Geospatial Health
Geospatial Health 2026; 21:1428
doi:10.4081/gh.2026.1428

The contrary Russian flu: London 1890-1892

Walter Peterson

Captain, US Navy (Retired), Stafford, VA, United States

Abstract

Influenza epidemics tend to impact the poorest populations living in dense, unhealthy conditions more than the wealthier living in healthier, less dense surroundings. This study shows how the relationship between influenza mortality and the wealth of London's population during the Russian Flu pandemic of the early 1890's contradicts this conventional wisdom. This analysis examines London's 1890, 1891 and 1892 epidemic waves statistically and geographically, comparing wave flu mortality to population wealth, density and healthiness metrics. Correlation analysis shows that flu mortality directly correlates with wealth in all three waves; and inversely correlates with both population healthiness and density metrics. Some deficiencies exist in the 130-year-old data that preclude applying 21st-century rigor to the data analysis. For example, the causative agent of the flu was unknown at the time causing significant misidentification of causes of deaths. Nevertheless, analysis of the spatial association of flu mortality with population wealth using Lee's L statistic shows areas of both high mortality and high wealth in the wealthy areas east of the City of London, supporting the counterintuitive results of London's experience. This study does not seek to explain the reasons for these unexpected outcomes; however, the results suggest that today's metropolitan and regional planning authorities need to account for unexpected nuances in contingency plans for potential epidemics based upon best practice recommendations from appropriate national authorities. These plans need to consider previous local experience and must have a mechanism/process in place to detect and react to observed departures from the 'expected.'

Key words: Russian flu, socioeconomic effects, London mortality.

Correspondence: Walter Peterson, 2266 Aquia Drive, Stafford, VA, 22554, United States. E-mail: wpete3bx@mail.umw.edu

Introduction

The influenza pandemic of the early 1890's has been variously described as the last pandemic of the nineteenth century, the Russian flu (its deadly approach breathlessly heralded via telegraph), an enigma, and in the last few years, caused by a coronavirus. The results of this first spatial analysis of the epidemic in London add an additional descriptor: contrarian.

Bukhara, in what is now Uzbekistan – then part of the Russian Empire – is frequently cited as the point of origin for the last great pandemic of the nineteenth century, killing over a million worldwide in 1889 and 1890 alone. It arrived in the Russian capital of St. Petersburg during November of 1889 infecting nearly 200,000 out of a population of just less than one million – including the tsar – and reached London in late December 1889, the first deaths occurring in the first week of January 1890. The first wave lasted six weeks, followed by a second wave in May/June 1891 and a third in January/February 1892. Just over 5,000 deaths were directly attributed to the flu during the three waves. For various reasons this number greatly under-reported the epidemic's actual impact. Contemporaneous analysis that included excess deaths attributed to other flu-related respiratory diseases like pneumonia and bronchitis put the epidemic's actual toll in London for these three waves at just over 16,000 (Dixey, 1892). Table 1 summarizes the characteristics of the three waves.

In London the epidemic manifested itself differently from the frequent assertion that the poorest populations – living in dense and unhealthy conditions – experience greater mortality than the more affluent. Statistical and spatial Geographic Information Systems (GIS) analyses of the over 130-year-old data show that the Russian flu exacted a greater toll on London's wealthier residents than those in poorer districts. Noted physician Henry F. Parsons prepared the definitive (official) reports for the Russian Flu in England and Wales (Parsons, 1891, 1893) for the Local Government Board – the supervisory bureau responsible for local governmental administration in England and Wales from 1871 to 1919. His reports addressed the flu mortality in 1890, 1891 and 1892. Although subsequent years experienced flu outbreaks, this study follows Parsons' lead and addresses the same years.

Materials and Methods

Study area

London County, England, as organized in Sanitary Districts defines the study area. The Metropolis Management Act of 1855 (Scott, 1855) organized the civil parishes of London County plus several adjacent parishes in Surrey, Middlesex and Kent into Sanitary Districts (sometimes referred to as Sanitary Areas). The extant organization of Registration Districts and Sub-Districts remained in place for the 'registration' of births, deaths, and marriages. Each Sanitary District was required to appoint a "qualified medical practitioner…to inspect [and] report periodically [and] to ascertain the existence of diseases, more especially epidemics…" (Scott, 1855, p.77). Figure 1 shows the outlines of the Sanitary Districts with the City of London highlighted in yellow as a visual reference.

