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Public Health

Disease and Epidemics

"*Without exaggeration, I may assert that, so far as trade and commerce are concerned the plague has assumed the importance of an unexampled calamity*." Sir William Robinson, British Governor of Hong Kong describing the 1894 Bubonic plague outbreak in the city.

The spread of acute diseases, epidemics, and pandemics has been a significant component of urban history. Epidemics are defined as the widespread occurrence or presence of an infectious disease in a community at a particular time. Epidemics that spread over several countries or continents and affect many people can be defined as pandemics. They both have caused public health stresses and crises and significant debate and rethinking of city form and function. The COVID-19 pandemic has been only the most recent example of this since its initial outbreak in the early months of 2020. The virus spread rapidly around the world first impacting especially hard global urban transportation hubs and then urban areas generally. During the early days of the pandemic, the structure and social organization of cities were often described by experts as influencing both speeding up or slowing down the spread of the disease and capacity to effectively respond to it. In general, it is now clear that populations in heavily urbanized areas were no more at risk to COVID than those in rural areas and in many cases had greater capacity to respond than rural communities (Han et al. 2023; Wu, Wei, and Liu 2023).

7.1 Basic of Urban Disease and Epidemics

The earliest written account of a disease spread in a city comes from parts of Thucydides' *History of the Peloponnesian War*, during which the Spartan

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army invaded and devastated Athens in the year 430 BC. While the invasion led to significant losses for Athens, a simultaneous plague pandemic caused greater loss of human life. In the summer of 430 BC, plague killed nearly a third of the Athenian population and severely disrupted the social structure and governance capacity of Athens, leading to its eventual decline as a major power. In his account, Thucydides writes, [2.47.3] "Not many days after their [the Spartans] arrival in Attica the plague first began to show itself among the Athenians. It was said that it had broken out in many places previously in the neighborhood of Lemnos and elsewhere [including through Piraeus, the city's port and sole source of food and supplies]; but a pestilence of such extent and mortality was nowhere remembered."

The disease spread especially quickly because of a defense strategy pursued that included a policy of retreat within the Athens city walls. This policy resulted in the massive in-migration of the rural inhabitants into the already densely settled city, generating immediate heightened densities and resource shortages. Athens in turn became a breeding ground for disease as a result of the close quarters and poor hygiene. Debate still persists as to what pathogen caused the disease outbreak, and like many ancient events, lack of scientific knowledge hampers analysis of such moments.

As long as there has been illness and disease, there have been explanations regarding how and why people became ill and how the illness was spread. The historiography of disease is rich and varied. Disease trajectories, infections, and responses in human history have been associated with biological, cultural, historical, and socio-structural (e.g., class divisions) factors. Premodern or nonwestern societies used a wide diversity of disease explanations and methods to combat outbreaks. The science of disease has advanced significantly with the development and expansion of germ theory, transforming the understanding of diseases.

Germ theory states that affected individuals are exposed to a common pathogen agent. Illness emerges when germs (i.e., pathogens) invade a host and their growth and reproduction manifest as disease. Diseases caused by pathogens are defined as infectious diseases. A wide range of pathogens exist, including bacterium, protists (i.e., fungi), viruses, prions, and viroids. Several key pathways for transmission exist, including via airborne, water, animal hosts, surfaces, and person to person. Germ theory first proposed in the sixteenth century to describe the process of illness was not fully accepted in scientific and medical communities until the second half of the nineteenth century.

A wide range of other medical theories of disease predated the now widely accepted germ theory. The essence of these theories was that the disease took hold through the airborne transmissions emerging from contamination, rot,

and decay. Before the advent of germ theory, miasma theory was dominant in western medicine. Miasma was associated with poisonous vapors or mists that presented as airborne particles that emerged from poor hygiene, foul air, and contaminated water. In general, under this approach, disease transmission was largely seen as limited to individual exposure to the environmental sources and not person-to-person transmission. Keeping clean, removing trash and other waste, and avoiding fouled water were significant modes for preventing disease.

The interconnection between disease outbreaks and prevention and urban form is complex. This interaction has had significant impacts on the construction and layout of cities and the everyday life of residents. The narrative that links population density and the increased likelihood of disease transmission is deeply embedded in the history of cities. When disease or illness strikes a locale, the tendency has been to move away or relocate to diminish exposure. In early New York, the wealthy of the city would regularly leave during the summer to avoid the heat and disease outbreaks that often struck the city during those months. With the occasional major disease outbreak, an even larger segment of the population would evacuate the city. In the early decades of the nineteenth century during especially harsh epidemics, nearly half of the city's population left the city for outlying rural areas (Thomas 2005). Mimicking past events, during the height of the initial COVID-19 wave in spring and summer 2020, hundreds of thousands of Manhattan residents, mostly wealthy, left their homes for exurban locations or more distant sites. A vast majority of commuters also stopped coming into Manhattan. By 2021, many residents relocated and the US Census Bureau estimated that between July 1, 2020, and July 1, 2021, Manhattan (New York County) saw a population decline of 6.9% (US Census Bureau).

Epidemic and pandemic outbreaks are associated with acute trauma in cities. The prospect of disease also has significant long-lasting impacts on cities and their form. For example, wealthy citizens of cities have long sought to separate themselves from the poor and underclasses in part to avoid exposure to disease and other risks. Early twentieth-century work by geographers and urban planners consistently highlighted the presence of high-income residential neighborhoods as a fixed element of contemporary urban form. The logic of suburban development in the same way was also a mechanism to distance wealthier or more advantaged residents from the congestion, pollution, crime, and risks associated with high-density urban life. White flight with its massive relocation of white urban residents to the suburbanizing edges of cities in the United States, while including a significant racist element, was largely framed around allowing these residents to avoid the ills of urban life (Frey 1979; Trounstine 2018).

The control of urban space to avoid illness also focused on removing "natural" sources of disease. The draining of swamps and removal of wetlands is the most storied example of this phenomenon. The connection between swamps and malaria goes back thousands of years. In ancient Rome, city planners and managers actively drained swamps to eliminate malaria (Sallares 2002). In Middle Age Europe, local rulers believed marshes to be source sites of plagues and incurable fevers, and that the marshes should be avoided or destroyed. Cities in nineteenth-century Europe and North America aggressively drained local wetlands and swamps, and increasingly so as scientific evidence in the late nineteenth century conclusively proved that mosquitoes, which breed in marshes, were the disease vector of malaria.

