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## Review Article

## Back to the future: Covid-19 and the recurring debate over social determinants of disease, and health

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## ABSTRACT

Since the 1980s, a large literature has developed on the social determinants of health, primarily non-communicable diseases for which mortality and morbidity can be shown to change across a socioeconomic gradient. Primarily regional or national in focus, they are joined, today, with an increasing focus on international health and the effect of inequalities between nations effect disease generation and spread. Similar and earlier literatures first considered socioeconomic factors influencing disease incidence and intensity primarily at local and regional levels. One such literature was primarily “sanitarian,” focusing on general infrastructure needs (safe water, for example) to create a better health environment. A second, primarily nineteenth century literature focused on social inequalities and the epidemic diseases in specific populations. This paper seeks to review these separate foci and then combine them into a more comprehensive understanding of both the general and specific determinants of health and disease at local, national, and international scales of address. It notes that while disease dynamics have been long known that current literatures typically consider socioeconomic determinants at local, national, and global scales as a new phenomenon.

In recent decades increasing attention has focused on the social determinants of health (Gray, 1982), and resulting “afflictions of inequality” (Wilkinson, 1996, p. 226) that fall disproportionately on the least advantaged members of modern societies. Differences influencing physical well-being, and thus attendant risk to infectious disease, are generally understood to be economic, ethnic, geographic, and social attributes active at local, regional, national, and global scales of address (WHO, 1986). The majority of contemporary literatures typically correlate their prevalence with rates of relative mortality and morbidity resulting from non-communicable diseases like cancer, heart disease (Havranek, Mujahid, Barr, et al., 2015) and asthma in city neighborhoods located near highways and toxic waste sites (Kozol, 2012, pp. 148–150). More recently, the issue has been their relation, noted in various news articles, to relative risk for COVID-19, for example in nursing and long-term care homes (Cenziper & Jacobs, 2020).

During the 2020–2021 Covid-19 pandemic critical attention has been paid in the failure of officials in most jurisdictions to the recommendations in reports issued after the earlier, SARS pandemic in 2003. “Lessons learned”—and largely ignored—included the need for all levels of health governance to assure there would be adequate supplies of

personal protective equipment (PPE’s), ventilators, etc. (Clark & Sirleaf, 2021).

Neither those recommendations nor current governance focused on the role of socioeconomic factors in accentuating disease incidence in this or previous pandemics. Contemporary researchers often express a “need and demand for clear scientific evidence” to support policymakers and public health researchers in this area (Tsouros et al., 2003, 5). For them, the relation between disease incidence and socioeconomic status is a thesis so new as to require detailed substantiation. And yet there is a detailed and robust 19th century literature on the effect of socioeconomic inequality and disease incidence.

It therefore is no surprise that the conclusions and recommendations of the seminal 1980 *Black Report* correlating health and social inequalities in Great Britain, came “disconcertingly close to a recapitulation of the recommendations [Rudolph] Virchow made 130 years ago” (Taylor & Rieger, 1984, pp. 202–217). While *The Black Report’s* focus was on non-communicable conditions (heart disease, for example), Virchow’s landmark study of a ferocious typhus epidemic, and the incidence of other communicable diseases in Upper Silesia indicted systemic governmental failures for the epidemic (Brown and Fee, 2006).

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These included general health-related characteristics—adequate housing, nutrition, and a public health infrastructure—and their absence for a specific, disadvantaged and subjugated population.

The mid-nineteenth century was a period of widespread communicable disease: cholera, typhus, tuberculosis, etc. Perhaps because these literatures focused on them, data accumulated by nineteenth century reformers has been largely ignored in contemporary literatures on the socioeconomic determinants of typically non-communicable disease (Waitzkin, 1981). Similarly lacking has been a focus on general civic needs and the specific effects of income inequality on the general health of densely populated, under-served sub-populations.

A historical review offers the opportunity to merge current and historical literatures detailing the manner in which socioeconomic inequalities promote mortality and morbidity at every scale: local, national, and global. This paper thus provides a kind of Foucauldian archeology in which a history of public health and disease in general are reviewed and then joined to create a contemporary perspective (Foucault, 1972).

There is first a “pre-history” describing the traditional focus on general health determinants. The second focuses on a nineteenth century perspective describing the relationship between socioeconomic inequalities and the incidence of infectious disease. Finally, the last section relates these histories to the contemporary literature on social determinants of health. During the 2020–2021 Covid-19 pandemic the relation between social inequalities and disease incidence again became as important an issue as it had been in the mid-nineteenth century.

## 1. An early history

Hippocrates’s *Airs, Water and Places* was the first text to describe environmental conditions, natural and social, as general health determinants (Jouanna, 2012). That became the basis of a set of broadly sanitarian, primarily urban health initiatives. These would later include, for example, the Roman construction of aqueducts to assure a consistent and safe water supply; bathhouses to promote cleanliness; and support of public hospitals and physicians (Fee, 1993, xix).

