## Masters of 'Metrics: John Snow

British physician John Snow was one of the fathers of modern epidemiology, the study of how illness moves through a pop-ulation. Studying an outbreak of cholera in London in 1849, Snow challenged the conventional wisdom that the disease is caused by bad air. He thought cholera might be caused by bad water instead, an idea he first laid out in his 1849 essay *On the Mode of Communication of Cholera*.

A further cholera outbreak in 1853 and 1854 claimed many lives in the London neighborhood of Soho. Snow attributed the Soho epidemic to water from a pump on Broad Street. Not afraid to give a natural experiment a helping hand, he convinced the local parish council to remove the handle of the Broad Street pump. Cholera deaths in Soho subsided soon after, though Snow noted that death rates in his Broad Street treatment zone were already declining, and that this made the data from his natural experiment hard to interpret. DD was as fickle at birth as it is today.

Snow was a meticulous data grubber, setting a standard we still aspire to meet. In an 1855 revision of his essay, Snow reported death rates by district and water source for various parts of London. He noted that many of the high-death-rate districts in South London were supplied by one of two companies, the Southwark and Vauxhall Company or the Lambeth Company. In 1849, both companies drew water from the contaminated Thames in central London. Start-ing in 1852, however, the Lambeth Company drew from the river at Thames Ditton, an uncontaminated water source up-stream. Snow showed that between 1849 and 1854 deaths from cholera fell in the area supplied by the Lambeth Com-pany but rose in that supplied by the Southwark and Vauxhall Company. Our Figure 5.7 reproduces Table 12 from Snow's 1855 essay.11 This table contains the ingredients for Snow's two-period DD analysis of death rates by water source.

11 John Snow, On the Mode of Communication of Cholera, John Churchill, second edition, 1855.

From Mastering 'Metrics, by J. Angrist and J. Pischke. (c) Princeton University Press 2015

