Cholera: John Snow and London's sewage

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A depiction of cholera

Figure: Venetian woman, aged 23, depicted before and after contracting cholera

What is cholera?

- From the CDC: "Cholera is an acute, diarrheal illness caused by infection of the intestine with the toxigenic bacterium *Vibrio cholerae*."
- The cholera bacterium is usually found in water or food contaminated by fecal matter from someone with cholera.
- It is most likely to occur and spread in places with poor sanitation and inadequate water treatment (e.g. London in the mid-1800s).
  - Hence, we now know it to be a waterborne disease.
  - But before...

Old theories about the disease

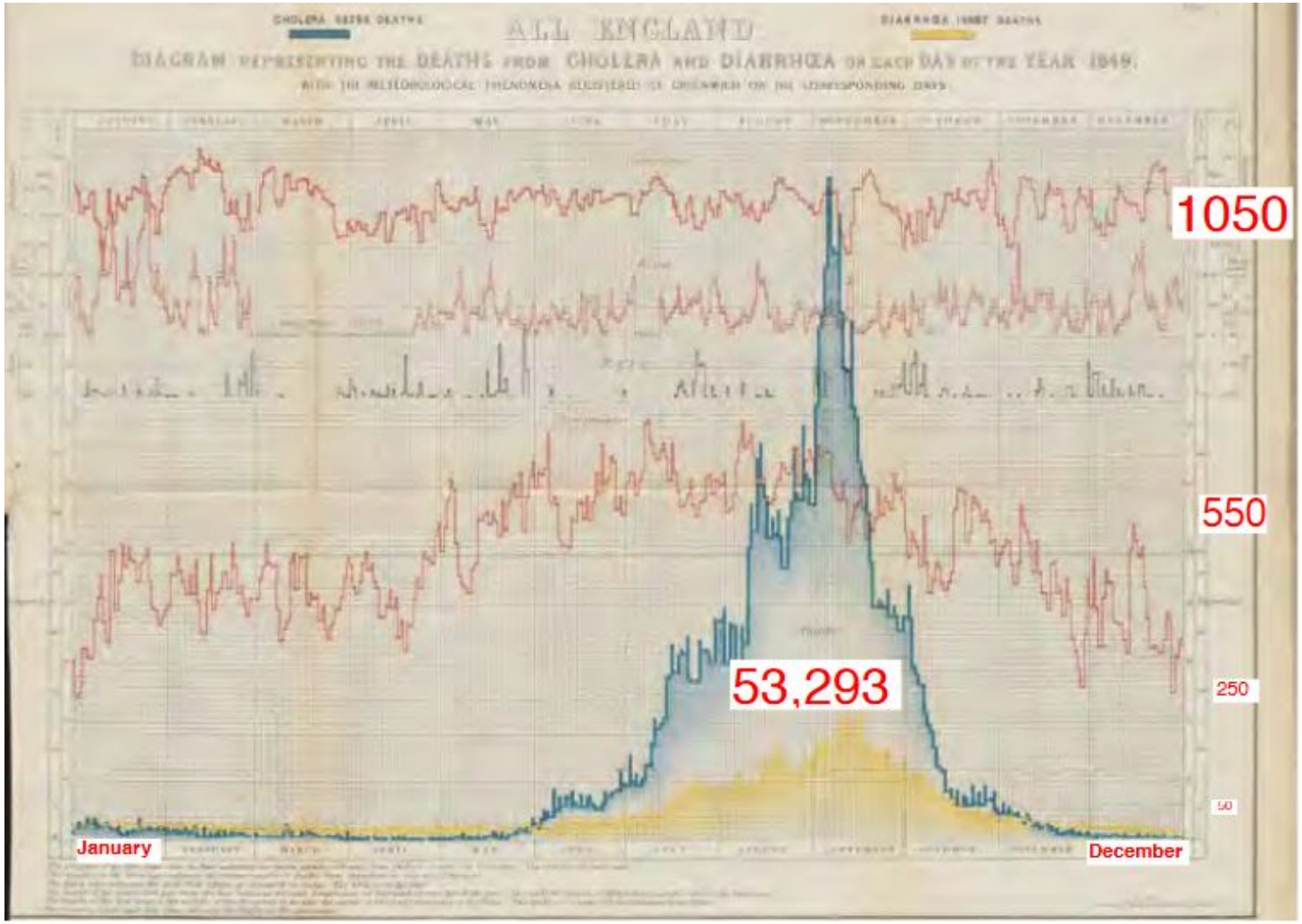
Figure: Robert Seymour. 1831. U.S. National Library of Medicine