Separately, in *Epidemics*, Hippocrates cataloged a set of infectious diseases and their symptoms, for example the “cough of Perinthus” which we now understand as influenza (Spinney, 2017, p. 13). Outside of his assumption that environmental factors generally influence health, and “unhealthy” places promote disease, he made little mention of epidemic events as a separate area of study. For their parts, Thucydides, Plato and Lucretius all similarly described plague outbreaks without attention to the mechanisms of their spread in specific populations (Ranger & Slack, 1992, pp. 31–36). Others in this early period described a range of non-communicable conditions adversely affecting the health of specific populations including, for example, slaves (Pliny), blacksmiths (Juvenal), and miners (Rosen, 1993, p. 99).

Fig. 1 thus in the historical period there were at least two distinct literatures. The first focused on general determinants of population health and that of specific sub-populations; the second documented the incidence of communicable diseases albeit without reference to their causes or the means by which they spread. Both literatures argued, or at least implied, an official responsibility to secure broad constituents of general population health (housing, water, sanitation).

Following the “Black Death,” and subsequent plague epidemics, the assignment of governmental responsibility for protection from and during an epidemic was broadened to include general measures to limit the import of infectious diseases (Kelly, 2005). By the fourteenth century state-directed, quarantine systems were employed regularly as a response by officials seeking to inhibit plague’s introduction by travelers from infected areas (Rosen, 1993, pp. 43–45). Local and national bureaucracies were created to oversee appropriate containment programs at principal ports as well as to assure proper burial of the dead and a general cleansing the city as a prophylaxis when epidemic diseases threatened (Porter, 1999).



Fig. 1. Holbein’s Dance of Death.

While the nature of plague and other infectious diseases was unknown their portability, country to country, with trade and travelers was assumed. This 1538 woodblock from Holbein’s *Dance of Death* shows death as a passenger on commercial sailing ships.

It was not plague, however, but yellow fever that forced eighteenth century physicians and public officials to consider more closely the relationship between social determinants of health and infectious disease incidence. The first “modern” scientific studies, those involving the testing of a hypothesis, attempted to correlate the relation between disease incidence and unsanitary refuse sites in New York City (Seaman, 1798).

The severity of outbreaks required the creation of local and regional health bureaucracies responsible for overseeing the collection and analysis of disease-related data to be employed in fashioning civil programs of public health and safety (Koch, 2011, pp. 83–86). Studies conducted during this period were, for the first time, published in medical journals and news reports empowered by new, less expensive and faster printing technologies. In 1798, for example, New York physician Valentine Seaman published in 1798 a seminal study of yellow fever in New York City and its relation to local waste sites, in *The Medical Repository*, the first American medical journal. His was the first paper to use maps as evidentiary tools in the study of an epidemic’s origins.

Because yellow fever was assumed to be miasmatic—originating in foul airs arising from unsanitary urban waste sites—sanitarian initiatives promoting clean streets and a safer urban water supply were promoted as means of eliminating “predisposing” conditions inviting epidemic occurrence. Thus the general ecology of Hippocrates’s *Air, Water and Places* was expanded to include epidemic diseases as well as more general issues of population health.

2. Nineteenth century: social medicine

In the first decades of the nineteenth century that perspective—bureaucratic and clinical—evolved to include a more general focus on socioeconomic conditions. In the early years of industrialization and increasing urbanization, French hygienists, for example, defined *les maladies* of industrialization, the abysmal living and working conditions of society’s least advantaged workers, as the cause of an increasing incidence of communicable diseases (typhus, tuberculosis, etc.). (Ackerknecht, 1948). Their arguments employed newly rigorous systems of cartographic and statistical analysis to parse increasing volumes of public data collected by expanded public health bureaucracies.

This new, approach became urgent as cholera spread from India in 1818 (Jameson, 1819) to the Middle East, Europe, Russia, and finally, in 1831, to Great Britain (Koch, 2011, pp. 83–86, Chapter Six). Following an 1838 typhus epidemic, Former British Poor Law commissioner Edwin Chadwick undertook a detailed survey of the state of public health in England. As a sanitarian, Chadwick was interested principally in the way urban cleanliness might limit disease incidence and thus protect and promote general public health. But he also detailed—cartographically and statistically—a relationship between mortality resulting from infectious *and* non-infectious diseases (for example, infant mortality) and socioeconomic status (Chadwick, 1843) (Fig. 2).

A supplement to his report included the testimony of physicians practicing among the poor who decried a variety of conditions (inadequate nutrition, poor housing, etc.) that encouraged chronic and infectious diseases like cholera, typhus, and tuberculosis among less advantaged populations (Hamlin, 1998, Ch. 6). Nor was he alone. In the early 1840s Scottish physician William Poultny Allison echoed the French hygienists in blaming the inequalities resulting from industrialism on generally high mortality and morbidity rates among the poorest members of society (Alison, 1811).

