



Lecture 2

Cause and Effect

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Connector Course Spotlight

Announcements

Questions

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 (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](https://www.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.

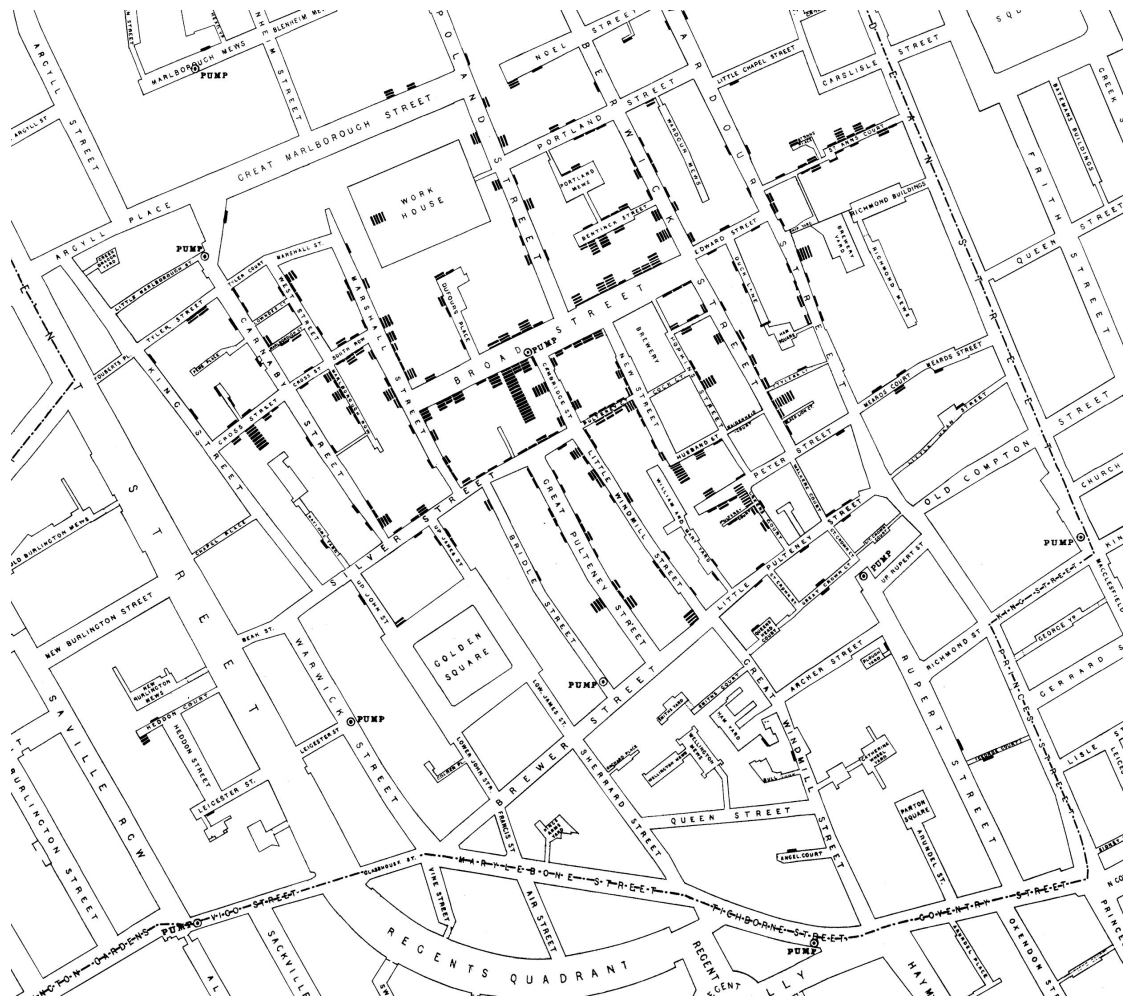
Illustration from *Punch*
(1852).

