Healthy Numbers

Historical Perspective on Quantitative Analysis in Health

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28 September 2013

Why study history?

- It is more important to make history than write or read it- D. D. Kosambi

(TIFR Math professor, statistician , Marxist, historian)

- Those who cannot learn from history are doomed to repeat it.
- Many remarkable examples of quantitative arguments leading to significant medical insights
- Some contemporary cases too are given.

Basic tools of Statistics

- Simple arithmetic
- Summary of data
- Graphs and charts

William Harvey

1 April 1578- 3 June 1657

Blood circulation

- Each pumping action expels 5ml per beat
- 1000 beats every half hour= 5 liters
- In 24 hours 240 liters
- Cannot be all new
- Hence circulation

Florence Nightingale

12 May 1820 – 13 August 1910

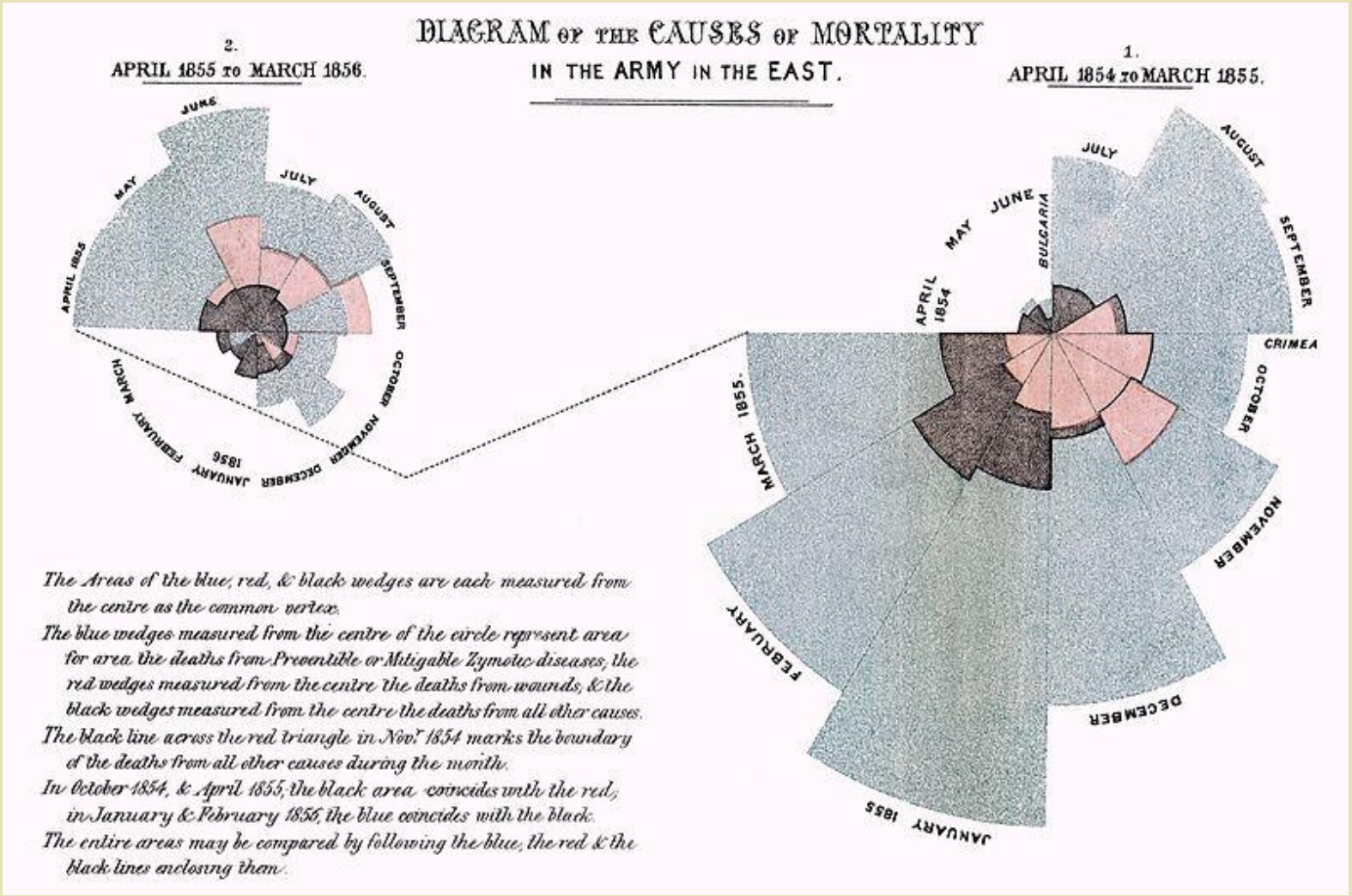
Crimean war (1854)