In a similar vein, Manchester’s Dr. John Ferriar argued that to prevent infectious ‘fevers’ (consumption, typhus, etc. the referent is somewhat unclear) officials needed to assure the health of lower class

citizens through a series of public initiatives including better housing (Hamlin, 1998, p. 73). Reformers argued that a failure to address these social constituents of disease represented a threat to the health of all. Outbreaks in poorer neighborhoods frequently spread to the communities of the well-to-do. As Ferriar put it: “The safety of the rich is intimately connected with the welfare of the poor ... minute and constant attention to their wants is not less an act of self-preservation than of virtue” (Hamlin, 1998, p. 70).

In 1845, Friedrich Engels similarly documented the relation between poverty and a range of communicable and non-communicable diseases—rickets, scrofula typhoid, tuberculosis—among workers in his father’s Manchester cotton-textile mills (Engels, 1953). Finally, in 1848 Dr. Rudolph Virchow completed his famous report for Prussian officials on a savage typhus epidemic in Upper Silesia (Virchow, 2006). In addition he cataloged a litany of ‘crowd’ or ‘artificial’ diseases—include dysentery, measles, and tuberculosis he described as the direct result of government neglect of at-risk populations (Taylor & Rieger, 1984, p. 204).

3. Results: economics and health

For some, like Poultny, the disease burden resulting from inequalities inherent in the emerging industrial society evidenced its failure: “If destitution, fever, and overpopulation were consequences of the creation of the industrial proletariat, then there must be something wrong with the system” (Hamlin, 1998, p. 82). Others like Chadwick saw higher incidences of mortality and morbidity primarily as a threat also to the nation’s economic and political well-being. If the poor were too ill to work, he argued, not only would they be unable to pay but unlikely to actively participate in the economic and political life of the nation.

Opposed to this perspective was one insisting health was a purely individual responsibility and promoting general economic growth, not the coddling of the poor, was the principle duty of government. As early as 1831 *Lancet* authors argued the introduction of cholera to Britain was



Fig. 2. Map Leeds Here Edmund Chadwick’s map of Leeds correlated the incidence of cholera and other infectious diseases with the relative wealth of individual districts. The result distinguished healthy and unhealthy neighborhoods based on rates of fertility (births), mortality and the presence of cholera and respiratory disease.

preferable to the costly effect on trade that protective quarantine programs would impose. If political economy was to reign supreme then public funds might best be deployed, if at all, solely for general sanitarian measures improving the health potential of the city-at-large (cleaner streets, better water supply) rather than attention to the socioeconomic contributors to ill health among the poor.

The 1859 publication of Charles Darwin's *On the Origin of the Species* seemed to give scientific credence to those favoring what later would be called Social Darwinism and its neoliberal focus on economic growth rather than population health. Individual responsibility rather than communal care was the new focus of state policies (Claeys, 2000). The symbol of the age became *Ragged Dick*, Horatio Alger's 1868 young bootblack who persevered in his largely unaided climb from poverty to middle-class respectability. The message was clear: individuals might rise above their origins if they had the grit and resolve to do so. It was not for society to reward a lack of initiative or the simple bad luck of those who fell ill along the way.

All this has a thoroughly modern ring. Contemporary neoliberal economics similarly insists upon if not a *laissez-faire* approach to public health needs then what Spark calls an *aidez-faire*, limited focus that at best grudgingly accepted only broadly sanitarian rather than social reformist objectives (Sparke 2020).

#### 4. Social determinants of health: back to the future

In the first decades of the twentieth century social reformers presented a series of attempts to address the socioeconomic limits that promoted disease in immigrant populations. Here, for example, were the settlement initiatives of Jane Adam's Hull House in Chicago and Canon Samuel Barnett's Toynbee Hall in England. In large part because of social reformers, a general improvement in living conditions—diet, public education, housing, etc.—led to a national decrease in mortality and increased longevity in the general population. Beginning with the discovery of insulin and then of penicillin in the 1920s a newly robust clinical pharmacopeia similarly contributed to increased longevity and decreased morbidity in most industrialized populations. The continued success mid-century of new antibiotics and vaccines (especially for poliomyelitis) suggested the threat of infectious disease, excepting perhaps the annual influenza pandemic, had been largely contained.

##### 4.1. Wilkinson and the Black Report

It therefore is not surprising that British researcher Richard Wilkinson's famous open letter in 1976 to the British Secretary of State for Social Services, David Ennals, focused on non-communicable diseases (Wilkinson, 1976). In response to Wilkinson's detailed description of adverse health effects (diabetes, hypertension, heart attacks) correlated with systemic socioeconomic inequality, Ennals commissioned a report by Sir Douglas Black whose 1980 *Inequalities in Health* described a broad, inverse relationship between socioeconomic status, on the one hand, and on the other, mortality/morbidity resulting primarily from non-infectious diseases (Black, 1980).