Another method to reduce the threat of disease comes in separating humans from animals. In many societies, animals have been seen as a source of disease. Across many US cities in the nineteenth century, municipal ordinances were put into place to remove farm animals from city limits. These actions connected the emerging planning profession with the growing understanding of the public health requirements for a hygienic and sanitary city. These efforts focused on disconnecting animal agriculture and husbandry from the urban food supply, waste management, and public space (Brinkley and Vitiello 2014). Charles Dickens visiting New York in 1842 was aghast by the number and size of pigs wandering the streets of the city (Muzzio 2018). As the connection between animals, especially mice and rats, and disease became better understood, the ambition to remove farm animals and eliminate rats, mice, and other vermin accelerated.

While disease outbreaks by definition cause significant social and personal hardship and loss, the short-term and long-term economic impacts of disease have also been extremely significant. Epidemics and pandemics force the everyday rhythm of life to be interrupted. The typical modes of economic exchange are significantly altered and often can be literally shut down. As an example, during the periods of three well-documented plague pandemic outbreaks (centered around the years 541, 1347, and 1894), the businesses of cities were shut down, trade declined or stopped, workers died or fled, and the decision-making processes were disrupted. The significance of these events led to the collapse of economic activity, which often lasted for years. The recent COVID-19 pandemic is another illustration of these conditions.

Disease outbreaks can have even more profound and longer-lasting impacts as in the example of Athens, Greece, described earlier. The story of the 1793 yellow fever outbreak in Philadelphia – the US capital at the time – is particularly sobering. The outbreak started in early August and disappeared by November, but during that time approximately 5,000 people died (out of a

population of about 50,000). Half of the population fled the city, most businesses were shut, and federal officials left the city virtually shutting down the US government. Though the city was able to recover quickly with the autumn frosts killing the mosquitoes, which were the disease vector, yellow fever outbreaks occurred again in 1794, 1796, 1797, and 1798. Each episode brought further economic trauma to the city and contributed to it giving up its status as the nation's financial capital to New York, a position it never regained. In general, the small, dense cities of the new country seemed to be incapable of stopping these recurring outbreaks. Politicians, reformers, and intellectuals, including ardent agrarian Thomas Jefferson, professed the benefits of healthier rural areas outside of cities and pushed to direct growth in these places and the new western lands of the country instead of arguing for the further development of seemingly fouled and contaminated cities (Langton 2022). Urban reformers wrote of the immediate need to create more open green space in cities to make them more livable and less prone to disease – an argument that was recalled with the recent actions during the COVID-19 outbreak. The COVID-19 response in cities included demands for increased indoor ventilation, promotion of outside dining and activities, and the creation of pedestrian-friendly streetscapes and the closing of selected streets to cars.

The inequity of epidemics and pandemics in cities can be quite stark. As with other urban stresses and crises, the poor and marginalized of the cities are often most vulnerable and impacted by widespread disease outbreaks. These populations typically live in areas with substandard, vermin-infested housing, less consistent access to potable water, less access to effective health care, and fewer financial resources to leave an infected area or stay out of situations where they might be infected. Again, the COVID-19 pandemic provides a good illustration. Ribeiro and others (2021) through an extensive epidemiological study of COVID mortality in Sao Paulo, Brazil, found that across a range of socio-economic variables, lower income, less education, more household crowding, and Black populations were all positively associated with higher rates of mortality. The analysis further concluded that not only did the impacts of COVID reveal inequity, but the pandemic effects also worsened inequities since the widespread illness and social and economic distributions were more likely to lead to greater relative loss of income and loss of socio-economic status among these populations that were more disadvantaged at the outset. Marginal populations and neighborhoods are further biased against by the fact that the disease outbreaks typically affect them more than other communities, and the health crisis occurrence can reinforce pre-existing prejudices and antipathies.

7.2 Case Studies

Disease and pandemic have impacted every city. The case studies presented illustrate a variety of contexts. The examples span across several centuries and three continents and include two plague outbreaks, one of influenza, and one of COVID-19. The case studies include Hong Kong, China, Marseille, France, St. Louis, US, and Seoul, South Korea. Although very different, each case illustrates the rapid onset of a disease outbreak and how fundamentally disruptive the surrounding events can be and how quickly a crisis and demand for policy transitions emerge. The transformative legacy of each event are profound.

7.2.1 Hong Kong, China

The history of Hong Kong as a city and relatively small territory is complex. The land area of the Hong Kong territory is roughly 1,100 km^2 (428 sq. mil) or about two-third the size of Greater Metropolitan London. A significant part of this more recent history has been defined by tension and conflicts between mainland China and foreign interests, especially the British. Hong Kong and its harbor were seen as a key gateway between China and the world. The harbor and associated in- and outflow of goods and people however also served as a key mechanism for disease transfer. Hong Kong was held as a British colony from 1842 to 1997 and during that time it grew dramatically both in population and importance. At the time of takeover by the British in 1842, the population was 7,450; in 1901, it had grown to 368,981, and after growing rapidly in the mid-twentieth century, its population in 2021 was estimated to be 7.4 million. In 1897, Hong Kong was one of the world's top five ports by tonnage with 15.94 million tons of cargo and 1,652,016 passengers and 77,293 port calls (*Report Harbour Master* 1897, 370–71 in S. Davies 2015). With its return to the People's Republic of China, its development trajectory was increasingly connected to the dramatic regional growth in the Pearl River Delta and the metropolitan regions of the expansive cities of Shenzhen and Guangdong.

The history of Hong Kong has been connected to a variety of acute stresses and crises. During its modern history, Hong Kong has been characterized by extremely high population densities, significant in- and outflows of people and goods, proximity to source areas of viral outbreaks, and intense social divisions and inequities. All these factors are associated with favorable conditions for reported disease outbreaks. Outbreaks of historical significance include the 1894 Bubonic Plague (part of the third plague pandemic that

lasted from 1855 to 1945), the 1968 Hong Kong Flu, and the SARS (Severe Acute Respiratory Syndrome) outbreak in 2003. Here the focus is on the 1894 Bubonic Plague outbreak.