Miasmas, miasmaticism, miasmaticists


- **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





☰ John Snow 🔍 ✕



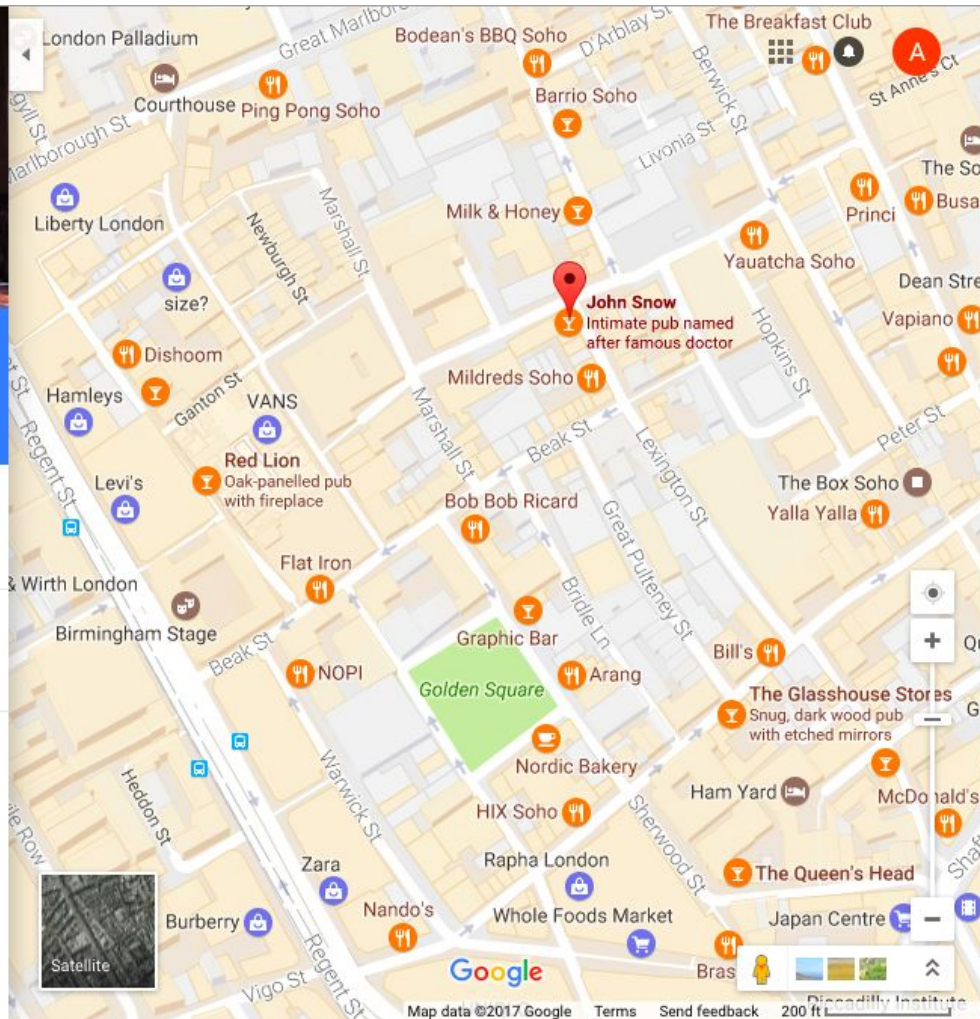
John Snow
3.7 ★★★★★ 193 reviews
Pub

📍 Directions

★ SAVE 📍 NEARBY 📱 SEND TO YOUR PHONE ➦ SHARE

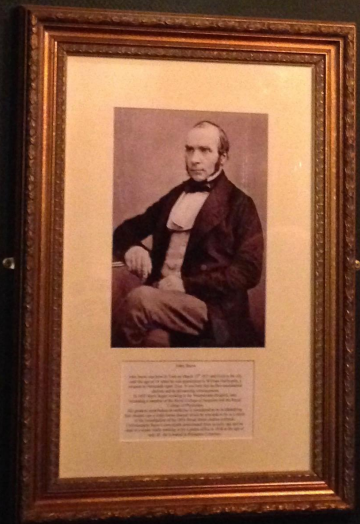
Dark-wood saloon bar serving Yorkshire ales, named after doctor who traced London cholera outbreak. - Google

- 📍 39 Broadwick St, Carnaby, London W1F 9QJ, UK
- 📞 +44 20 7437 1344
- 🕒 **Closed.** Opens at 12:00 PM ▾
- 👤 Claim this business
- ✎ Suggest an edit
- 🚩 Add a label