A series of subsequent studies (for example, the 1998 *Acheson Report*) detailed with remarkable consistency the unequal non-infectious disease burden among those in lower compared to more wealthy socioeconomic strata. Begun in a period of relative political liberalism, the *Black Report* was received only grudgingly by then recently elected, Prime Minister Margaret Thatcher's new Conservative government. While acknowledging the report's findings, Ennals' successor rejected out of hand its recommendations for redress as impossible given the economic priorities of the nation (Jenkin, 1980). Thatcher's neoliberal agenda, like that of Ronald Regan in the United States, was general economic advancement measured by indices like gross national product (GDP) and trade balances. The assumption was that improving economies through privatization and a focus on corporate enablement would naturally lead to increasing support for all peoples, including the poor. "Investment"

aimed at reducing social inequalities was at best a very hard sell for those seeking to reduce structural social inequalities (Kim, 2018b).

##### 4.2. Modern epidemics

In the 1980s a series of new communicable diseases began to emerge. First was HIV/AIDS in the 1980s; In 2002–2005 it was Severe Acute Respiratory Disease (SARS). That was followed by the Middle East Respiratory Syndrome (MERS); Ebola in West Africa in 2014–5; and most recently COVID-19. Simultaneously there was a resurgence of previously controlled, communicable diseases with new microbial generations resistant to existing, previously effective treatments.

It became increasingly difficult to ignore the relationship between socioeconomic disadvantage and communicable diseases like HIV/AIDS and tuberculosis (Gould 1993; Wallace et al., 1995). Similarly, Hoetz (2007) drew attention to the socioeconomic determinants of "neglected tropical diseases" primarily affecting migrant and poorer workers in the southern U.S. states. A literature that once had focused upon the social determinants of non-communicable diseases expanded to include new classes of infectious diseases. Central to these concerns was a focus on housing deficits, low income for marginal works and a general lack of adequate healthcare.

While nineteenth century literatures focused primarily on national disease incidence and only secondarily on global diffusion, a new global perspective on the "global disease burden" has emerged in recent years. It is not simply that this or that bacterium or virus originated in Africa (Ebola), China (SARS-Cov-2), Mexico (H1N1 Influenza), or the Middle East (MERS). Rather, that poverty and socioeconomic imbalances are critical determinants in the evolution of new microbial disease challenges at global as well as national, regional, and local scales. Environmental degradation (including deforestation), limited investments in national and international health infrastructures and the ills resulting from poverty (dense and substandard housing, poor nutrition, limited medical care, etc.) were all identified as factors influencing microbial evolution and disease spread. Where the nineteenth century focus was local, and regional, the new focus included the failure of international health infrastructures and international as well as national inequalities.

The 2014 Ebola epidemic in West Africa, to take one example, resulted in part from the degree to which local conditions—environmental and socioeconomic—promoted the evolution and diffusion of a potentially fatal microbial agent (Koch, 2016). These included overfishing by EU nations that drove up the cost of fish in West Africa and thus forced a greater reliance on "bush meat" (bats) by local peoples. The resulting regional epidemic affected first, rural peoples with few health resources and then city populations, and especially the least advantaged among them.

The result threatened a global pandemic that was feared but did not result. Ferriar's warning that disease among the poor would easily spread to the well-to-do in nineteenth century Britain become in the twenty-first century a warning of the likely spread of disease from poorer to richer nations. The earlier focus on local challenge and the socioeconomic determinants of disease was thus transposed into a problem of global exchange and interchange.

#### 5. Discussion

This archeology of social responses to epidemic disease, and to the social constituents of disease reveals a surprisingly consistent, recurrent pattern. First, there is the recognition from the Middle Ages to the present day that epidemic diseases represent a national threat, economic and social, requiring an active and comprehensive governmental response. Early on, the focus was on quarantines to prevent the introduction of infectious disease or, if present, to manage its worse effects. Bureaucratic responsibilities included the creation of lazarettos, the burial of corpses, and a focus on urban cleanliness as a possible prophylaxis. In feudal states this was the obvious responsibility of the

Crown which delegated authority to one or another official. Today the need to protect populations from invasive bacterial or viral events, and assure care in the event of an epidemic, remains a function of the state, democratic or authoritarian.

Since the plague years of the Middle Ages a first response was isolation and quarantine, isolating areas of epidemic activity and preventing disease introduction from abroad. The assumption was that plague, and later other infectious diseases (cholera, typhus, yellow fever, cholera, etc.) were transported from place to place by trade and travelers. That thesis became demonstrable in the early 1830s when cholera pandemic's progression was mapped along the world's trade routes (Brigham, 1832). By the twenty-first century the manner in which Covid-19 spread was similarly mapped in relation to airline and cargo ship traffic (Bogoch et al., 2020).

Similarly constant across the long history of epidemic and pandemic events has been the observation that disease incidence is always higher among less advantaged citizens. This was true during the plague years when the wealthiest citizens tended to flee the city for country homes and more certainly asserted in both yellow fever and cholera epidemics. The correlation of disease intensity among disadvantaged compared to advantaged neighborhoods was a recurring theme of nineteenth century studies of cholera incidence in individual cities. (Koch, 2011, pp. 83–86; 2017). Investigators like Chadwick (1843) employed new cartographic and statistical methods to highlight the relation between socioeconomics and disease occurrence based on increasingly robust public health statistics. Thus in a "Sanitary Map of the town of Leeds," he employed official mortality records and basic statistics to demonstrate the relatively higher incidence of mortality in the poorer districts

relative to more affluent wards.