Charles Dickens' novels *Hard Times* and *Oliver Twist* provide vivid depictions of the living conditions experienced by the poor and disadvantaged in the Victorian Era. Charles Booth's work (Orford *et al.*, 2002) in mapping the London poor shows the extent and complexity of understanding poverty in London, which ultimately led to government intervention. The Public Health Act of 1891 codified efforts to improve healthcare for the poor and expanded reporting requirements for London's sanitation districts (Holdsworth, 1891). Established charitable organizations, including hospitals and dispensaries, also expanded their efforts to provide more efficient processes, including hiring professional administrators. Additional charities worked to provide access for infant and women's health in order to overcome previous deficiencies.

Data sources with relevant notes

At the time, influenza deaths were not recorded by Registration District/Sub-District in the "Weekly Return of Births and Deaths in London and in Twenty-Seven Other Great Towns" (with the number of 'great towns' increasing over time) published by the Registrar General (RGWRs). These weekly publications do note the number of deaths attributed to influenza; however, they were aggregated by week but only sporadically spatially quantified. The annual summaries list an aggregate for the year but, again, with no spatial quantification. In 1894 the "Annual Summary of Births, Deaths, and Causes of Death in London and other Large Towns, 1894" (Registrar-General, 1895) provided a listing of deaths attributed to influenza for the preceding years by Sanitary District, aggregated by year. These data were used in the study presented here to calculate Crude Death Rates (CDRs) and perform statistical and spatial analyses.

The Metropolis Management Act of 1855 (Scott, 1855) provided the basis for creating the Sanitation District geographic boundary feature layer in the GIS constructed for the study presented here. Three metrics were created to characterize each Sanitation District, with two of them serving as proxies for district wealth and health in the same manner that the Registrar General characterized each Borough in its final report of the so-called Spanish Flu epidemic of 1918/19 (Registrar-General, 1920). The wealth metric represents the percentage of Sanitation District households employing live-in servants and the health metric represents the average of each District's all-cause mortality for the three years preceding the epidemic. The third metric is each District's population density.

Sanitary District population and area data were extracted from the 1891 UK census as reported at the On-Line Historical Reports website. UK Data Service Study Number 8613 (Reid, 2020) provided Registration Sub-District percentage data for homes employing live-in servants. These data were converted into Sanitary District percentages of homes employing live-in servants.

The *Vision of Britain* website supplied the 1891 census data containing Registration Sub-District number of houses to facilitate the calculation of Sanitary District servant percentages. Sanitary District total all-cause deaths were extracted from the Annual Summary of Births, Deaths, and Causes of Deaths in London and Other Great Towns for the three years preceding the epidemic.

Data processing

The software package ArcGIS Pro (3.5.1) (ESRI, Redlands, CA, USA) was used to display and spatially analyse the Sanitary District mortality data.

Approach

The primary focus of this study analysed the relationship between Sanitary District influenza mortality and Sanitary District wealth using both statistical and spatial methods. Lee's *L*, a bivariate spatial correlation coefficient which measures the association

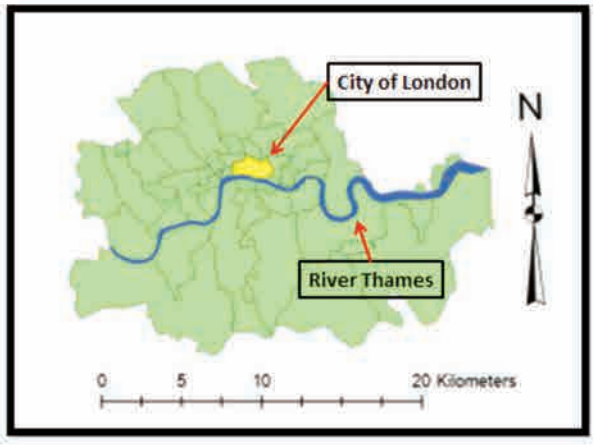

Figure 1. The study area: Greater London area at the time of the Russian Flu, with outlines of the Sanitary Districts. The City of London is shown in yellow for visual orientation purposes.

Table 1. Summary of wave characteristics.