- UK versus Russia
- 18000 soldiers admitted to hospitals
- Lady with the lamp
- Angel of Crimea
- With cleanliness hospital death rate cut to 1/3
- Bacteria are more deadly than bullets and bayonets

- Ten times more soldiers died of typhus, typhoid, cholera and dysentery than from battle wounds
- Crucial for military budget
- Similar study of British soldiers in India
- More red coats died in barracks than in battle fields
- Reason? Unhygienic living conditions.
- Established cantonments

Nightingale's depiction of causes of death

red – wounds, blue- preventable, black- others

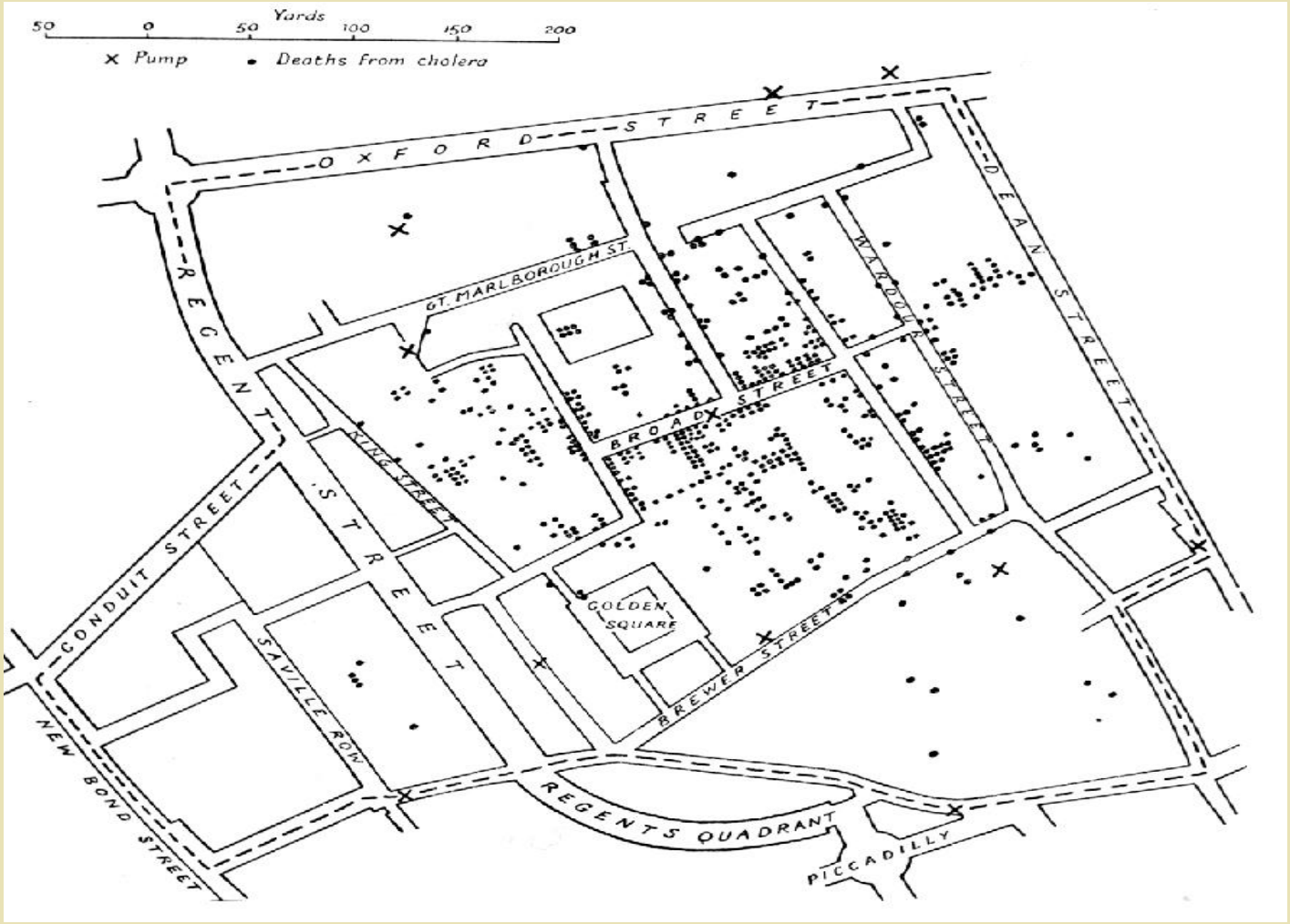


John Snow on Cholera

Great Britain 1849- 33000 people died of cholera, 13000 in London

Mortality rate – 50%

15 March 1813 – 16 June 1858



Map of London area with dots (cholera deaths) and Hand pumps (crosses)