## 206 Chapter 5

## FIGURE 5.7 John Snow's DD recipe

## TABLE XII.

Sub-Districts.		Deaths	Deaths from	
St. Olave	Sub-Districts.		Cholera	Water Supply.
St. Olave	St. Saviour, Southwark.	283	371	
St. John, Horsleydown   192   148   St. James, Bermondsey   249   362   St. Mary Magdalen   259   244   Leather Market   226   237   Rotherhithe*   352   282   Wandsworth   97   59   Battersea   111   171   Putney   8   9   Camberwell   235   240   Peckham   92   174		157	161	
St. James, Bermondsey .       249		192	148	
St. Mary Magdalen				
Leather Market	St. Mary Magdalen	259	244	
Rotherhithe*				
Wandsworth       97       59       hall Company only.         Battersea       111       171       171         Putney       8       9       235       240         Peckham       92       174       174         Christchurch, Southwark       256       113       174         Borough Road       267       174       174         Borough Road       312       270       270         London Road       257       93       177         Trinity, Newington       318       210         St. Peter, Walworth       446       388         St. Mary, Newington       143       92         Waterloo Road (1st)       193       58         Waterloo Road (2nd)       243       117         Lambeth Church (1st)       215       49         Lambeth Church (2nd)       544       193         Kennington (1st)       187       303         Kennington (2nd)       153       142         Brixton       2       10         Streatham       114       165         St. George, Camberwell       176       132         Norwood       2       10         Streatham <td></td> <td></td> <td></td> <td></td>				
Battersea				hall Company only.
Putney       .       .       235       240         Peckham       .       .       .       235       240         Peckham       .       .       .       .       .       .       .         Christchurch, Southwark       .		••		
Camberwell        235       240         Peckham        92       174         Christchurch, Southwark       256       113         Kent Road        267       174         Borough Road        257       93         Trinity, Newington       318       210         St. Peter, Walworth       446       388         St. Mary, Newington       143       92         Waterloo Road (1st)       193       58         Waterloo Road (2nd)       243       117         Lambeth Church (1st)       215       49         Lambeth Church (2nd)       544       193         Kennington (1st)       187       303         Kennington (2nd)       153       142         Brixton       81       48         Clapham       114       165         St. George, Camberwell       176       132         Norwood       2       10         Streatham       1       154         Dulwich       1       -         Sydenham       5       12         Kensident in the sub-districts       2261       2458         Routhwk.& Vauxhall				
Peckham         92         174           Christchurch, Southwark Kent Road         267         174           Borough Road         312         270           London Road         257         93           Trinity, Newington         318         210           St. Peter, Walworth         446         388           St. Mary, Newington         143         92           Waterloo Road (1st)         193         58           Waterloo Road (2nd)         243         117           Lambeth Church (1st)         215         49           Lambeth Church (2nd)         544         193           Kennington (1st)         187         303           Kennington (2nd)         153         142           Brixton         81         48           Clapham         114         165           St. George, Camberwell         176         132           Norwood         2         10           Streatham         154         15           Dulwich         1         -           Sydenham         5         12           First 12 sub-districts         2261         2458           Southwk.& Vauxhall.           Next 1				1
Christchurch, Southwark         256         113           Kent Road				
Kent Road       .       267       174         Borough Road       .       312       270         London Road       .       257       93         Trinity, Newington       .       318       210         St. Peter, Walworth       .       446       388         St. Mary, Newington       .       143       92         Waterloo Road (1st)       .       193       58         Waterloo Road (2nd)       .       243       117         Lambeth Church (1st)       .       215       49         Lambeth Church (2nd)       .       187       303         Kennington (1st)       .       187       303         Kennington (2nd)       .       153       142         Brixton       .       .       81       48         Clapham       .       .       176       132         Norwood       .       .       2       10         Streatham       .       .       1       -         Dulwich       .       .       .       1         Dulwich       .       .       .       .         First 12 sub-districts       .       .	recknam	32	1/4	
Kent Road       .       267       174         Borough Road       .       312       270         London Road       .       257       93         Trinity, Newington       .       318       210         St. Peter, Walworth       .       446       388         St. Mary, Newington       .       143       92         Waterloo Road (1st)       .       193       58         Waterloo Road (2nd)       .       243       117         Lambeth Church (1st)       .       215       49         Lambeth Church (2nd)       .       187       303         Kennington (1st)       .       187       303         Kennington (2nd)       .       153       142         Brixton       .       .       81       48         Clapham       .       .       176       132         Norwood       .       .       2       10         Streatham       .       .       1       -         Dulwich       .       .       .       1         Dulwich       .       .       .       .         First 12 sub-districts       .       .	Christchurch, Southwark	256	113	
London Road		267	174	1
London Road	Borough Road	312	270	
Trinity, Newington       .       318       210         St. Peter, Walworth       .       446       388         St. Mary, Newington       .       143       92         Waterloo Road (1st)       .       193       58         Waterloo Road (2nd)       .       243       117         Lambeth Church (1st)       .       215       49         Lambeth Church (2nd)       .       544       193         Kennington (1st)       .       187       303         Kennington (2nd)       .       153       142         Brixton       .       .       81       48         Clapham       .       .       176       132         Norwood       .       .       2       10         Streatham       .       .       154       15         Dulwich       .       .       .       12         First 12 sub-districts       .       2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts       .       3905       2547       Both Companies.		257	93	