Year	Total deaths[1] (no.)	Total with excess respiratory deaths[2] (no.)	Period of maximum mortality
1890	644	2,800	January - February
1891	2,318	5,800	May - June
1892	2,216	8,000	January - February

[1]*Parsons, 1893;* [2]*Dixey, 1892.*

between two sets of observations made at the same spatial sites, was used to determine correlation coefficients and calculating the statistic. In effect, Lee's L is an integration of Pearson's ρ and Moran's *I* accounting for correlation and spatial clustering similarity. Correlation analyses were also performed among Sanitary District mortality, district population density, and health metrics looking to corroborate or contradict the results of the wealth analysis. Two issues exist with this study's calculated CDRs. As noted, deaths attributed to influenza do not reflect the actual mortality due to the epidemic. Several frequently cited reasons include that the last great influenza epidemic in England occurred 135 years ago–outside of the medical establishment's 'corporate memory' – and that there was no specific test to determine what the causative agent might have been to differentiate it from other respiratory illnesses. Dr. F. A. Dixey (FRS) provided a striking example of the actual impact of the epidemic in an article published in the *British Medical Journal* on 13August, 1892 (Dixey, 1892). For the years 1890, 1891 and 1892 he calculated influenza mortality figures accounting for the excess mortality in other respiratory diseases to be 2,800, 5,800, and 8,000 respectively. The numbers in the Register-General Annual Summary for 1894 reported influenza mortality for 1890, 1891, and 1892 to be 644, 2,318, and 2,216 respectively. For these three years, the epidemic's actual impact becomes nearly three times the number recorded as directly attributed to influenza (See Table 1). Regretfully Dixey's data lacks a spatial component. Therefore, the Registrar-General's tabulation that does contain spatial distributions was used in the present study to represent Sanitary District influenza mortality. The mathematics of calculating correlation coefficients is such that multiplying in-put datasets by a factor does not alter the resulting calculated coefficients. Of course, the inherent assumption therein is that there are no spatial differences in the multiplicands. The second issue regarding this study's CDRs is the Sanitary District population. Usually, a CDR is calculated by dividing the relevant number of deaths by the mid-year population. Mid-year population estimates are not recorded for the Sanitary Districts for the years in question. The decennial censuses surrounding the epidemic were done in 1881, 1891 and 1901. Therefore, the Sanitary District population numbers from the 1891 census were used to calculate CDRs in the study presented here. Finally, to facilitate visual comprehension and comparison of mapped variables, the data displayed in this paper have been 'normalized.' That is, the data were transformed to a scale of 0 to 1 (frequently described as min-max scaling). Figure 2 shows the spatial distribution of wealth among the Sanitary Districts using the percentage of households having live-in servants as the wealth metric. Although the survey by Charles Booth of poverty in London (Orford *et al.*, 2002.) conducted during the 1890's does not cover the entirety of London County, there is a striking resemblance in what it did cover to what is shown in Figure 2 providing further justification for using this metric as a proxy for wealth. Sanitary District metrics for population density and health are shown alongside the wealth metric.

Results

Table 2 shows the Pearson coefficients of all three years' wealth coefficients, which are all positive. However, the negative signs associated with the coefficients resulting from correlating flu mortality with both population density and health show an inverse relationship. Figure 3 shows a side-by-side comparison of mortality due to influenza in London for the three waves in years 1890,

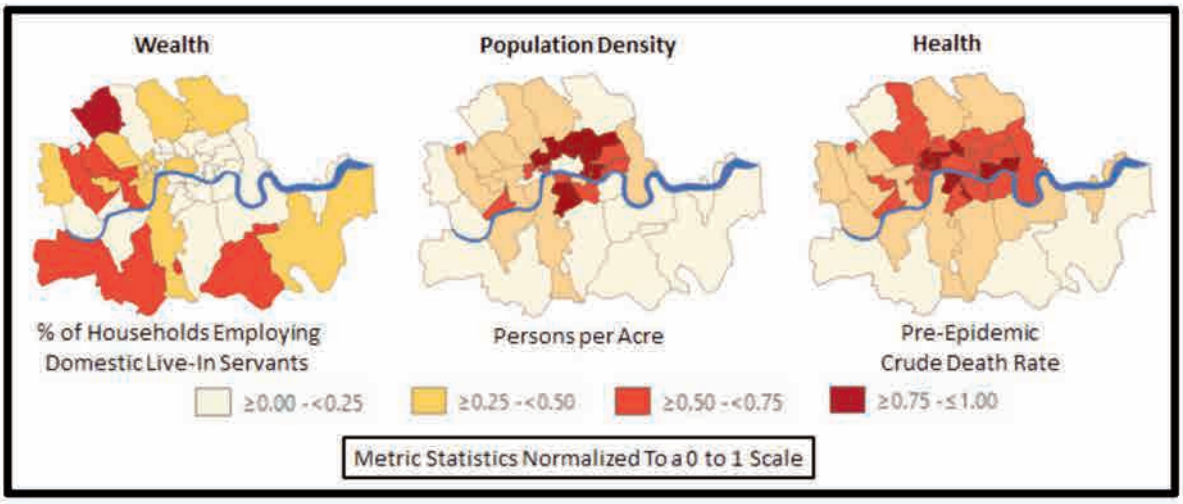

Figure 2. Wealth, health and population density metrics in the greater London area at the time of the Russian Flu.