7.2.1.1 Stress

The Plague while continuously a global risk has caused three pandemics of devastating historical significance. These include the Justinian Plague of 541, which originated in central Africa and spread to the North African and Mediterranean Region, the infamous Black Death, which started in Asia in 1347 and spread to Crimea, Europe, and Russia and killed approximately 30–50% of Europe's population at the time, and the third pandemic, which originated in the Yunnan region of China. By January 1894 plague had been observed in Canton (now Guangdong) about 130 kilometers from the British territory of Hong Kong. The disease appeared soon after in the city, with it being declared an infected port on May 10 of that year and by July the disease had already claimed 2,442 lives (Pryor 1975).

Hong Kong had grown significantly in the latter decades of the nineteenth century and had become a major *entrepot*, linking western influences with mainland China. Tens of thousands of ethnic Chinese came to the colony as economic development created new employment opportunities. A formal census in 1865 illustrated a vast difference between the Chinese and non-Chinese residents. The population at the time was approximately 125,000 of which only about 2,000 were westerners. Just before the plague outbreak, the population in 1891 had reached 221,000 and was growing quite rapidly. Significant divisions were present between the ethnic Chinese population and the foreigners. Housing segregation and the extremely limited political role of the vastly dominant ethnic Chinese population carried out through British colonial policies created tensions. The vast majority of the Chinese population was squeezed into the Tai Ping Shan area, which was approximately 1.25 sq. km. While foreigners lived in comparative splendor in spacious communities a few kilometers away.

The outbreak both revealed these tensions and contributed to a more intense epidemic (Pryor 1975). The Chinese had great mistrust of the British and western medical practices and rumors were circulating of abuse by British doctors of Chinese women and children patients and mistreatment of dead bodies. These issues also fostered a lack of compliance by Chinese residents to report illness and to bring sick individuals to medical facilities. The Chinese community in Hong Kong became panic-stricken as the outbreak worsened. Chinese workers evacuated the colony in huge numbers leading to further and more significant trade and economic disruption. It is estimated

that approximately 100,000 Chinese laborers and merchants, about half of the labor force, fled from the colony in an attempt to avoid the plague (Echenberg 2002). Large swaths of housing either left empty or evacuated in the Tai Ping Shan district were razed in an attempt to stamp out the plague (Lee 2013).

7.2.1.2 Crisis

While the outbreak of 1894 could be defined as a crisis, the problem continued and deepened in the years following a retreat of the plague in 1895. By 1896, the plague returned and killed another 1,078 residents, almost all those crammed into the ethnic Chinese residential districts. The plague was present annually between 1895 and 1929. During that time, it killed over 20,000 residents and had a fatality rate of more than 93%. The period from 1894 to 1901 was particularly intense because of the high numbers of illnesses and disparate explanations for the disease and lack of adequate medical capacity to deal with those who were ill. For much of this period, limited medical information was available on how the disease occurred and was transmitted. The British and western medical explanations differed widely from the perspectives of Chinese medical experts and community members. The western medical consensus was that human transmission was a key mechanism or that it was associated with rat droppings. The medical and popular debate raged for a decade. While others continued to cling to the miasmatic theory (i.e., airborne vapors), which attributed the disease to noxious poisonous gases emanating from infected soil or from the bodies of plague victims (Echenberg 2002). The outbreak led to a series of conjectures regarding how the plague spread – much of it associated with the Chinese and things Chinese – that is, their lifestyle and property (Peckham 2013). For example, one theory was that disease had spread from Canton to Hong Kong via bales of opium being shipped to the colony.

The crisis was fed by the fact that public health officials trying to cope with outbreaks were often no better prepared than those in premodern, pregerm theory times. The officials used plague control practices such as burning of homes and personal property of victims taken from old European practices. While the demographic impact of the plague was not as significant as in other British colonies, the psychological impact of the outbreak was highly significant since it brought into question the position of *entrepots* in the empire, and as described by Peckham (2013) – "possibility that the networks, which sustained the empire were also the very source of its weakness." The outbreak, while a medical crisis, exposed significant social divisions and severely disrupted trade and commerce, resulting in a more complex crisis.

7.2.1.3 Transition

The plague outbreak and its repercussions were a major turning point in the history of colonial Hong Kong. While the initial response to the disease in many ways exacerbated existing problems, the following years (in the late 1890s and early 1900s) brought a significant transition in the daily life of the city, and its long-term prospects for economic development and the betterment of its residents' lives. A critical element of the transition was the development, application, and widespread acceptance of new medical science regarding the origin and spread of plague. While a significant amount of anecdotal evidence existed that its spread was somehow related to rats, the medical and popular debate raged until 1905 when the source of the infection – fleas on rats – was confirmed by researchers in India (another hard-hit British colonial plague region) and translated to China.

During this latter part of the 1890s, significant dialogue took place between Chinese community representatives and British officials regarding disease theory, the cause of the plague, and more broadly the merits of western as opposed to Chinese-style medicine. A significant breakthrough occurred when a Chinese, western-trained physician was put in charge of a local hospital used by Chinese residents. The appointment of the new head signified a compromise between the colonial government and the Chinese elites, thereby removing a significant amount of suspicion between British colonial power and the general Chinese population (Lee 2013). The outbreak also forced a stark reevaluation of Chinese residents' living conditions. Germ theory helped define connections between Chinese housing, trade, and the spread of the disease and how a reorganization of urban space could eliminate or significantly decrease the spread of the disease. For example, the first floors of many buildings, where Chinese lived in upper floors, were used as storehouses for cargo, and it was recognized that this cargo was often infested with rats (Peckham 2013). Eliminating this co-mingling of building uses would reduce opportunities for disease exposure. It was also acknowledged as important that sections of Chinese residential districts initially razed to eradicate disease should be rebuilt with better drainage and more ventilation to reduce the spread of future disease outbreaks.

7.2.1.4 Transformation

The late nineteenth-century plague in Hong Kong is well recognized as a major turning point in its colonial history. The trauma of the outbreak forced the British colonial government to dramatically reconsider the policies that dealt with the Chinese community and to increase the focus on the Chinese residents' well-being and forge a partnership with the community that

enabled a reorganization of the social and economic order of the city. One of the numerous aftereffects of the Hong Kong Plague was the questioning of the merits of rapid economic globalization that emerged with colonialization (Peckham 2013). In addition, a series of reforms took place including new cargo protections to reduce the risk of disease introduction. New controls on immigration and residential overcrowding were also imposed. The district that was most heavily impacted by the disease outbreak and subject to razing by the colonial authorities – Taipingshan area – was rebuilt with the addition of new medical facilities that became the nucleus of one of the colony's hospital centers.