- Direct person-to-person contact
- Miasma theory:
  - *Miasma* is "bad air"; popular theory for many diseases
  - Described as vaporous exhalation, unpleasant or unhealthy smell or vapour
  - "All smell is, if it be intense, immediate, acute disease." Edwin Chadwick (1800-1890)
  - The heavily hit areas also smelled terribly – concurrently, there was no good sanitation system for the sewage ⇒ confounding?

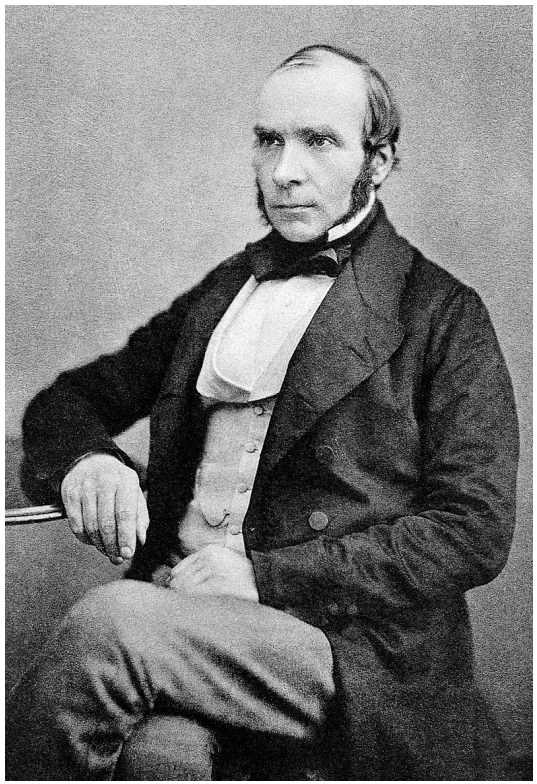
Miasma - the evil air

Figure: 1881 cover from Harper's Weekly depicting bad smells as death itself, as the New York City street commissioner, Thomas Coleman, tries to clean up