Table 2. Pearson correlation coefficients comparing Sanitation District metrics with district influenza mortality.

Year	Wealth	Heath	Pop. Density
1890	ρ = 0.57339 p = 8.9042 x 10^{-5}	ρ = -0.19395 p = 0.22435	ρ = -0.20364 p = 0.20159
1891	ρ = 0.34596 p = 0.02672	ρ = -0.36731 p = 0.01815	ρ = -0.15171 p = 0.34371
1892	ρ = 0.36990 p = 0.01730	ρ = -0.30593 p = 0.05174	ρ = -0.26132 p = 0.09887

1891 and 1892. The statistic displayed represents the Sanitation District CDR data, normalized to a scale of 0 to 1. Sanitary District wealth is correlated with Sanitary District influenza mortality. The resultant Pearson correlation coefficients (ρ) are shown in Table 2. Also shown are the resultant Pearson coefficients when influenza mortality is correlated with the health and population density metrics. Lee's L statistic was used to determine the degree of spatial clustering between each Sanitary District's wealth metric and influenza mortality. Table 3 shows the calculated Lee's L from spatially comparing Sanitary Districts' wealth and influenza mortality. The ArcGIS Pro tool that calculates the Lee's L statistic also produces a map that shows where the two variables have similar spatial clustering with non-insignificant *p*-values. Figure 4 shows the areas that demonstrate similar spatial clustering for the three waves addressed in this study.

Discussion

From the standpoint of the present study the signage of the Pearson correlation coefficients is the most salient feature of Table 3. The positive coefficients of all three years' wealth coefficients signifies that higher Sanitation District wealth is directly associated with higher influenza mortality, contrary to the axiom that the wealthier are less subject to epidemic mortality than those less wealthy. The negative signs associated with the coefficients resulting from correlating flu mortality with both population density and health show an inverse relationship, contrary to conventional wisdom and supporting the findings of the wealth analysis.

This study's results clearly show that during the early 1890's the wealthiest Londoners suffered greater mortality due to the Russian Flu than those less wealthy. Admittedly the nineteenth-century mortality data do not conform to the rigor expected of twenty-first century collection and analysis practices and consequent calculations can be subject to scepticism; nevertheless, the

Table 3. Lee's Statistic correlating Sanitation District wealth metric with influenza mortality.

Year	Outcome
1890	L = 0.355886 p = 0.002
1891	L = 0.174732 p = 0.052
1892	L = 0.180702 p = 0.062

L, Lee's L Statistic; p, probability.

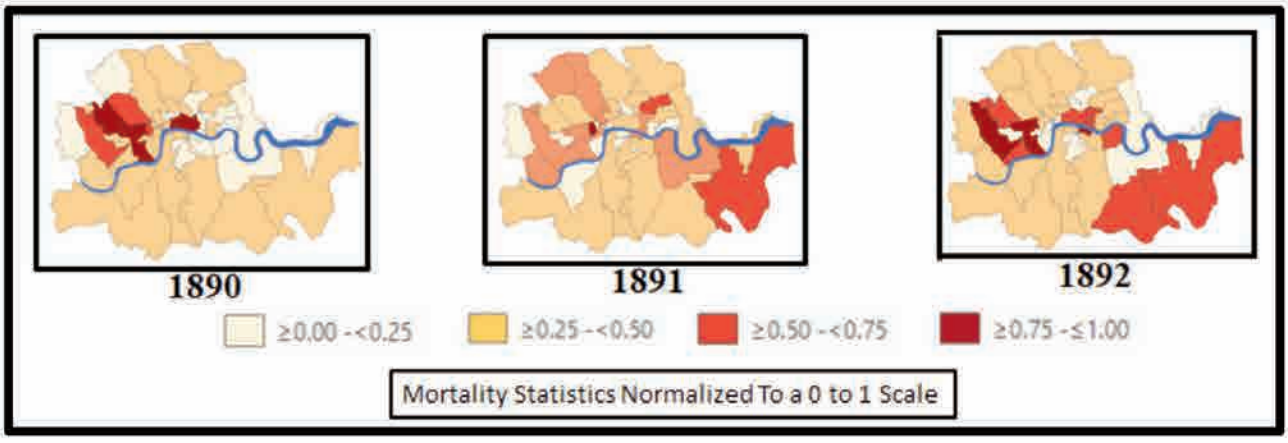

Figure 3. Side-by-side comparison of Sanitation District influenza mortality for each wave.