And again, during the current epidemic, the relation between socioeconomic criteria and disease intensity has been a recurrent subject of a number of primarily local and regional studies (O'Dowd, 2020). In Toronto, Canada, for example, the relative risk of Covid-19 per 100,000 persons was shown to be higher in lower income neighborhoods (Wallace and Winsa 2020). At the national level, a recent US study analyzed and documented the effect of structural barriers and racial inequalities on disease prevalence and severity in the current pandemic. It found infection and mortality rates were negatively influenced by a range of socioeconomic determinants of health (SDOH) including, in a partial list, income disparities, related housing density, more limited access to health care, and a rural-urban divide. In summary, the authors concluded that, as others have since the mid-nineteenth century, "SDOH [social determinants of health] dimensions matter for health outcomes" (Qinyun, Paykin, Halpern et al., 2022, p. 13).

In this vein, the US Covid Atlas team has expanded to include a Community Advisory Board focused on "the complex topic of the Social Determinants of Health (SDoH) and its many intersections with the pandemic across populations" (theuscovidatlas.org). Its maps include a precise location of more and less vulnerable communities based on the evolving data (Fig. 3).

A focus in this pandemic has been the recognition that internationally as well as nationally "current institutions, public and private, failed to protect people from a devastating pandemic" (Clark & Sirleaf, 2021, 5). These failures included a lack of national health services and infrastructure exacerbated by a pattern of "blatantly unjust and not strategic" vaccine distribution to poorer nations. Covid-19's 'disproportionate

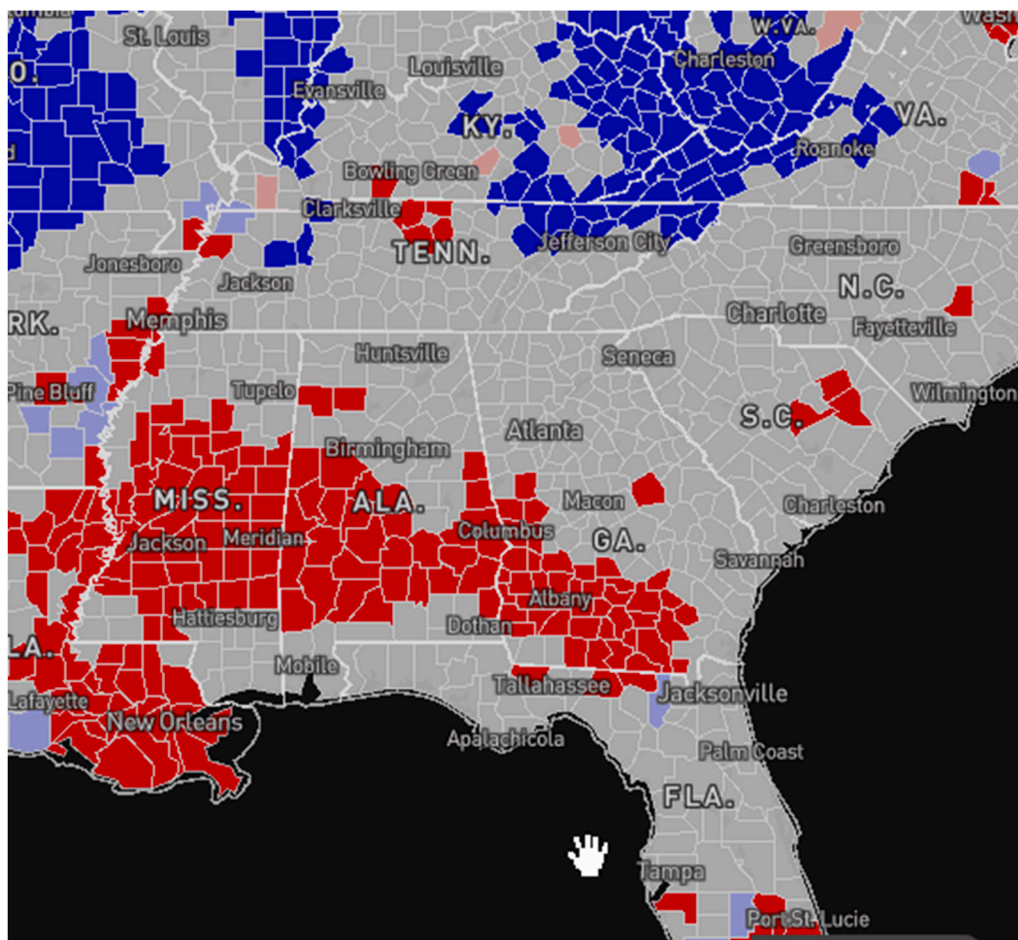


Fig. 3. This map of medically underserved US counties with higher rates of Covid-19 infection included, in data for each county, details on ethnicity, income, and employment.

socio-economic impact” on those more isolated nations resulted not only in increased disease mortality but a widening of preexisting inequalities that were themselves factors influencing severity of disease incidence.