Daily number of deaths from cholera in England in 1849



John Snow



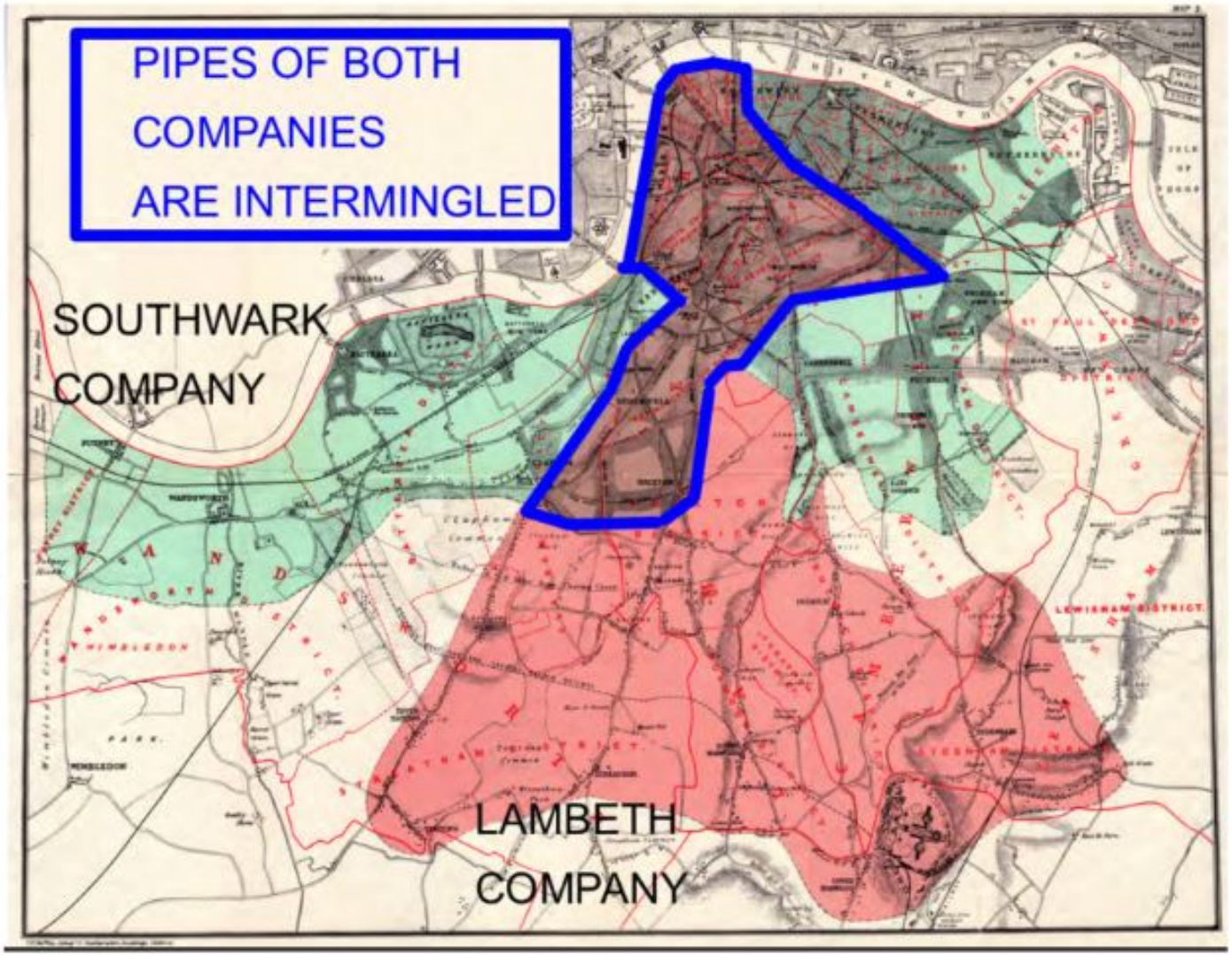
- During the cholera epidemic of 1848-1849, Snow proposed the idea that disease came from oral ingestion rather than air
- In 1849, he released a pamphlet about cholera being "faecal-oral; waterborne"
- 'When no other water can be obtained, so much of it as is used for drinking and culinary purposes should be filtered and well-boiled'