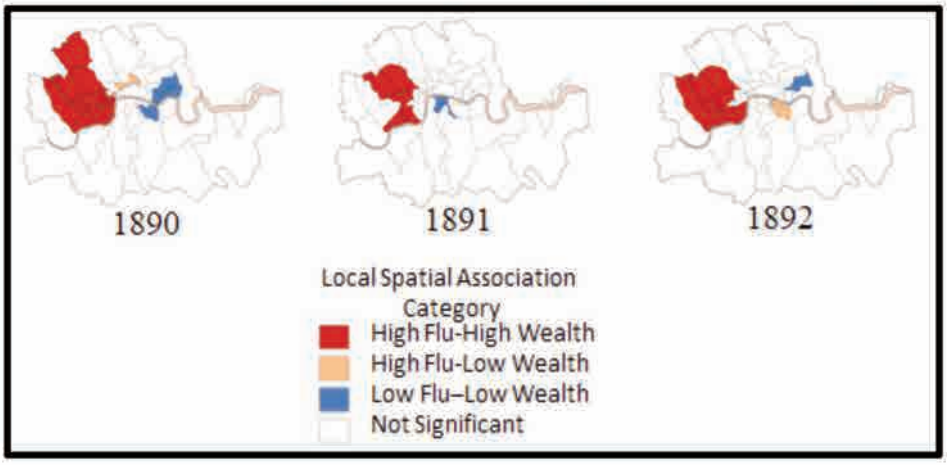

Figure 4. Spatial association (Lee's Statistic) of Sanitation District influenza mortality with each district's wealth metric.

results should not be dismissed out of hand. Indeed, this was the same conclusion that Parsons described in his 1893 report concerning London's 1892 wave (Parsons, 1893, p. 56), where he states:

"…it has been found that the quarters in which the mortality from Influenza have been the highest have been often those inhabited by the well-to-do classes and not the crowded and unhealthy quarters inhabited by the poor."

Parsons identified the Sanitation Districts that had experienced numerous influenza deaths in proportion to their populations during January and February 1892 – and those identified match the distribution shown in Figure 3 for 1892. He further identified those Districts primarily made up of a working-class population – closely matching the wealth distribution shown in Figure 2. The Lee's L Statistic results shown graphically in Figure 4 confirm Parsons' observations of the 1892 wave –that the areas of London traditionally thought of as 'wealthy' during the Victorian era are also the areas with the highest influenza mortality. If Lee's L had been available to Parsons he could perhaps have reached the same conclusions for the 1890 and 1891 waves.

Conclusions

The principal lesson from this Russian flu study – applicable to all levels of authorities-local, regional, and even national – is that epidemics do not always follow the expected paradigm. At the local level it is necessary to understand the local geography of wealth, poverty, population density and historical neighbourhood healthiness. This knowledge should be based on current conditions and updated regularly – as opposed to dated studies. Reports of how previous epidemics affected a locality are as important as knowledge of current conditions. Processes and infrastructure need to be in place and tested regularly to be able to monitor local disease spread – for example, hospital collaborators with a preplanned and established 'incident centre' – need to look for apparent deviations from the expected script. Similarly, historical information is required at the regional and national levels – to include anticipating needs such as sufficient levels of vaccine supply.

A study by Mamelund *et al.* (2021) determined that higher mortality was associated with lower socioeconomic status during the 1918 and 2009 influenza pandemics. The results of this essay's singular geographic analysis of London's Russian flu epidemic, although contrary to the 2021 meta-analysis findings still serve to confirm the importance of the meta-analysis' conclusion: "The social lessons from historical influenza pandemics…have not yet been taken into account in influenza pandemic preparedness…" (Mamelund *et al.*, 2021, p.21). This study shows that the relationship between lower economic status and mortality is not as straightforward as the conventional wisdom suggests.

The present study reveals an epidemiological anomaly; it does not, however, provide a reason why the wealthier suffered greater mortality than the less wealthy. The answer to that question is left for demographers to study further.

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Received: 4 August 2025; Accepted: 20 December 2025.

Availability of data and material: data analysed in this study are publicly available where indicated in the listed references.

Conflict of interest: the author declares that he has no competing interests.

Funding: none.