### 5.1. Cartographies of disease

Since the late seventeenth century maps have been a constant tool “enabling the governmental ordering of the neighborhood, the city, the state, and the planet” (Wilson 2017, ix) in relation to disease incidence and its probable cause. The earliest such maps were summaries of bureaucratic programs to contain infectious events through programs of quarantine and supervision of infected areas. Filippo Arrieta’s maps of plague containment in Bari, Italy, are the oldest known example (Arrieta 1694). In them he described a complex system of interlocking barriers that sought to both prevent cholera from entering by maritime travel and to both contain it in cities where it was active and to prevent entry to others where it had yet to present (Fig. 4).

At the end of the eighteenth century, evidentiary maps were employed to test theories of disease causation by correlating disease prevalence and biogeographic or socioeconomic factors. Earliest among these were the copperplate maps of Valentine Seaman testing a probable relation between yellow fever and local sites of odiferous waste (1798). From the 1830s through the 1870s there were scores of maps describing the incidence of cholera in neighborhoods, countries, and as globally (Koch, 2014, 64–71). In this period many mapped the socioeconomic disparities effecting both disease incidence in cities and nationally. Others mapped disease transfer along rail, road, and shipping routes.

The development of syndromic systems of international data collection has permitting the increased emphasis on the global pattern of disease incidence in relation to broadly comparable socioeconomic characteristics. This focus on “global health,” maps a traditional focus on local or regional disease determinants in this or that nation to inform global patterns of infectious disease expansion (GBD 2020). Where in earlier centuries maps merely described the global progression of some diseases (plague, yellow fever, cholera, etc.) along trade and travel networks, contemporary work asserts the responsibility of richer nations to those that are poorer and have served as incubation sites for new bacterial or viruses.

Thus one may see, map to map, the current pandemic as not simply “the worst combined health and socioeconomic crisis in living memory”

(Clark & Sirleaf, 2021, Preface) but from history’s perspective merely the latest disease event whose unequal address has highlighted social inequalities and structural limits of healthcare and healthcare planning at every scale, local to international. What is unknown is whether this will result in any substantive change in the support of disadvantaged nations, and communities within other nations, or remain merely a datum that is not incorporated into plans for substantive change.

### 6. Conclusion

The relationship between health and local determinants began with the Hippocratic idea of health and unhealthy places defined by socio-economic and biogeographic characteristics. These ideas were the underpinning of a sanitarian perspective that dominated thinking about various diseases through the Middle Ages into modern times whenever an epidemic occurred. Time and again, the progress of a bacterial or later viral pandemic would raise concern over the degree to which local programs and policies encouraged or retarded this or that epidemic. Beginning in the nineteenth century the characteristics influencing epidemic incidence came to include a range of socioeconomic as well as biogeographic criteria including, in a partial list, education, ethnicity, housing density and relative wealth.

In the last century the social determinants of disease arose as an independent literature focused primarily on non-communicable disease states and relative poverty and its effect. More recently this perspective has broadened during a series of epidemic and pandemic events to include a global perspective on the relative burden of specific diseases and the socioeconomic characteristics that promote them. It is an old story, in other words, but one renewed each time with new urgency whenever a pandemic threatens.

Contemporary researchers predict the global introduction of an unknown pandemic pathogen, “Disease X,” with high mortality in the near future (WHO, 2017). Its origins almost certainly will be—as were Ebola, SARS, MERS, and COVID-19—in countries distinguished by high density, low income and limited health structures. As it spreads its severity will reflect, as has COVID-19 and its predecessors, disparities in health structures at every level. To prepare for it will require a unified, global system of preparedness “that is coordinated, connected, fast-moving, accountable, just, and equitable” (Clark & Sirleaf, 2021, 4.).

Even were that created—and the underfunding of the WHO and



Fig. 4. This 1690s map of the containment fields introduced by Filippo Arrieta to contain and control the spread of cholera in Bari, Italy is the oldest disease map so far recover. It presented a complex and interlocking system of containment fields provincially and among city areas in the province.

other international health agencies makes it unlikely—pandemic preparedness will be an inadequate response to bacterial or viral infectious events unless individual governments create systems of local, national, and especially international health governance capable of addressing the socioeconomic features that promote endemic and epidemic diseases. It is not a new conclusion although it's global emphasis today might make it seem to be so. It is the old argument of those like Ferriar, earlier quoted, and Virchow, who by the mid-nineteenth century argued that, on the evidence of the day, that inadequate and unequal socioeconomic conditions promoted this or that infectious disease and its potential for regional, national, and international transmission.