The second cholera outbreak in 1854

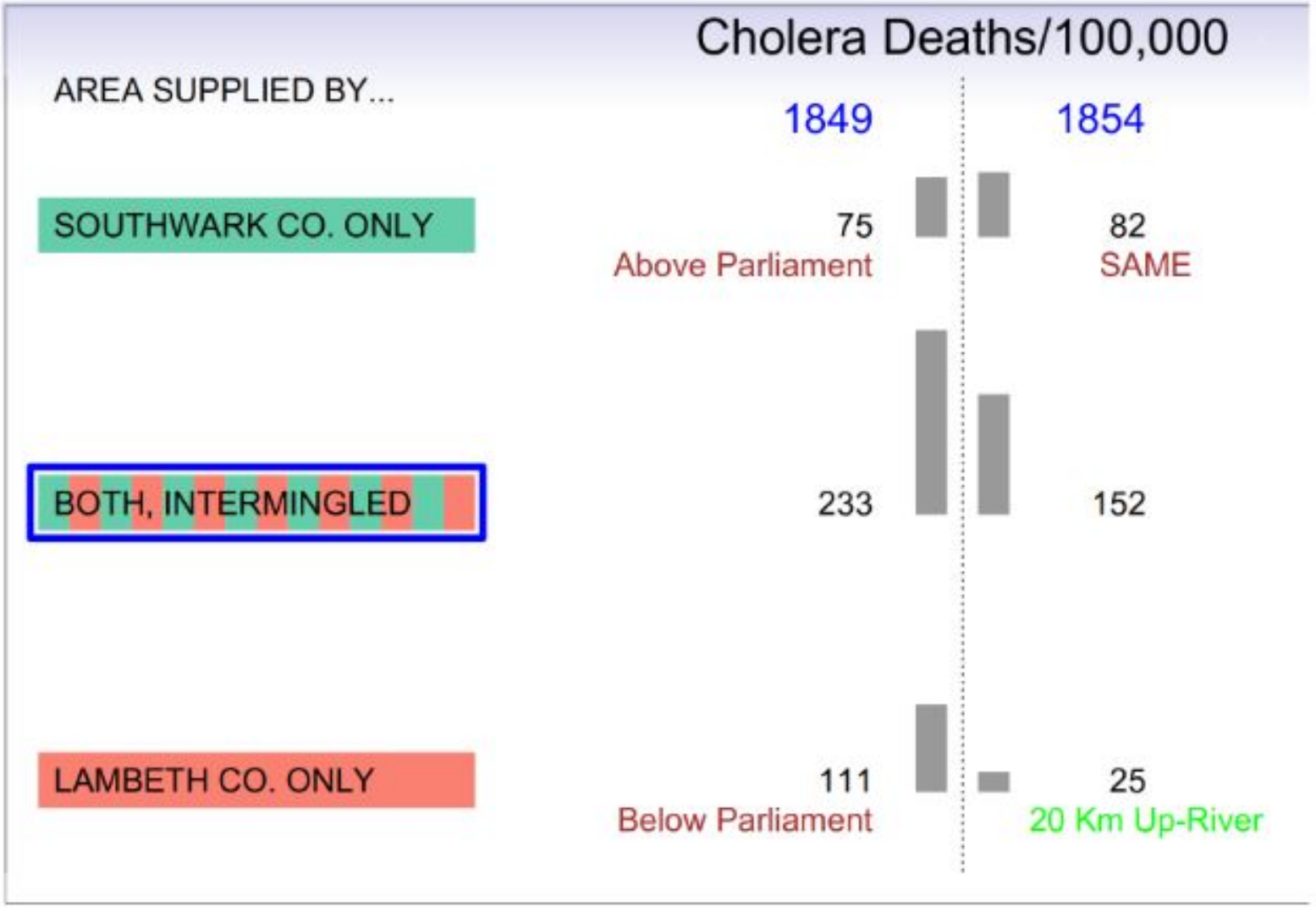
- During the second outbreak of 1853-1854, Snow gathered data to support this, i.e. that cholera was primarily spread by sewage-contaminated water

First BBC video.