7.2.2 Marseille, France

The Mediterranean port city of Marseille in southern France is one of the oldest cities in western Europe. It was founded by Greek traders about 2,600 years ago. The current population of Marseille and its extended metropolitan region, which includes portions of the Provence region, is almost 2 million making it the third largest population center in France. The economy of the region has traditionally been focused on agriculture and trading. The Mediterranean region, long a site of civilization, has experienced an extensive record of disease outbreaks. Given that, Marseille's history reflects extensive experience with the diagnosis, prevention, and action against epidemics. Marseille pioneered the development and implementation of quarantine practices, a city-wide sanitary board, and hospital facilities specializing in contagious diseases (Barbieri and Drancourt 2018). Twenty-two significant plague outbreaks have occurred in Marseille in recorded history, the most recorded for any Mediterranean city, with the earliest documented in 49 BC. The outbreak in 1720 was especially impactful, and was the last major outbreak of plague in western Europe (Ermus 2021). The outbreak killed half of the city's population (about 85–95 thousand at the time) and upward of 125 thousand in the city and surrounding Provence region and caused massive social and economic disruption.

7.2.2.1 Stress

Following a plague in Marseille during 1580, the city's leaders worked to develop new measures to limit the spread of future outbreaks (Barbieri and Drancourt 2018). The city council created a sanitation board composed of local doctors. The board facilitated the construction of the first public hospital and accreditation procedures for medical staff. The board also helped organize a robust quarantine system that included several tiers of cargo and crew

review and isolation in lazarettos/lazarets (stations for maritime travelers). By the time the 1720 plague struck, Marseille had then a long-established and sophisticated quarantine protocol and a range of well-tested sanitary cordons that had prevented any plague outbreaks for almost three-quarters of a century (since 1649). However, on May 25, 1720, a ship named the Grand Saint-Antoine returned back to Marseille with a variety of goods it had purchased across the Mediterranean. It was the practice that all ships would be subject to extended quarantine before the cargo and crew could be disembarked at the port. That was not to be the case with the Grand Saint-Antoine. A wealthy municipal official who owned part of the ship and its valuable cargo pressed to have the goods off-loaded to the city's warehouses so they could be quickly sold at a soon-to-occur annual fair (Ermus 2015, 2021).

7.2.2.2 Crisis

Soon thereafter, disease broke out in the city and within months the quickly spreading disease grew to become a crisis. Officials initially tried to hide the fact that the disease was in fact the plague. Hospitals rapidly were overwhelmed and it was widely recognized that plague was once more in the region. Mass graves were dug and then quickly filled, and residents panicked and started to leave the city. The local public health system collapsed and later in the summer, thousands of corpses lay scattered throughout the city. Squads of volunteers and prisoners were sent to the city to remove and dispose of bodies and also perished. The overall death rate in the city and outlying area ranged from 25 to 50%. Even though Marseilles had extensive local expertise in responding to pandemics – the 1720 outbreak devastated the city. Over the next two years, the plague would take 50,000 of Marseille's total population of 90,000. At its height, the plague killed up to 1,000 per day. The social and economic disruption was extensive.

7.2.2.3 Transition

As the initial phase of the outbreak started to ebb, it became clear that other forms of response were needed. In addition, it had become evident that the disease outbreak not only had significant local economic impact but also was having larger-scale, ripple effects throughout France's national economy, which had become increasingly integrated in the 1600s and early 1700s. The situation was seen to require a new large-scale integrated approach. In order to address the risk, a series of proposals were put forward and implemented that created for the first time in modern history a comprehensive central government disaster response to the emergency situation (Ermus 2015; Barbieri and Drancourt 2018).

Most significant was the transition that had to do with the role of the external state during a local/regional crisis – that is, the governance beyond Marseille and Provence. The plague outbreak was a disaster of enormous proportions. The governance capacity of the city and region collapsed and it became clear that outside governance capacity needed to engage to control the situation on the ground and limit the further spread of the disease. At this time, the central royal government of France became much more engaged in disaster management and illustrated an early example of the state-centralized crisis management that is widely evident today globally (Ermus 2015). This moment also marked a moment of increased concentration of central government state oversight that became increasingly emblematic of French state actions moving forward.

The new pandemic response came with a series of steps to minimize the spread of the illness, minimize the extent of the broader economic impacts, and help support the local governance and public health capacity of the heavily impacted sites. Officials within Marseille and outside the city were enlisted to help coordinate the response to the outbreak. For example, a General Commissioner was put in place to manage the plague response in one of the worst-hit Marseille port neighborhoods. The individual and their office established a land-based quarantine by setting up checkpoints, protected unattended properties against looters, established field hospitals, and organized the distribution of humanitarian supplies for the neighborhood and the city itself. Fundamentally, the General Commissioner was given absolute power in matters having to do with policing and administration of the city or imposition of de facto martial law. This type of authorization during a major disaster or crisis is another protocol that remains a critical component of most national emergency response strategies.

Another innovation was the policy to control the spread of the disease. It normally had been the case that with an outbreak of disease, residents would flee often resulting in these individuals further spreading the disease to previously uninfected areas. As an attempt to stop this mechanism of spread, an act was initiated by the Provence parliament that imposed the death penalty for any commerce, communication, or movement between Marseille and the rest of Provence. A regular army, military cordon was put in place to control movement. A plague wall, or *mur de la peste*, was rapidly erected across the countryside around Marseille to enforce this separation. The wall was built of stone and was about 2 m (6 ft 7 in) tall and 70 cm (28 in) thick. To further prevent escape, guard posts were incorporated into the wall construction. After the plague subsided, the central government further strengthened the port's plague defenses by building a larger waterside containment area with 15-foot walls for

crew and cargo to be quarantined. Furthermore, crew and cargo were required to pass initial inspection at an island further out in the harbor.