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### References

- Ackerknecht, E. H. (1948). Hygiene in France, 1815-1848. *Bulletin of the History of Medicine*, 22(2), 117–155.
- Alison, W. P. (1811). *The management of the poor in Scotland and its effects on the health of Great towns*. Edinburgh: William Blackwood and Sons. <https://archive.org/details/observationsonma00alisrich/page/n6>.
- Arrieta F. *Ragguaglio storico del contagion occorso della provincial de Bari negli ani 1690, 1691, e 1692*, Naples: Dom. Ant. Apparrino e Michele Luigi Mutii.
- Black, D. (1980). *Report of the working group on inequalities in health*. London: Stationary Office. [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/265503/ih.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/265503/ih.pdf).
- Bogoch, L., Watts, A., Bachli, A., et al. (2020). Potential for global spread of a novel coronavirus from China. *Journal of Travel Medicine* taaa011. <https://doi.org/10.1093/jtm/taaa011>. <https://academic.oup.com/jtm/advance-article/doi/10.1093/jtm/taaa011/5716260>
- Brigham, A. (1832). *A treatise on epidemic cholera: Including an historical account of its origins and progress to the present period*. Hartford: H and F.J. Huntington.
- Cenziper, D., & Jacobs, J. (2020). Nursing numbers. *Investigative Reporters and Editors Journal*, 43(4), 28–31.
- Chadwick, E. (1843). *Report on the sanitary condition of the labouring population of Great Britain*. London: R. Clowes & Sons, for Her Majesty's Stationery Office. [https://archive.org/stream/reportonsanitary00chadrich/reportonsanitary00chadrich\\_djvu.tx](https://archive.org/stream/reportonsanitary00chadrich/reportonsanitary00chadrich_djvu.tx).
- Claeys, G. (2000). The "survival of the fittest" and the origins of social darwinism. *Journal of the History of Ideas*, 61(2), 223–240. [https://www.researchgate.net/publication/n/236750078\\_The\\_Survival\\_of\\_the\\_Fittest\\_and\\_the\\_Origins\\_of\\_Social\\_Darwinism](https://www.researchgate.net/publication/n/236750078_The_Survival_of_the_Fittest_and_the_Origins_of_Social_Darwinism).
- Clark, H., & Sirleaf, H. (2021). Co-chairs. Covid-19: Make it the last pandemic. The independent panel for pandemic preparedness. [https://theindependentpanel.org/wp-content/uploads/2021/05/COVID-19-Make-it-the-Last-Pandemic\\_final.pdf](https://theindependentpanel.org/wp-content/uploads/2021/05/COVID-19-Make-it-the-Last-Pandemic_final.pdf).
- Engels, F. (1953). *Preface to the English edition. The condition of the working class of england, trans. Andy blunden*. Moscow: Progress Publishers. <https://www.marxists.org/archive/marx/works/1892/01/11.htm>.
- Fee, E. (1993). Public health, past and present: A shared social vision. In G. A. Rosen (Ed.), *History of public health* (Expanded Edition). Baltimore: Johns Hopkins Press (xix).
- Foucault, M. (1972). *The archeology of knowledge and the discourse on language*. A. M. Sheridan Smith, trans. NY: Pantheon books. [https://monoskop.org/images/9/90/Foucault\\_Michael\\_Archaeology\\_of\\_Knowledge.pdf](https://monoskop.org/images/9/90/Foucault_Michael_Archaeology_of_Knowledge.pdf).
- GBD. Global and regional burden of chronic respiratory disease in 2016 arising from non-infectious airborne occupational exposures: a systematic analysis for the Global Burden of Disease Study. (2020). Occupational chronic respiratory risk Factors collaborators, 2016 *Occupational and Environmental Medicine*, 77, 142–150 <https://oem.bmj.com/content/77/3/142>.
- Gray, A. M. (1982). Inequalities in health. The Black report: A summary and comment. *International Journal of Health Services*, 12(3), 349–380.
- Hamlin, C. (1998). *Public health and social justice in the age of Chadwick: Britain, 1800-1854*. NY: Cambridge University Press.
- Havranek, E. P., Mujahid, Donald, A., Barr, D. A., Blair, I. V., et al. (2015). Social determinants of risk and outcomes for cardiovascular disease. *Circulation*, 132, 873–878. <https://doi.org/10.1161/CIR.0000000000000228>
- Hoetz, P. (2007 (12 Dec.)). Neglected diseases and poverty in "the other America": The greatest health disparity in the United States? *PLOS Neglected Diseases*. <https://doi.org/10.1371/journal.pntd.0000149>
- Jameson, J. (1819). *Report on the epidemic cholera morbus, as it visited the territories of the presidency of Bengal .... E Balfour*. Government Gazette Press.
- Jenkin, C. P. (1980). *Forward. Report of the working group on inequalities in health*. London: Stationary office. <https://www.sochealth.co.uk/national-health-service/public-health-and-wellbeing/poverty-and-inequality/the-black-report-1980/black-report-for-eword/>.
