

Cholera and the Science of Medicine: Problem Handouts



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Cholera and the Science of Medicine

Part 1

London in the mid-19th century was a city of great contrasts. It was as modern as any in the world and prospered because it was the center of an industrial empire that spanned the globe. On the other hand, the living conditions were among the worst imaginable for many of its inhabitants. The air reeked from coal-fired stoves and factories and from sewage that flowed into the Thames River. Dogs, cats, horses, cows, and sheep added their waste to the litter in the streets. Few houses had plumbing—water for drinking and domestic use was available from pumps or from a patchwork of water companies that piped water from the Thames into homes. Housing was extraordinarily cramped, often with several generations of a family living in two or three rooms.

Disease was a fact of life and death in London and other similarly grimy urban areas of Europe. Typhus, malaria, and, especially, bubonic plague, had periodically erupted in the distant and recent past and decimated large regions, sometimes even whole continents. The most notorious instance perhaps was the plague outbreak of 1347-1352 when, as a result, the population of Europe dropped from 75 to 50 million people.

In the 19th century, a new killer arrived in the form of cholera. It first appeared in London in 1832 and hundreds died; it reappeared again in 1848 and then yet again in 1853. The disease was quick. Two friends might be enjoying lunch together and by the next morning both would be dead.

Questions:

1. Think and write individually: What do you know about these diseases and the epidemics they cause?
2. Share and discuss your ideas with your group and prepare a set of group notes that you will share with the class.
3. As a group, discuss your thinking why, in the 1850s, there was almost no understanding the causes, prevention, and treatment of disease.



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Part 2

After the first cholera epidemic, authorities in London began collecting health statistics. As an example, Table 1 shows the Weekly Returns of Births and Deaths in London, published each Saturday by the General Register Office,

Questions:

1. As a group, discuss the question: "why did authorities collect health statistics?"
2. Looking at Table 1 below: What ideas can your group suggest as to the mid-19th century thinking about the causes of cholera?
3. If you were on the health board of London in the 1850's, what data would you like to collect to understand the causes of cholera and other diseases?



WEEKLY RETURN
BIRTHS AND DEATHS IN LONDON.

PUBLISHED BY AUTHORITY OF THE REGISTRAR-GENERAL.

1853. VOL. XIV.] WEEK ENDING SATURDAY, NOVEMBER 26. [No. 48.]

HEALTH OF LONDON DURING THE WEEK.

THE MORTALITY of the metropolitan districts has risen considerably during the week. In the preceding week the deaths registered were 1162; in the week that ended on Saturday last they were 1339. The mean weekly temperature has suffered a great fall. In the last week of October it was 55.5°, in the 4 weeks that followed it was 48.9°, 45.7°, 38.5°, and (last week) 36.7°.

In the ten corresponding weeks of the years 1843-52 the average number of deaths was 1093, which, raised in proportion to increase of population, becomes 1202. There is an excess in last week's return, amounting to 137.

Diseases of the respiratory organs have suddenly become more fatal; they rose from 180 in the preceding to 397 in the last week; in this class bronchitis rose from 68 to 134, pneumonia from 92 to 124. Phthisis was fatal in the two weeks respectively in 133 and 166 cases. Cholera, it is gratifying to observe, subsides, and last week was fatal to only 46 persons. In the first 14 weeks of the epidemic of 1848-49 (reckoning from 1st October), it destroyed 529 persons; in the same number of weeks of the present attack, commencing 21st August, it has carried off 744, or 215 persons more than in the former. But the epidemic beginning at an earlier season in 1853, the mean temperature has been on an average 5° higher, and making allowance for this circumstance, there does not appear any sufficient ground to conclude that the distemper now prevailing is of a more virulent character than that of 1848.

MORTALITY FROM CHOLERA IN DISTRICTS SUPPLIED BY WATER COMPANIES.