7.2.2.4 Transformation

The transformation resulting from the plague outbreak and exertion of state power was both consistent with the growing governance capacity of a centralized French state that was taking place during the sixteenth and seventeenth centuries as well as a new context to express this authority. During the late seventeenth and early eighteenth centuries, the French royal government transitioned from a limited and undeveloped state to a more mature monarchical state (Ermus 2015). The state and its bureaucracy became better able to yield its power in more professional and expansive ways during this period. Ermus (2015) makes the case that during the plague of Provence, the French government took advantage of the circumstance to demonstrate the integrity, usefulness, and value of the state by extending its activities into what up to that point had been typically seen as a local matter. The model of central state engagement with crisis and disaster management became the approach of other emerging nation-states including Britain, Portugal, and Spain, in Europe. They would go on to soon institute or further develop a variety of similar measures to advance the administrative centralization and control processes.

7.2.3 St. Louis, US

St. Louis is a regionally significant city in the Midwest of the United States. The city grew tremendously from the mid-nineteenth to the early twentieth century, and during the early decades of this period was in competition with Chicago to become the great city of the country's interior (Cronon 1991). In 1850 the population of St. Louis was almost 78,000 and it was the eighth largest city in the country and by 1910 it had almost 680,000 residents and was the fourth largest in the country. Known as both the gateway to the American West and the largest city along the Mississippi River, it first became a trading and distribution site and then later an industrial center. The manufacturing generated great wealth and employment opportunities yet made the city one of the most polluted places in the US, along with Pittsburgh, during the early twentieth century. In 1900, Union Station in St. Louis was the busiest station in the country and 22 railroad lines converged at the city. In 1904, the city hosted both a World's Fair and the Olympics placing it as a focal point on the world's stage. At the same time, St. Louis' history is riven with racism.

In 1916, St. Louis voters, who were mostly white, voted by a two-thirds majority to legally mandate racial housing segregation, thereby becoming the first city in the country to do so.

7.2.3.1 Stress

In March 1918, the first known case of what became widely known as the Spanish Flu[1] was recorded in Fort Riley, Kansas, about 600 kilometers west of St. Louis. The presence of the disease expanded and spread to the eastern US and Europe most directly via US Army troop deployments to the European battlefronts of The Great War (World War I). By late summer the flu cases had begun to occur throughout the US and by early September it was front-page national news. During the latter days of September, Dr. Max C. Starkloff, the long-serving St. Louis Health Commissioner, was actively monitoring the westward spread of the disease from Boston, the initial large-scale epicenter in the US. To prepare for the flu's arrival in St. Louis, Starkloff first asked that all doctors voluntarily report any cases of influenza to his office. He also wrote an article for the *St. Louis Post-Dispatch* about how to avoid the flu. Then on October 5, a family with seven cases of influenza became the first reported incidences in the city. On the next day, 50 cases in the city were reported (UM Center for the History of Medicine ND).

7.2.3.2 Crisis

Realizing the possibility of a health crisis, Starkloff within days asked the city's Board of Alderman (an elected legislative body in St. Louis that acts to create, pass, and amend laws, as well as approving the city's annual budget) to pass an emergency law declaring influenza a contagious disease, thereby giving the city's mayor legal authority to declare a public health emergency (Kalnins 2006; Belshe 2012) and also provide for stiff fines for physicians who did not report cases of the disease. Starkloff, becoming increasingly alarmed by the rapidly growing number of disease cases, quickly went further and asserted the need for a sweeping closure order and a ban of public or private gatherings. Within days there had been 100 cases in the city and 900 at the nearby army facility, Jefferson Barracks, only 15 kilometers from downtown St. Louis.

On October 7, Starkloff brought together a meeting that included St. Louis Mayor and members of the US Public Health Service, the Red Cross, the St. Louis medical community, city business interests, local hospitals,

[1] It is widely recognized in the influenza pandemic of 1918–1919 originated in the United States.

and the public school system to confer on the most effective ways to fight the city's emerging health crisis. Many participants were against a policy of mass closures of public spaces and large private spaces. Starkloff, however, argued for the need for extreme action to disrupt the disease spread. After extended debate during the meeting, the group agreed to a sweeping closure order. Starkloff also was conferred by the mayor legal authority to make further public health edicts. It should be noted that five years earlier, Starkloff had run and was defeated in a bid to be the city's mayor. He lost to fellow Republican Henry Kiel, the very mayor he was now to work with so closely.

7.2.3.3 Transition

The meeting and the resulting action led to a dramatic transition in public health policy during the epidemic. Very soon after the meeting, the city's health department put forward an order to close schools, theaters, and other public places in an attempt to reduce the transmission of the disease. The proclamation went on to state that all public meeting places would be closed until further notice. The city's Catholic Archbishop also announced that churches similarly would be closed. The Department of Health provided this additional strong advice for those that became sick.

> Go to bed and place yourself under a physician's care. If you must go about, avoid gatherings of persons, crowded streetcars, elevators, etc. Do not sneeze, cough or spit unless you protect nose or mouth with a handkerchief. Remember your cold, under other conditions is a trivial matter, is now a public menace. Well persons are advised to avoid crowds, to sleep in well-ventilated rooms, to avoid using common cups and towels, and to wash the hands frequently (Belshe 2012, p. 121).

By October 13, the Health Department felt that closures and restrictions would keep the situation well in hand and prevent further substantial spread. But just five days later, on October 18, 559 cases and 32 deaths per day were recorded in the city. Even though the numbers started to decline by November 1, Starkloff remained committed to the closures and against the pressure by Mayor Keil and businesses who argued that the ban on public gatherings be lifted. Within the weeks, a decline in the number of cases and persistent interest in ending the closures led to the reopening of theaters, churches, and soon thereafter, schools. Again, within days the number of cases started to increase again, especially among the young, and by late November, schools were closed again and children were banned from stores and theaters. On December 3, the number of cases per day peaked with 1,467 cases, and a week later the peak in the number of deaths occurred with 58 deaths per day. The number of cases quickly declined thereafter and by the end of the year, all bans were lifted (Belshe 2012).