Map data ©2017 Google Terms Send feedback 200 ft





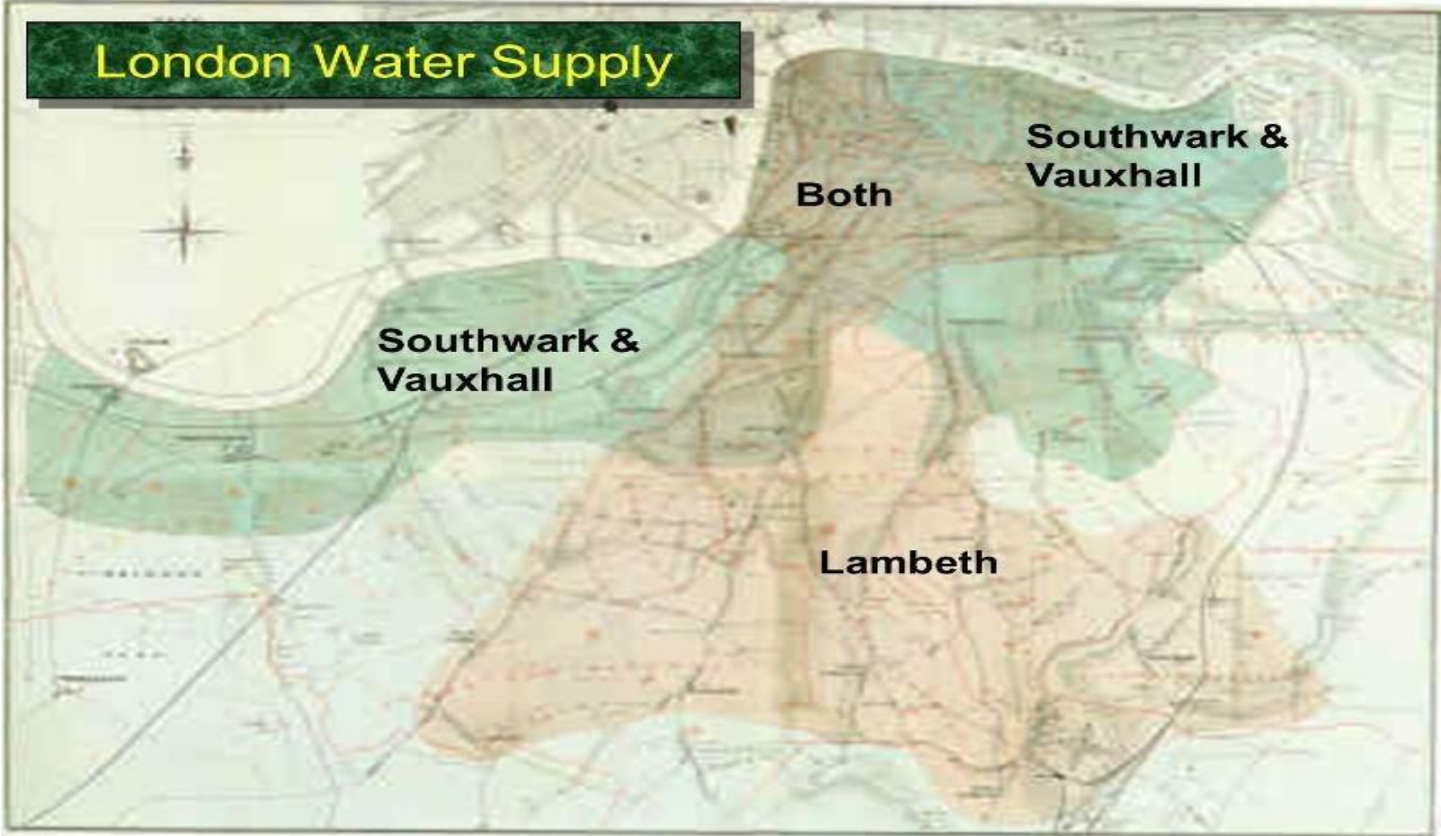


Mr. Nicholas Cleary kindly moved aside so I could photograph the wall behind him, and then returned to strike a familiar pose.

– London, 2017

Causation

London Water Supply



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**.

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 \neq Haphazard