St. Peter, Walworth       446       388       Lambeth Company, and Southwark and Vauxhall Compy.         St. Mary, Newington       143       92       and Southwark and Vauxhall Compy.         Waterloo Road (2nd)       243       117       Vauxhall Compy.         Lambeth Church (1st)       215       49       Vauxhall Compy.         Lambeth Church (2nd)       544       193       Vauxhall Compy.         Kennington (1st)       187       303       Vauxhall Compy.         Kennington (2nd)       153       142       Vauxhall Compy.         Brixton       81       48       Vauxhall Compy.         Clapham       114       165       Vauxhall Compy.         St. George, Camberwell       176       132       Vauxhall Compy.         Norwood       2       10       Vauxhall Compy.       Vauxhall Compy.         Streatham       154       15       Vauxhall Compy.       Vauxhall Compy.         First 12 sub-districts       2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts       3905       2547       Both Companies.		<b>3</b> 18	210	
St. Mary, Newington       143       92       and Southwark and Vauxhall Compy.         Waterloo Road (2nd)       243       117       Auxhall Compy.         Lambeth Church (1st)       215       49       Auxhall Compy.         Lambeth Church (2nd)       544       193       Auxhall Compy.         Kennington (1st)       187       303       Auxhall Compy.         Kennington (2nd)       153       142       Auxhall Compy.         Brixton       81       48       Auxhall Compy.         Clapham       114       165       132         Norwood       2       10       10         Streatham       154       15       Lambeth Company only.         Sydenham       5       12         First 12 sub-districts       2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts       3905       2547       Both Companies.			388	Tambath Commons
Waterloo Road (1st)       .       193       58       Vauxhall Compy.         Waterloo Road (2nd)       .       243       117       Vauxhall Compy.         Lambeth Church (1st)       .       215       49       49         Lambeth Church (2nd)       .       544       193       48         Kennington (2nd)       .       153       142         Brixton       .       .       81       48         Clapham       .       .       114       165         St. George, Camberwell       176       132         Norwood       .       .       2       10         Streatham       .       .       154       15         Dulwich       .       .       .       12         First 12 sub-districts       .       2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts       .       3905       2547       Both Companies.	St. Mary, Newington		-	
Waterloo Road (2nd)       243       117         Lambeth Church (1st)       215       49         Lambeth Church (2nd)       544       193         Kennington (1st)       187       303         Kennington (2nd)       153       142         Brixton       81       48         Clapham       114       165         St. George, Camberwell       176       132         Norwood       2       10         Streatham       154       15         Dulwich       1       -         Sydenham       5       12         First 12 sub-districts       2261       2458         Southwk.& Vauxhall         Next 16 sub-districts       3905       2547         Both Companies	Waterloo Road (1st)			
Lambeth Church (1st)       215       49         Lambeth Church (2nd)       544       193         Kennington (1st)       187       303         Kennington (2nd)       153       142         Brixton       81       48         Clapham       114       165         St. George, Camberwell       176       132         Norwood       2       10         Streatham       154       15         Dulwich       1       -         Sydenham       5       12         First 12 sub-districts       2261       2458         Southwk.& Vauxhall         Next 16 sub-districts       3905       2547         Both Companies			1	vauxnam compy.
Lambeth Church (2nd)       544       193         Kennington (1st)       187       303         Kennington (2nd)       153       142         Brixton       81       48         Clapham       114       165         St. George, Camberwell       176       132         Norwood       2       10         Streatham       154       15         Dulwich       1       -         Sydenham       5       12         First 12 sub-districts       2261       2458         Southwk.& Vauxhall       Next 16 sub-districts       3905       2547         Both Companies			1	1
Kennington (1st)       .       187       303         Kennington (2nd)       .       153       142         Brixton       .       .       81       48         Clapham       .       .       114       165         St. George, Camberwell       176       132         Norwood       .       .       2       10         Streatham       .       .       154       15       Lambeth Company only.         Dulwich       .       .       .       5       12         First 12 sub-districts       .       2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts       .       3905       2547       Both Companies.			-0	
Kennington (2nd)       .       153       142         Brixton       .       .       81       48         Clapham       .       .       114       165         St. George, Camberwell       176       132         Norwood       .       .       2       10         Streatham       .       .       154       15       Lambeth Company only.         Dulwich       .       .       .       5       12         First 12 sub-districts       .       2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts       .       3905       2547       Both Companies.				
Brixton	Kennington (2nd)		1 000	
Clapham		1 -00		
St. George, Camberwell       176       132         Norwood        2       10         Streatham        154       15       Lambeth Company only.         Dulwich        5       12       only.         First 12 sub-districts        2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts        3905       2547       Both Companies.		1 0-		
Norwood       .       .       2       10         Streatham       .       .       154       15       Lambeth Company only.         Dulwich       .       .       .       5       12         First 12 sub-districts       .       .       2261       2458       Southwk.& Vauxhall.         Next 16 sub-districts       .       .       3905       2547       Both Companies.	St. George Camberwell	,		1
Streatham	St. deorge, Camberwell	170	102	
Dulwich 1 — only.  Sydenham 2261 2458  First 12 sub-districts . 2261 2458 Southwk.& Vauxhall.  Next 16 sub-districts . 3905 2547 Both Companies.	Norwood	2	10	
Dulwich 1 — only.  Sydenham 2261 2458  First 12 sub-districts . 2261 2458 Southwk.& Vauxhall.  Next 16 sub-districts . 3905 2547 Both Companies.	Streatham	154	15	Lambeth Company
Sydenham 5 12  First 12 sub-districts . 2261 2458 Southwk.& Vauxhall.  Next 16 sub-districts . 3905 2547 Both Companies.	Dulwich	1		
Next 16 sub-districts . 3905 2547 Both Companies.	Sydenham	1 -	12	
	First 12 sub-districts .	2261	2458	Southwk. & Vauxhall.
Last 4 sub-districts . 162 37 Lambeth Company.	Next 16 sub-districts .	3905	2547	Both Companies.
	Last 4 sub-districts .	162	37	Lambeth Company.

<sup>\*</sup> A small part of Rotherhithe is now supplied by the Kent Water Company.