Comparative data

- Two parallel streets
- Each received water from a different company (Southwark company and Lambeth company)
- Customers of Southwark higher incidence of cholera
- Source just below sewage dumping point
- Water contamination the cause

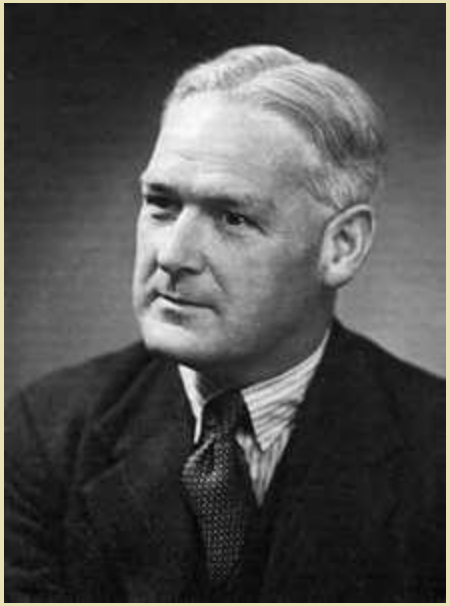
Pierre-Charles-Alexandre Louis- numerical method bloodletting is not efficacious

April 14, 1787
August 22, 1872

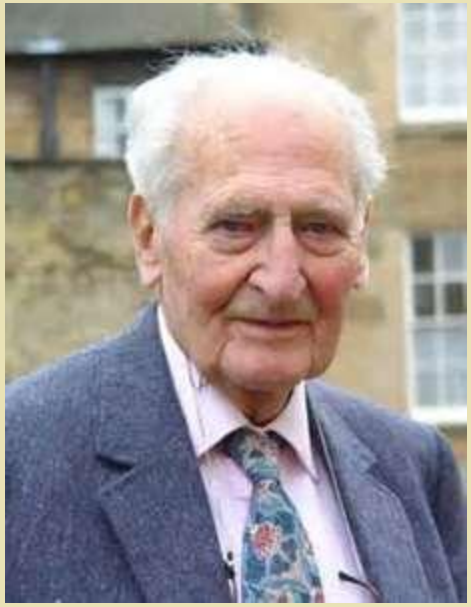
Blood letting

- Fevers- caused by inflammation
- Bloodletting can give relief, use leeches
- 1833- 42 million leeches imported into France
- Louis' Test on pneumonia (Leeches on chest)
- 77 patients- blood letting when?
- Early (within 4 days from onset) or
  late (between 5-9 days from onset)
- Early group had higher death rate (44%) than late group (25%)
- Better wait before bloodletting