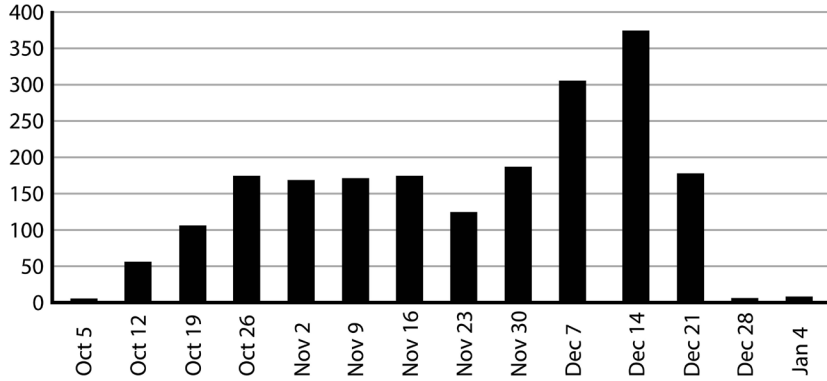

Figure 7.1 Deaths in St. Louis from influenza by week from October 1 to early 1919. Source: Belshe (2012).

7.2.3.4 Transformation

The influenza deaths by week are summarized in Figure 7.1. Two peaks in the curve are a direct reflection of the influence of the closure and the temporary reopening of schools in November.

The strict measures advocated by Dr. Starkloff and enforced by Mayor Kiel were thought to be largely responsible for dampening the general impact of the flu pandemic in St. Louis. In turn, St. Louis had the lowest number of influenza cases and influenza-related deaths of any of the ten largest cities in the United States (Belshe 2012; Navarro 2019). The infection curve of St. Louis (death rate of 352 per 100,000 in population) is often compared to that of Philadelphia on the east coast of the US, which did not enact significant restrictions and in fact went on with a massive parade during the early days of its outbreak (see Figure 7.2). Philadelphia's highest death rate was more than double that of St. Louis at 748 per 100,000 in population.

The case of St. Louis was transformative with respect to presenting a model of how a large city could respond to a disease outbreak. The case illustrates the value of a strong-willed policy innovator such as Starkloff who acted quickly and decisively but was also flexible as the latest medical information became available. Operationally, two other innovations were recognized in the city's response. The usefulness of a dedicated official to focus on risk communication between the health officers and the advisory committee and the public and different segments of the public (i.e., age-appropriate restrictions for children) was noted. The translation of medical science to public policy in a meaningful and transparent fashion was highly significant. And probably most important, the city's policies showcased the value of social distancing strategies to flatten the epidemic case load curve.

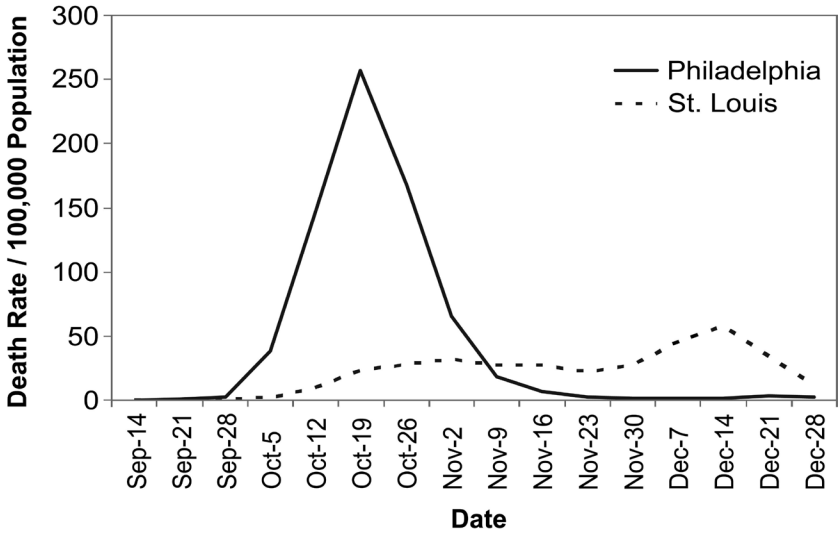

Figure 7.2 Excess pneumonia and influenza mortality over 1913–1917 baseline in Philadelphia and St. Louis, September 8 to December 28, 1918. Source: Hatchett et al. (2007).

7.2.4 Seoul, South Korea

Seoul, South Korea, is a major global city. Its current metropolitan population is just under 10 million, and the extended metropolitan region including Seoul, Incheon, and Gyeonggi Provinces accounts for approximately 42% of the country's population (in 2021, 51.7 million). More importantly, it is ranked as the fourth largest metropolitan economy in the world behind New York, Tokyo, and Los Angeles. Human settlement in the region stretches back at least 6,000 years. The history of the city is full of periods of rapid growth and decline or destruction. The city was heavily damaged during the Korean War (1950–1953) but started to grow dramatically in population and economic power during the mid-1950s. The rapid growth continued through the next several decades. It is currently home to several of the largest corporations in the world. The city is often rated as one of the most livable and technologically savvy cities in East Asia and globally.

7.2.4.1 Stress

East Asian countries have had significant experiences with disease. South Korea has had extensive experience with disease outbreaks that emerged during periods of occupation and warfare in the first half of the twentieth century. Japan brutally occupied Korea from 1910 to 1945 during which the

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medical capacity of the region was hindered and could not effectively respond to disease outbreaks. The Korean War was by itself much more disruptive. Significant outbreaks of a wide variety of diseases occurred including smallpox, typhoid, and typhus. A false alarm about a potential plague outbreak also occurred during the war (Sames et al. 2008).

In 2015, South Korea experienced an outbreak of the Middle East Respiratory Syndrome coronavirus (MERS). The outbreak was started when a 68-year-old Korean businessperson returned from travel in the Middle East. The individual visited four hospitals in Korea before he was diagnosed. The failure to detect the early case led to a substantial spread of the disease to other individuals. The Korean MERS outbreak involved a total of 186 cases, including 38 fatalities. Eighty-three percent of transmissions were the result of five super-spreader events. The epidemic persisted for two months and the government quarantined 16,993 individuals for two weeks to control the outbreak (Oh et al. 2018). While the initial outbreak was not in Seoul, the vast majority of the cases occurred in the Seoul metropolitan region. The MERS outbreak caused $18 billion USD in gross domestic product (GDP) losses, equivalent to 1.31% of South Korea's annual average GDP (Park 2019).