Water Companies.	Sources of Supply.	Aggregate of Districts supplied chiefly by the respective Water Companies.			Deaths to 100,000 Inhabitants.
		Elevation in feet above Trinity High-water Mark.	Population.	Deaths from Cholera in 13 Weeks ending Nov. 19.	
LONDON	- - -	39	2362236	698	30
* (1) Hampstead and (2) New River.	Springs at Hampstead and Kenwood, two artesian wells, and New River.	80	166956	8	5
New River	At Chadwell Springs in Hertfordshire, from river Lee, and four wells in Middlesex and Herts.	76	634468	55	9
Grand Junction	The Thames, 360 yards above Kew Bridge.	38	106636	14	13
Chelsea	The Thames, at Battersea.	7	122147	22	16
Kent	The Ravensbourne in Kent.	18	134200	30	22
West Middlesex	The Thames, at Barnes.	72	277700	84	30
East London	The river Lee, at Lee Bridge.	26	434694	144	33
* (1) Lambeth and (2) Southwark.	The Thames, at Thames Ditton and at Battersea.	1	346343	211	61
Southwark	The Thames at Battersea.	8	118267	111	94
* (1) Southwark and (2) Kent.*	The Thames, at Battersea, the Ravensbourne in Kent, and ditches and wells.	0	17803	19	107

* In three cases (marked with an asterisk) the same districts are supplied by two companies.

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Figure 10.2. Weekly Return of Births and Deaths (26 November 1853).

Table 1 from: Vinten-Johansen, P., Brody, H., Paneth, N., Rachman, S., and Rip, M. (2003). *Cholera, chloroform, and the science of medicine. A life of John Snow*. Oxford: Oxford University Press.



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Part 3

In the mid-19th century, people who strove to find an explanation for cholera tended to divide into the "miasmatists," the "sanitarians," and the "contagionists." Each group could find and cite statistics and examples to support their particular "theories." Ideas swirled in newspapers (see Fig. 1) as well as medical journals.

At the center of the controversy was John Snow, a prominent London physician. Like many others, John Snow had strong opinions about the cause of cholera. However, the diligent collection of data distinguished Snow from the many voices raised in the controversy. He used a variety of sources, plus he did his own field research in the areas affected by cholera, at times going from door to door, asking questions, gathering information. And he communicated his ideas. In October of 1854, he wrote:

The most terrible outbreak of cholera which ever occurred in this kingdom, is probably that which took place in Broad Street, Golden Square, and the adjoining streets, a few weeks ago. Within two hundred and fifty yards of the spot where Cambridge Street joins Broad Street, there were upwards of five hundred fatal attacks of cholera in ten days.

As soon as I became acquainted with the situation and extent of this irruption of cholera, I suspected some contamination of the water of the much-frequented street-pump in Broad Street, near the end of Cambridge Street; but on examining the water, on the evening of the 3rd of September, I found so little impurity in it of an organic nature, that I hesitated to come to a conclusion. Further inquiry, however, showed me that there was not other circumstance or agent common to the circumscribed locality in which this sudden increase of cholera occurred?except the water of the above-mentioned pump. I found, moreover, that the water varied, during the next two days, in the amount of organic impurity, visible to the naked eye, on close inspection, in the form of small white, flocculent particles; and I concluded that, at the commencement of the outbreak, it might have possibly been still more impure...

From Snow, J. (1855). *On the mode of communication of cholera (2nd Ed.)*. London: Churchill, p.38: available at www.ph.ucla.edu/epi/snow/snowbook2.html.

Questions:

1. Think individually and then as a group, discuss the following question. Based on his writing, what is John Snow's understanding of the relationship between explanation and evidence? Be prepared to share your group's ideas.
2. As a group: Assume for the moment that you are John Snow, preparing to conduct door-to door interviews. What questions should you ask of the residents of Golden



Square in order to test your ideas? Prepare a list of these questions. Indicate which are most important.

3. What do you make of the letter printed in the London Times (Fig. 1)? What is his argument? How would you collect data to support or refute that argument?

Figure 1. A letter to the Editor of the London Times, describing one Londoner's explanation for the cause of cholera. Source: www.sph.unc.edu/courses/john_snow/episode_4/link3.htm

TO THE EDITOR OF THE TIMES.

Sir, I trust that, being a resident in Broad street, St. James's parish, where the present frightful epidemic has been raging so fearfully, you will allow me a line of your valuable space to mention a curious fact connected with this district.

Some two years back, when the baths and washhouses situated at the back of Broad-street were being constructed, the piers to support the building were obliged to be sunk some distance through the ground, this ground being the old parish burying ground; at that time I saw human remains (flesh and hair as well as bones) which from the dates on the coffins, must have been underground 100 years, in a most wonderful state of preservation. Is it not therefore reasonable to suspect that (seeing the earth in this neighbourhood appears to possess in a great degree the power of retarding animal decomposition) when the new sewer was constructed, here in some places 30 or more feet deep, it must have most injuriously disturbed the soil saturated with the remains of persons deposited here during the great plague of London (as mentioned in your journal by a resident of Regent-street), and this a deadly miasmatic atmosphere has been for some months arising through the gully holes connected with this sewer, poisoning the surrounding atmosphere and predisposing the inhabitants to any epidemic that might visit this metropolis?