Hill and Dole



Austin Bradford Hill
8 July 1897 – 18 April 1991



Richard Doll
28 October 1912 – 24 July 2005

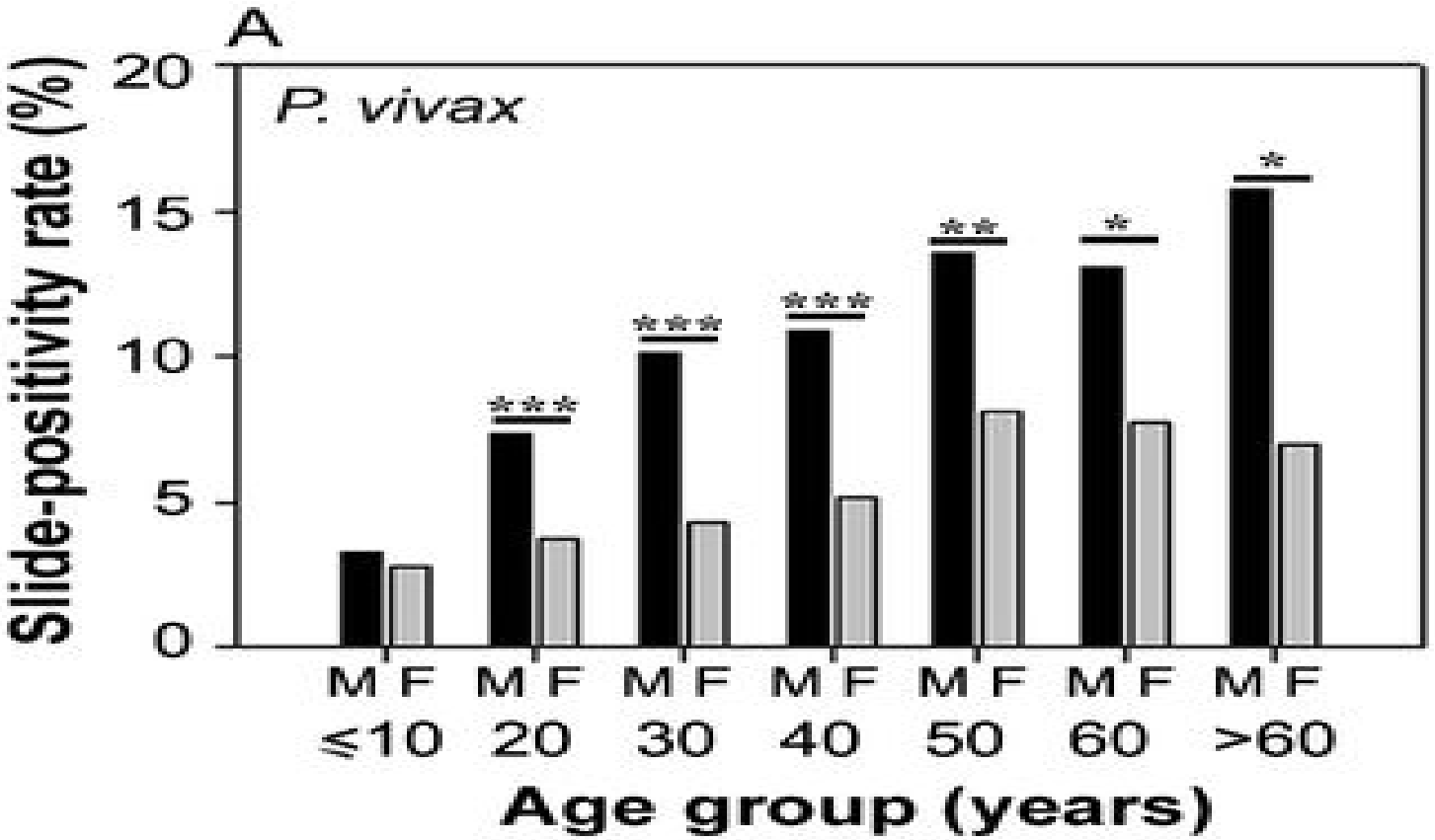
1950 study of lung cancer patients in 20 London Hospitals

- Suspicion- asphalt and car fumes are the causes
- Only common factor found- tobacco smoking
- Retrospective study
- Perhaps liking for tobacco related to cancer proneness
- Prospective study needed
- 1954 onwards – 40,000 doctors observed for 20 years
- Strong connection between lung cancer and smoking
- Similar connection between asbestos and lung problems
- Causes can be detected with statistics

Malaria in Mumbai

- Data from public hospitals
- Age, gender, ailment
- Focus- proportion of admissions due to malaria
- Females lower than males
- Why?
- Mosquitoes prefer males? No.
- Fewer females in Mumbai
- But we are discussing proportions not abs.#

- Females get less attention?
- Proportions not absolute numbers
- Perhaps females sleep inside and males outside
- But difference persists in rainy season
- Graph has peculiarity
- For young age classes- no gender difference
- Difference goes on increasing with age
- Interpretation?



1. At low age, no difference. 2. With rising age males have higher probability. 3. In females the values stabilize.

So why lower proportion in females?