The MERS experience provided the South Korean government with important cutting-edge evidence regarding the challenges that a country faces when responding to a disease outbreak. To facilitate testing and response during the outbreak, the Korean Society for Laboratory Medicine (KSLM) launched a MERS response task force. The South Korean public and commentators harshly criticized the government and hospitals response. It was argued that they had failed to detect the first case and did not conduct as thorough an initial epidemiologic investigation as possible, allowing the cases to increase. Once the government realized the significance of the threat, a set of MERS control and intervention strategies was put into place by central and local governments, nongovernment organizations (NGOs), and schools. These included an aggressive quarantine and isolation system, temporarily closing schools, and canceling public events, and sharing fully vetted information and data from trusted entities (Park 2019).

As the MERS outbreak was controlled, the South Korean medical community reflected on what lessons could be learned from the event and what recommendations should be made for future outbreaks. Five key recommendations were presented (Park 2019): (1) Develop a traveler tracking system utilizing information and communication technology, (2) strengthen the health care delivery system, (3) strengthen the country's infectious disease prevention legislations (e.g., South Korea's Infectious Disease

Prevention Act of 2015 amended the procedures on how to regulate and implement quarantine measures more effectively), (4) create greater risk communication capacity between the medical community and government, establishing bioethics standards for quarantine and isolation policies, and (5) more closely engage with the World Health Organization's guidelines and updates.

7.2.4.2 Crisis

South Korea recorded its first case of COVID-19 on January 19, 2020. The disease started to spread rapidly and by early March it became the second most infected country after China. A sudden jump in the number of cases was attributed to Patient 31, who while ill participated in a large-scale church gathering resulting in a super-spreader event. The church in question insisted on in-person meetings, banned health masks, prayed while touching others, and initially refused to turn over its membership list to health officials wanting to do contact tracing (Wildman et al. 2020). This occurrence became a warning signal to the world regarding the failure to practice social distancing and self-isolation (Cha and Kim 2020). By early March, the number of confirmed daily cases in Korea was approaching 1,000 per day.

7.2.4.3 Transition

In response to the rapidly accelerating crisis, the South Korean government quickly moved into action. The early super-spreader event also helped to alert local and national responders about the potential need for an aggressive response that followed a 3T (Trace, Test, Treat) strategy (Kim 2020; Anttiroiko 2021). This approach involved proactive, widespread, and free screening of symptomatic individuals and their contacts. The flexible adaptation approach including a policy of enhanced transparency of data gathering, analysis, and decision-making proved to be very successful. While schools were closed, working remotely was recommended, and large gatherings were banned, lockdowns and the restriction of movement were not instituted. Specific action in Seoul closely mirrored these actions (Park et al. 2020). Seoul was able to develop key strategies that interrupted the transmission chains of COVID-19 including such actions as preemptive testing, isolation of positive infected individuals, quarantine and strict restrictions of contacts, and provision of proper treatment (Park et al. 2020). The country also relied on open access health informatics such as disclosure of real-time information on COVID-19 by the government through websites, mass media, phone alerts and messages, and mobile phone apps. As a result of this preemptive action, South Korea was able to flatten the curve of disease outbreak during its early days without

closing businesses, putting out mandatory stay-at-home orders, or other strict measures taken by high-income countries at that time.

7.2.4.4 Transformation

Built from its extensive response capacity during MERS outbreaks, South Korea's initial response to COVID-19 in 2020 was quite impressive. It achieved relative success during the early months by quickly developing clear public guidelines, conducting widespread testing, innovative and high-capacity screening facilities, contact-tracing program, and supporting individuals in quarantine to make compliance easier. The country successfully managed significant limited outbreaks in March and August 2020, and even a wider and dispersed outbreak in December 2020. Overall, South Korea showed significant success in what was seen as three phases of the epidemic preparedness and response process: detection, containment, and treatment (Kim et al. 2021). The country's screening facilities and collaboration with manufacturers to provide a sufficient supply of test kits became a model that other countries followed. Containment strategies also were quite successful. Epidemiological intelligence officers had significant power to utilize a variety of data sources to trace contacts. Perhaps most impressive was that the South Korean health system was able to surge to meet the rapidly increasing demand. Across the country, especially in high-cluster sites such as Seoul, governments were restructured to increase health care access. Temporary hospitals were built, and shortages in health care equipment including personal protective equipment (PPE) were rapidly met.

The government of South Korea learned from its flawed response to the 2015 MERS outbreak and benefited from the significant number of reforms that were made to boost the public health emergency preparedness and response including greater coordination with and across government agencies and departments. This coordination as in the St. Louis case study allowed for much more effective and timely decision-making. This coordination was especially meaningful for developing preemptive measures of COVID-19 transmission in highly dense settings like Seoul (Park et al. 2020).

By the end of 2020, the South Korea experience was heralded as the model for successful COVID-19 containment. In the following years, 2021 and 2022, it did experience further outbreaks and spikes in the number of cases, eventually significantly overtopping the numbers seen in March 2020. Persistent use of extensive testing, an advanced immunization program, and preventive care, especially with respect to at-risk patients, allowed the country to keep the number of severe cases and fatalities to a low level. In a spike early in early 2022, South Korea was able to maintain the mortality rate among cases to 0.14%, approximately one-tenth the rates in the US and UK at the same time (Cha 2022).

7.3 Discussion

Like water scarcity, disease and epidemics represent an existential risk for urban populations. Not only is there the real risk of illness, incapacity, and even death associated with disease, but there is also the perception of risk that also significantly impacts communities. Given that it is understood that health risks associated with dread and the unknown generate heightened perceptions of risk (Siegrist and Arvai 2020), acute disease outbreaks often result in strong reactions that drive evacuation and relocation, prejudice against potentially exposed populations, and a break with typical norms of behavior. In the case studies, the risk response became significant as the outbreaks not only caused illness and death, they severely disrupted everyday life in the cities as laborers left their jobs, business and commerce collapsed, and governance systems ceased to function.

7.3.1 Conditions of Crisis

The examples highlight that once an outbreak is identified, it is mostly going to get a lot worse, especially as these moments typically set off a cascade of other events. Another significant dimension common to the case studies was that the crises came on very quickly. It was just a few days to a few weeks from the first local case to a large-scale public health emergency, and it was just as quick to direct significant impacts on the social and economic realms of the city. In all of the cases, the concern over illness drove people to leave the city further spreading the disease and in turn creating more illness and additional fear. This rapid out-migration caused additional disruption and the closing of business and economic activity because of a lack of customers and employees.