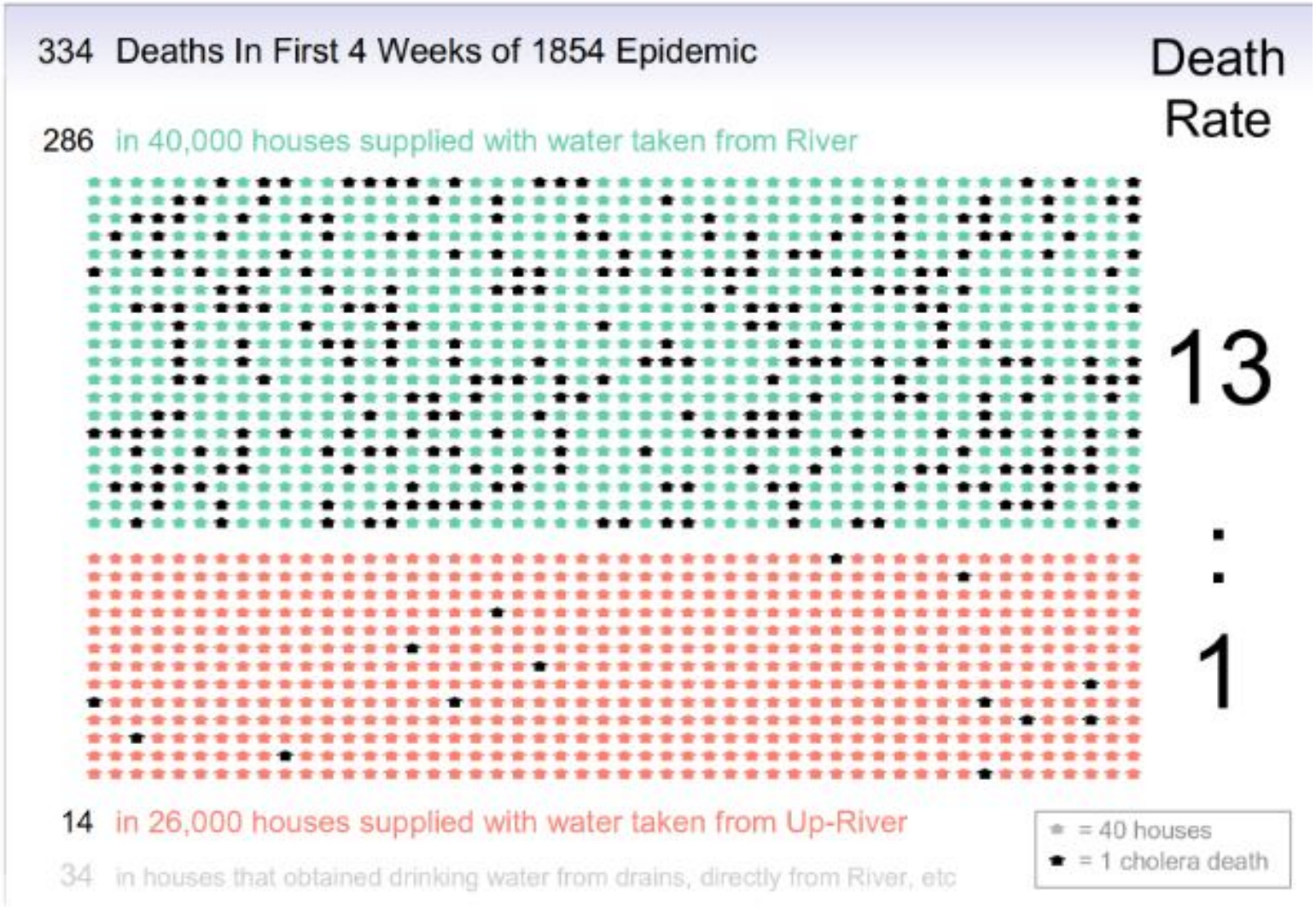
Water company map



Deaths in the second cholera epidemic (1854)



Deaths in the first 4 weeks



The Broad Street pump

Some context for the conditions: HarvardX's John Snow and the 1854 Broad Street cholera outbreak

The Broad Street pump

- A very famous example in epidemiology as a case of scientific reasoning.
- While Snow himself did not necessarily know it was contaminated, local curate was able to identify 'index case'
  - Engineer excavated and found cesspool (where diaper water was dumped into) blocked
  - Brickwork was defective and leaking contents into defective drain that leaked material into well to feed pump.
- Turning off this pump temporarily helped reduce cases.

Return of cholera?

- With the new sewage system in place, cholera seemed to have vanished.
- But what do we attribute it to: the smell or the water?
  - Still not everyone was convinced it was waterborne, even after removing the pump handle.
- Then, 12 years later...

Second BBC video.