- Jouanna, J. (2012). Water health, and disease in the hippocratic treatise airs, waters, places. Trans. neil allies. In P. Van der Eijk (Ed.), *Greek medicine from Hippocrates to Galen* (pp. 155–172). Boston: Brill. [https://www.jstor.org/stable/10.1163/j.ctt1w76vvr.14?refreqid=excelsior%3A18169ea1c92c0fe2f560f6b8b20db5f8&seq=1#metadata\\_info\\_tab\\_contents](https://www.jstor.org/stable/10.1163/j.ctt1w76vvr.14?refreqid=excelsior%3A18169ea1c92c0fe2f560f6b8b20db5f8&seq=1#metadata_info_tab_contents).
- Kelly, J. (2005). *The Great mortality*. NY: Harper Collins.
- Kim, J. Y. (2018b). The human capital gap: Getting governments to invest in people. *Foreign Affairs*, 97(4), 92–10.
- Koch, T. (2011). *Disease maps: Epidemics on the ground*. Chicago: University of Chicago Press.
- Koch, T. (2014). Hubris: The recurring pandemic. *Disaster Medicine and Public Health Preparedness*, 9(1), 51–63. <https://doi.org/10.1017/dmp.2014.107>
- Koch, T. (2016). Ebola in West Africa: Lessons we may have learned. *International Journal of Epidemiology*. <https://doi.org/10.1093/ije/dyv324>
- Koch, T. (2017a). *Cartographies of disease: Maps, mapping and medicine* (Expanded Edition). Redlands, CA: ESRI Press.
- Koch, T. (2017b). *Ethics in everyday places: Mapping moral stress, distress, and injury*. Cambridge: MIT Press.
- Kozol, J. (2012). *Fire in the ashes: Twenty-five years among the poorest children in America*. NY: Crown Pub.
- O'Dowd, A. (2020). Covid-19 pandemic is magnifying healthcare inequalities, says England's regulator. *BMJ*, 371, m4035. <https://doi.org/10.1136/bmj.m4035>
- Porter, S. (1999). *The Great plague*. Gloucestershire UK: Sutton Pub. Limited.
- Qinyun, L., Paykin, S., Halpern, D., et al. (2022). Assessment of structural barriers and racial group disparities of COVID-19 mortality with spatial analysis. *JAMA Network Open*, 5(3), Article e220984. <https://doi.org/10.1001/jamanetworkopen.2022.0984>
- Ranger, T., & Slack, P. (1992). *Epidemics and Ideas: Essays on the historical perception of pestilence*. Cambridge: Cambridge University Press.
- Rosen, G. (1993). *A history of public health* (Expanded edition). Baltimore: Johns Hopkins University Press.
- Seaman, V. (1798). Inquiry into the cause of the prevalence of hellow fever in New York. *Medical Repository*, 1, 314–322.
- Spinney, L. (2017). *Pale rider: The Spanish Flue of 1918 and how it Changed the world*. NY: Public Affairs.
- Taylor, R., & Rieger, A. (1984). Rudolf Virchow on the typhus epidemic in upper Silesia: An introduction and translation. *Sociology of Health & Illness*, 6(2), 201–217. § 204.
- Tsouros, T. F., Wilkinson, R., & Marmot, M. (Eds.). (2003). *Social determinants of health: The solid facts*. Geneva: World Health Organization, 5.
- Virchow, R. C. (2006). Report on the typhus epidemic in upper Silesia. *American Journal of Public Health*, 96(5), 2102–2105. PMID: PMC1698167.
- Waitzkin, W. (1981). The social origins of illness: A neglected history. *International Journal of Health Services*, 11(1), 77–103.
- Wallace, R. D., Wallace, H., Andrews, R., & Fullilove, M. (1995). The spatiotemporal dynamics of AIDs and TB in the New York metropolitan region from a socioeconomic perspective. Understanding the linkages of central city and suburbs. *Environment & Planning A*, 27, 1085–1108.
- Wallace, K., & Winsaw, P. (2020 (Oct. 30)). Ontario could be on course for 1,700 new COVID-19 cases a day. Use this interactive map to figure out where your risk is highest in Toronto. *Toronto Star*. <https://www.thestar.com/news/gta/2020/10/30/how-risky-is-a-get-together-in-toronto-right-now-in-some-scenarios-theres-a-25-chance-covid-19-will-be-a-guest-at-the-party.html>.
- WHO. (1986). *The ottawa charter for health promotion*. Geneva: World Health Organization. <https://www.who.int/healthpromotion/conferences/previous/ottawa/en/>.
- WHO. (2017). *Prioritizing diseases for research and development in emergency contexts*. Geneva, Switzerland: World Health Organization. <https://www.who.int/activities/prioritizing-diseases-for-research-and-development-in-emergency-contexts>.
- Wilkinson, R. (1976 (Dec. 16)). *Dear David Ennals*. New Society. <https://www.sochealth.co.uk/national-health-service/public-health-and-wellbeing/poverty-and-inequality/the-black-report-1980/the-origin-of-the-black-report/dear-david-ennals/>.
- Wilkinson, R. G. (1996). *Unhealthy societies: The afflictions of inequality*. NY: Rutledge.
- Wilson M.W. New lines: Critical GIS and the trouble of the map. Minneapolis, MN.