7.3.2 Drivers of Transitions

While the disease presence was the ultimate driver, how this driver interacted within the social context became the most important component of how the crises developed and how the eventual transition pathway formed. The past history of the disease in the cities also played a pivotal role in the crisis and transition. The exact function varied a bit; in some cases prior experience gave the city what proved to be a false sense of security (i.e., Marseille), while in other cases it seemed to afford the city with the prior experience needed to understand how best to act in the wake of the new outbreak (i.e., Seoul). In either situation, prior experience provided the citizenry of the city with either

confidence that the city would be able to respond to the threat, and if not to their satisfaction, it would result in panic, fear, and outrage. In several cases, the development of new knowledge was critical in driving the transitions since it allowed the local managers and residents to redefine the hazard more clinically and eliminate or dampen the public reactions to the perceived threat. The new knowledge allowed the residents to better understand the risks and how best to reduce the risks. Shifts or reforms in social structures also were significant drivers in how the transitions emerged. New social arrangements were forged (i.e., some progressive reforms against the harshness of British

Table 7.1 *Key drivers observed in each case study. Source: Author.*

	Drivers		
Case Study	Root	Context	Proximate
Hong Kong	Colonialism; anti-Chinese bias; port facilitating spread of disease	Conflict between Chinese and Western medical science; advance of science and cause of the plague	Acceptance of germ theory; and appointment of Chinese, western-trained doctor – connection between colonial power and Chinese elite
Marseille	History as a port city; history of plague; significant history of plague prevention; strong state control	Massive plague outbreak; collapse of public systems and commerce; assertion of central state control; creation of disaster response	Breaking of quarantine rules
St. Louis	City as crossroads in rapidly developing region of the country;	Spread of Spanish flu via World War I military; capacity to coordinate local government response; strong public, private, and medical coordination	Emergence of strong policy entrepreneur
Seoul	History of disease, especially in twentieth century with military and political conflict	MERS response failure and detailed response and self-evaluation; highly coordinated and integrated public and medical response	Super-spreader event – Patient 31; proactive medical surveillance and rapid science-to-policy action

colonial rule) and scales of governance developed (i.e., the growth of the central national authority in France) that had immediate impacts on the policy response to the outbreaks and also long-term ramifications on governance and the structure of civil society.

7.3.3 Spheres of Action and Legacies

Considering disease pathogens as elements of the physical systems, they significantly defined the operations of the socio-economic systems and infrastructure during the crisis and transition phases. The positive feedback effects within the social systems dramatically accelerated the crisis and became the centerpiece of the events that took place during the crisis and were the core of the debate during the transition period. Technological systems often embodied by transport facilities or modes of transport, whether they be ships, ports, or planes, acted as mechanisms through which the disease vectors were transferred and spread. The process of isolation and quarantine became a mechanism to utilize physical barriers to break the cycle of infection and disease spread.

The legacy of prior events and underlying social conditions played a significant role in how the crises and transitions played out. An outbreak of a highly contagious deadly disease is a cathartic crisis for any city. As such, these events unmask and reveal all underlying tensions and inequities present within the city. These then become woven into the fabric of the crisis and the foundations of the underlying prospects for a successful transition. The legacy of mistrust and lack of faith in local government action was widely present across the cases, with the possible exception of St. Louis, where confidence in local government was pivotal to the success of the aggressive action implemented to control the flu outbreak.

7.3.3.1 Urban Public Health and Climate Change

Climate change is impacting urban public health issues generally (IPCC WG2 SPM 2022). Excluding extreme heat issues discussed elsewhere (in Chapter 8), observed evidence and projections indicate that climate change will bring more outbreaks of disease, more unexpected outbreaks, and global shifts in the pattern of disease outbreaks with polar movement of many disease vectors (Dodman et al. 2022). Hotter annual and seasonal temps will bring increased spread of waterborne and vectorborne diseases, and longer exposure seasons and declines in winter cold temperatures (that could kill or diminish the number of vectorborne diseases). Extreme flooding events will

cause more disease spread through waterborne diseases. Extreme events also could significantly disrupt the health services provision in cities (IPCC WG2 SPM 2022).

The case studies reveal several important considerations for a variety of interested city stakeholders. These include the following.

- Expect the unexpected – disease outbreaks, such as flu, in some ways are expected as an annual event. It is the outbreak that is less typical that could become a crisis. The evidence seems to indicate that unexpected outbreaks can onset quite fast and that it is hard to avoid these episodes from becoming a crisis. Planning and preparedness for such events are crucial as is having a variety of proposals for potential action. Understanding how climate change could drive disease outbreaks in a specific city will be critical for advanced preparedness.
- Trust in government is critical – trust in government is a critical asset during crisis-related disease outbreaks given their rapid onset and the amount of unease and confusion they generate among local populations. Such trust can help facilitate rapid uptake of initiatives to slow the spread of the disease and mitigate its impacts. Conversely, the case studies show when the opposite is the case – when trust is not present – further disruption and devastation can occur. Effective and consistent communication between the government and residents and businesses could help to build the level of trust needed when such crises occur.
- Access to the latest information and data are invaluable – climate change has started to create very dynamic situations with respect to disease outbreaks. The pathways for increased exposure have increased and there is a need to acquire and develop the latest knowledge regarding disease and to gather monitoring data on disease presence and outbreak.
- Avoiding lapses of policy – the case studies illustrate several examples where a lapse of policy (i.e., absence or significantly flawed) can have significant implications and potentially result in a much wider population exposure to disease. Given the dynamic nature of disease outbreaks under conditions of climate change, it will be important to test the robustness of the policy through proactive monitoring, planning, and preparing.
- Value prior experience – previous experience with disease outbreaks provides a significant foundation for learning and enhancing future practice. As the prospect for an unexpected outbreak increases, it will be important for cities and their residents to maintain the memory of recent prior outbreaks and lessons learned.

- Avoid scapegoats – the disease outbreaks can be so intense and disruptive that scapegoat issues typically emerge as individuals and institutions look for easy answers to explain what has befallen their city. Often these reflect underlying prejudices and other biases (i.e., overcrowding, immigrants/recent migrants, poverty, racism) rather than what the empirical evidence is showing. It is important to look underneath and work to identify the prejudices and biases and keep pursuing the genuine reasons for the disease spread.

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