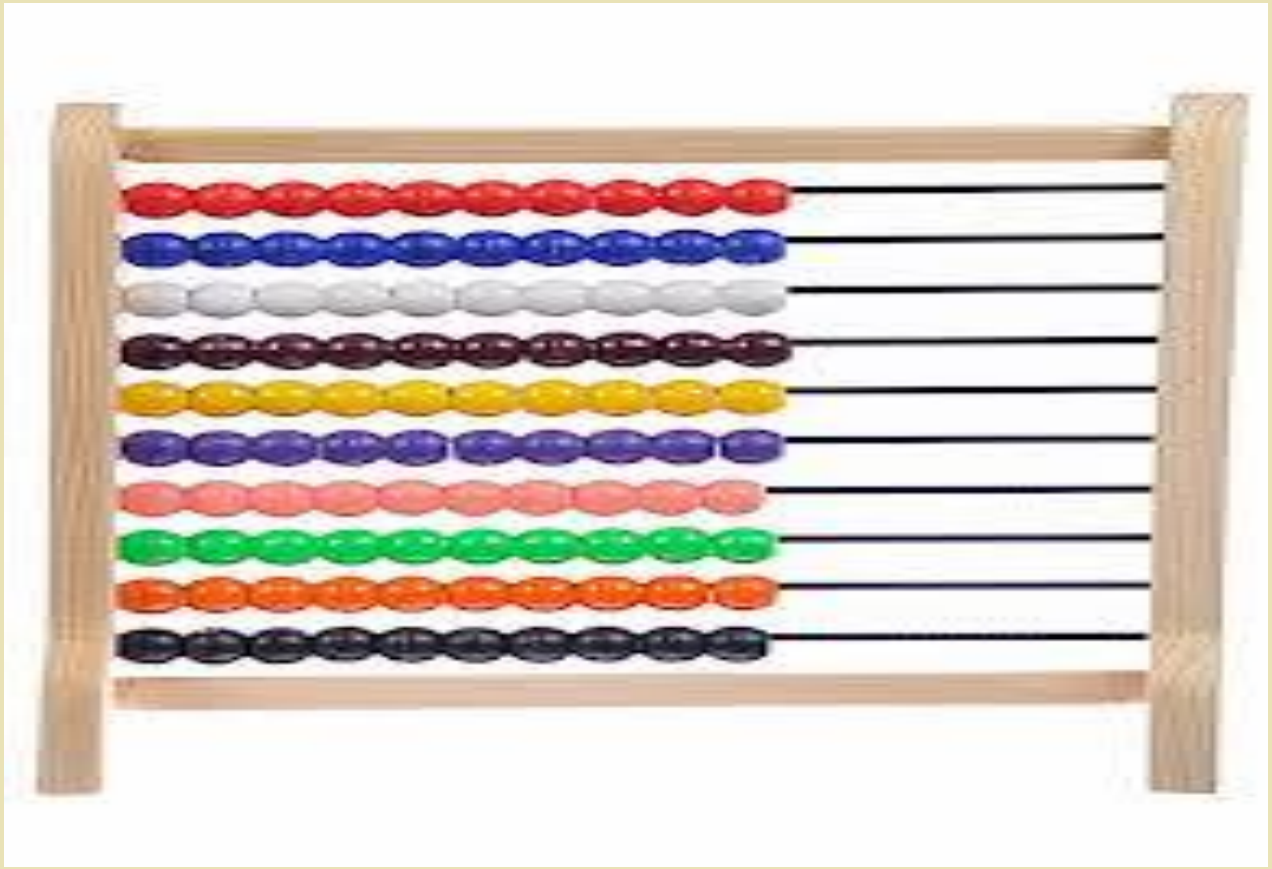
- What is the difference between genders that emerges in teens?
- Testosterone
- This puts males at a disadvantage
- Perhaps also in fighting malaria

Abhay and Rani Bang

Pneumonia in Gadchiroli

- Pneumonia a big infant killer
- If detected on time, treatment easy
- Testing difficult
- How to judge?
- Good discriminator- count of breathing frequency
- If more than 50 per minute, diagnose Pneumonia
- Village health worker cannot count up to 50

How to count 50 when you only know 10



Count wheezing with red beads. When all are used shift a Blue bead. If you need 5 blue beads, declare pneumonia.

Use of Statistical Control Charts to improve healthcare delivery

- William Nugent
- Improvement in outcomes of cardiac surgery

dartmed.dartmouth.edu/fall06/html/vs_data.php

- CABG (coronary artery bypass graft)
- Factors under control- use of aspirin after surgery, intra and post operative transfusion, source of graft vessel (internal mammary artery or vein in the leg)
- Variable plotted- mortality associated with various factors
- IMA grafts have lower mortality

- I have worked to develop effective ways to collect high-quality clinical data and more importantly, to use that data to improve outcomes.

Conclusion

- Quantitative thinking can make a difference
- Learning from experience has to be automated
- Future prospects for such exercise bright!