUGH MEWS
PUMP
BLENHEIM MEWS
ARGYLL STREET
ARGYLL ST
GREAT MARLBOROUGH STREET
POLAND STREET
NOEL STREET
BERWICK STREET
WARDOUR STREET
LITTLE CHAPEL STREET
CARLISLE STREET
DEAN STREET
SQ
BATEMANS BUILDINGS
CREEK
FRITH STREET
PORTLAND STREET
PORTLAND MEWS
WARDOUR MEWS
ST ANNS COURT
RICHMOND BUILDINGS
RICHMOND MEWS
WORK HOUSE
ARGYLL PLACE
BENTINCK STREET
EDWARD STREET
DUCK LANE
QUEEN STREET
GREEN DRAGON YARD
LITTLE MARLBOROUGH ST
TYLER COURT
MARSHALL ST
MARSHALL STREET
WEST STREET
DUFOURS PLACE
HOPKINS STREET
BREWERY
NEW STREET
CARNABY STREET
TYLER STREET
SOUTH ROW
BROAD STREET
CAMBRIDGE ST
KING STREET
CROSS STREET
CROSS ST
FOUBERTS PL.
MEARDS COURT
MEARDS STREET
HUSBAND ST
PETER STREET
LITTLE WINDMILL STREET
WILLIAM AND MARY YARD
OLD COMPTON STREET
CHURCH
REGENT STREET
SILVER STREET
GREAT PULTENEY STREET
LITTLE PULTENEY STREET
GREAT CROWN CT
UP RUPERT ST
BRIDLE STREET
CHAPEL PLACE
OLD BURLINGTON MEWS
NEW BURLINGTON STREET
UP. JAMES ST
UP. JOHN ST
GOLDEN SQUARE
KING STREET
MACCLESFIELD
GEORGE YD
GERRARD STREET
BEAK ST.
WARWICK STREET
LOW. JAMES ST
BREWER STREET
GREAT WINDMILL STREET
ARCHER STREET
RICHMOND ST
RUPERT STREET
PRINCES STREET
NEW BURLINGTON MEWS
HEDDON COURT
HEDDON STREET
LEICESTER ST
SAVILLE ROW
BURLINGTON STREET
LOWER JOHN STR.
SHERRARD STREET
WELLINGTON MEWS
HAM YARD
CATHERINE WHEEL YARD
LISLE
PARTON SQUARE
ARUNDEL ST.
QUEEN STREET
ANGEL COURT
FRANCIS ST
GLASSHOUSE ST.
MARYLEBONE STREET
VINE STREET
AIR STREET
TICHBORNE STREET
COVENTRY STREET
VIGO STREET
BURLINGTON GARDENS
SACKVILLE
RECENTS QUADRANT
REGENT
PICCADILLY
HAYMARKET
OXENDON ST
ARUNDEL PLACE

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

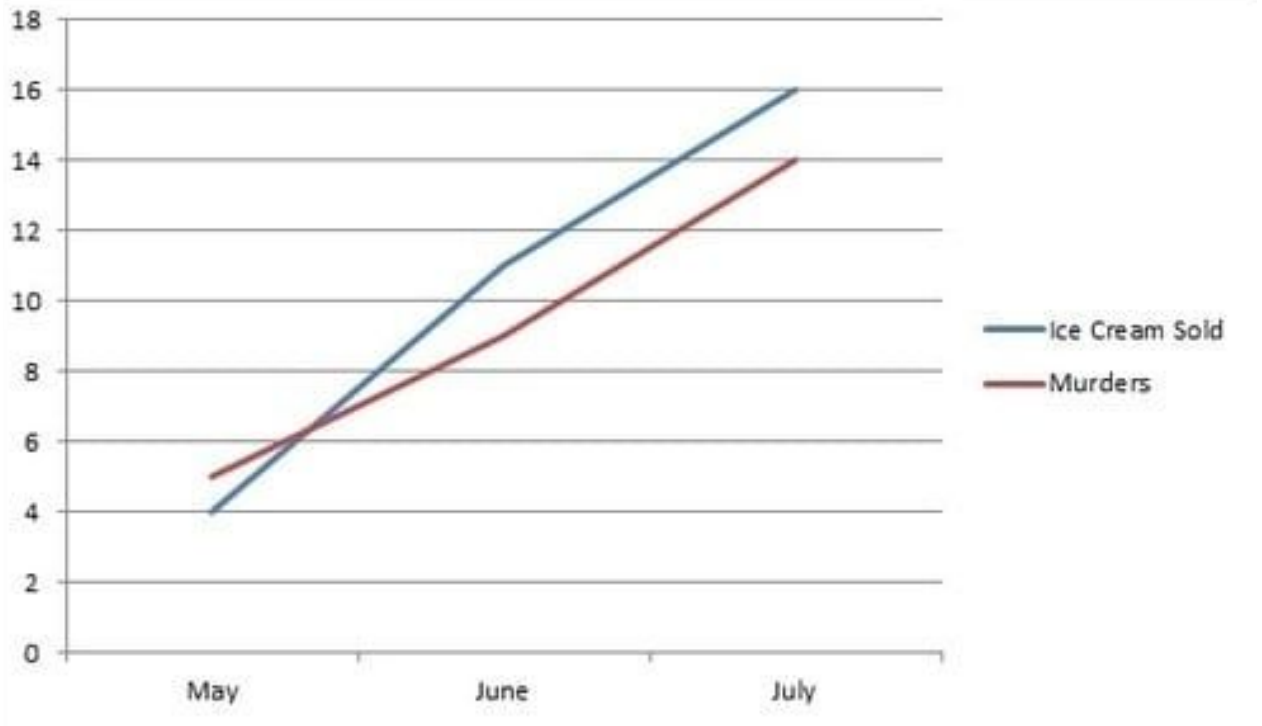
Trouble

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



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**

Careful ...

Regardless of what the dictionary says,
in probability theory

Random ≠ Haphazard