It has been observed by all that this disease has more especially followed line for line on either side the course of this new main sewer.

In no other way, I think, can be explained the extraordinary virulence of the outbreak in our district, which considering its limited extent and good drainage has been more fatally visited than the worst drained districts south of the Thames; hardly a house in Broad-street, a street of 50 houses, has escaped without three, four, or even five deaths in it.

I trust that through the influence of your powerful journal the Commissioners of Sewers will be induced to take some measures to prevent as much as possible the emanation of poisonous vapour from this main sewer, and thus, under Providence, avert from us another such awful plague at any other visitation of an epidemic.

I am, Sir, your obedient servant,

A RESIDENT OF BROAD-STREET

28, Broad-street, Golden-square.

SEPT. 11, 1854





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Part 4

In mid-summer of 1854, before the Broad Street outbreak, cholera was most devastating across the Thames. This was an area that obtained its water through pipes owned by private water companies and the source of that water was the river itself.

In a large area inhabited by some 300,000 residents, water was delivered by both the Southwark/Vauxhall and the Lambeth water companies. Both companies provided water to the localities with dual pipes traversing the streets side by side in some places. One household might receive its water from Lambeth and next door the residents would be drinking Southwark/Vauxhall water. Other nearby districts were served by one company or the other exclusively.

Combining regional mortality data available from the city health authorities for the 1849 as well as the 1854 epidemics with the distribution patterns of the water companies, John Snow was able to develop and publish the data in Table 2.

Questions:

1. What meaning can you find in the data in Table 2? What questions do you have?
2. If John Snow's thinking about cholera is correct, what explanation do you think he would find for the distribution of data?
3. What would you suggest that John Snow do now? What patterns would you predict would be observed in the data to be collected?

Table 2.: Data table from Snow's *On the Mode of Communication of Cholera*, 1855. Complete text available at the UCLA Department of Epidemiology web site:

<http://www.ph.ucla.edu/EPI/snow.html>

Sub-Districts	Deaths from Cholera in 1849	Deaths from Cholera in 1854	Water Supply
St. Saviour, Southwark	283	371	Southwark & Vauxhall Company only
St. Olave	157	161	
St. John, Horsleydown	192	148	
St. James, Bermondsey	249	362	
St. Mary Magdalen	259	244	
Leather Market	226	237	
Rotherhithe	352	282	
Wandsworth			



Battersea	97	59	
Putney	111	171	
Camberwell	8	9	
Peckham	235	240	
	92	174	
Christchurch, Southwark	256	113	Lambeth Company and Southwark & Vauxhall Company
Kent Road	267	174	
Borough Road	312	270	
London Road	257	93	
Trinity, Newington	318	210	
St. Peter, Walworth	446	388	
Waterloo Road (1 st)	143	92	
Waterloo Road (2 nd)	193	58	
Lambeth Church (1 st)	243	117	
Lambeth Church (2 nd)	215	49	
Kennington (1 st)	544	193	
Kennington (2 nd)	187	303	
Brixton	153	142	
Clapham	81	48	
St. George, Camberwell	114	165	
	176	132	
Norwood	2	10	Lambeth Company only
Streatham	154	15	
Dulwich	1	---	
Sydenham	5	12	
First 12 subdistricts	2261	2458	Southwark & Vauxhall
Next 16 subdistricts	3905	2547	Both companies

Last 4 subdistricts	162	37	Lambeth Company

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Part 5

John Snow saw the opportunity this situation presented. He recruited the health authorities to help him canvass the region supplied by the two water companies. Going door-to-door, they were able to gather data for virtually every house in the affected area.

Questions:

1. Create an interview form that would gather the important data from each household. This questionnaire should be short, including no extraneous information.
2. What pattern of cholera fatalities would John Snow expect to observe if his explanation was correct? Create a table with the two water companies on one axis and the pattern of deaths on the other and predict the relative numbers of cholera deaths.
3. Do the results presented in Table3 conform to your predictions?

Table 3. Table IX from On the Mode of Communication of Cholera (available at www.ph.ucla.edu/epi/snow/table9a.html, accessed 22 July 2009).

	Number of houses	Deaths from Cholera	Deaths in each 10,000 houses
Southwark & Vauxhall Company	40,046	1263	315
Lambeth Company	26,107	98	37
Rest of London	256,423	1422	59

4. Why aren't the numbers in some cells zero?