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### Bubonic Plague: Public Health Warnings from an Ancient Disease

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University of New Mexico

Bubonic Plague: Public Health Warnings from an Ancient Disease

Mikenzie E. Chessman

UHON 301: What is Health? From TB to COVID-19

Dr. Farnbach Pearson

10 Dec. 2021

Illness and disease have plagued humans with cyclic reoccurrences of violently relentless killers from the beginning of time. Perhaps the most tragic and destructive disease outbreak was the Bubonic Plague, more commonly known as the Black Death. Caused by the infection of an individual by the bacteria *Yersinia pestis*, historians and physicians alike attribute the plague to the deaths of nearly two-thirds of the European population during the Middle Ages. At the plague's first significant emergence in the early 1300s, there were no known treatments to combat the infection's progression, making death almost a certainty upon infection. With no understanding of Germ Theory or how to effectively treat disease, early humans feared what unpredictable atrocity would present itself to society next. Modern advancements in medical treatments, testing, and scientific knowledge have effectively increased society's ability to address public health crises. With the recent onset of the COVID-19 pandemic, these advancements prove invaluable in treating severe illness. However, it has become difficult to deny the parallels between the societal perception of plague and how many individuals choose to handle COVID-19 in the modern-day. Many have chosen to disregard medical advice regarding social distancing, mask usage, and vaccinations and suffered the consequences with their lives, leaving public health officials urgently in need of more effective methods of spreading health information. Given the extensive and morbid history of illness on a global scale, it is critical to reflect on the successes and failures of public health policies of the past to make adequately informed disease control decisions.

## **The Development of Public Health's Approach to Plague**

### ***Plague in the 1300s to 1500s***

When the Bubonic Plague first entered the world scene, society struggled to comprehend the disease. During the 1300s to 1500s, historians estimate that over 25 million individuals fell victim to the plague (Britannica), an insurmountable number of lost lives during a period where the total population was so drastically low compared to modern times. Byzantium Emperor John IV Kantakouzenos writes in John Aberth's "The Black Death: The Great Mortality of 1348-1350" about his son who was lost to the disease, and his observations regarding the non-discriminatory nature of the plague: "So incurable was the evil, that neither any regularity of life nor any bodily strength could resist it" (34). Each day brought upon the loss of thousands of lives, ravaging the old, young, rich, and poor the same, with victims lasting an average of only two to three days at the most. Treatments during this time were minimal but consisted of desperate attempts at bloodletting, incense burning, potions, rubbing chickens, snakes, and 'unicorn horns' on plague patients, or prayers. As expected, very few of these so-called treatments had any positive impact on the health of a plague patient and, in most cases, expedited their death. However, as detailed in "Medieval Cures for the Black Death," authored by Joshua J. Mark, Venice became the first known city to enforce a mandatory forty-day quarantine on merchants coming into their ports (Mark), an effort revolutionary for its time. Venice's quarantine rules came out of the Middle Ages as the time's only effective method of minimizing the spread of the plague. Despite the clear positive impacts of quarantines, many were reluctant to abide by such strict rules. Citizens of less strict cities were reluctant to comply with quarantine recommendations, which furthered the spread of disease in those areas. Those who were wealthy

enough chose to flee the infection of densely populated cities, taking the disease to rural areas before succumbing to illness themselves.

In an attempt to cope with the terrifying death consuming the world around them, many Europeans turned to, perhaps the sole constant they could find in their lives: God. Individuals saw the sudden and unexplainable onset of disease in their communities as God inflicting his wrath upon those who displeased him with their sins, leading to the emergence of groups of individuals known as flagellants, members of an organization known as the 'Brotherhood of the Flagellants'. Flagellants publicly harmed themselves with leather whips in the hopes that God would spare them of his wrath and free them from disease ("How did people try to 'cure' the Plague? (Flagellants)"). Those infected with the disease were cast away from society as undesirable sinners and often left to die alone. The plague's ever-persistent image as a manifestation of pure evil, and the inability of physicians to provide treatment of any benefit to plague victims, gave those surrounded by the disease no choice but to identify alternative coping methods to live with the uncertainty of the world around them. However, others turned towards heavy reliance on their faith in God's protection of their health to find peace within such strenuous times. Ibn al-Wardi expresses his fear of the plague and details in John Aberth's "The Black Death: The Great Mortality of 1348-1350" his pleas to God to provide him with security and salvation from the plague. "God is my security in every adversity. My sufficiency is in God alone. Is not God sufficient protection for His servant? Oh God, pray for our master, Muhammad, and give him peace. Save us for his sake from the attacks of the plague and give us shelter" (16). Such desperation highlights the magnitude of the importance of hope and faith to those who lived during the Bubonic Plague epidemics prior to the isolation of the *Yersinia pestis* bacteria and its identification as the cause of disease by medical researchers. Without hope, those

living in cities plagued with disease likely would have been driven to insanity by the death and fear consuming their lives. However, it would seem that these coping mechanisms primarily stemmed from the principle of a healthy self and an 'unhealthy' other that is still quite prevalent in society today. The separation of oneself from the overwhelming number of individuals impacted by the disease creates a mental detachment from the severity of the situation, allowing one to rationalize fear out of the forefront of thought. Those who had yet to fall victim to the illness had easy access to this rationalization with the disease's acceptance as a punishment sent by God for the sins of humanity, classifying victims of illness as 'sinners,' and creating a divide between the individual and the diseased society.

Prior to the emergence of the now widely-accepted Germ Theory, the spread of disease was explained by Miasma Theory, the idea that illness was spread by poor air quality. The prevalence of Miasma Theory directly correlated to the horrific sanitary conditions of large cities, a problem much more severe in areas of high population concentration such as London and Paris. Human fecal matter was thrown into rivers and onto the streets due to the lack of functioning sewage systems, and little concern was given to rodent infestations on the streets, trading ships, or in homes. In conjunction with the concept of plague victims being classified as sinners, Miasma Theory ruled the European epidemiological response, albeit as ineffective as it presented. Public health and response were not a priority during the Middle Ages, nor was it even recognized that it should be. This was primarily due to a lack of general knowledge regarding the impact of environmental factors on individual health and prolonging a period of immeasurable uncertainty and immeasurable death.

### *Plague in the 1600s - 1700s*

Not long after the disease's initial outbreaks subsided, it came back with a vengeance. London's Summer of 1665 brought about the deaths of approximately 15% of the English population, all of whom fell victim to the plague (Johnson). Mass burial sites became the standard as thousands fell victim to the disease. Those wealthy enough fled from the congregated cities in favor of smaller rural locations, furthering the spread of disease. During this time, society's approach to the plague began to shift. Many historians believe that the famous nursery rhyme "Ring Around the Rosie " has its origins in plague-era England. Although it is not definitive, many have linked the rhyme's name to the disease's external presentation of red sores with rings around them, and the "pocketful of posies" to the belief that carrying posies around would ward off the miasma so commonly believed to cause infection (Johnson). However, there are far too many variations of the rhyme for historians to accurately pinpoint the exact timeframe and context during which it was created. Were it to have originated from plague-era Europe, the rhyme likely would have been taught to children to warn them of the symptoms and consequences of infection from the plague.

During this timeframe, the medical community first acknowledged the risks of providing treatment to infected patients. French royal physician Charles De Lorme is credited with the infamous bird beak mask and outfit said to have been worn by physicians treating plague patients. The mask's long beak was usually stuffed with flowers or incense of some kind to ward off the bad smells, or miasma, attributed to the spread of disease. In addition to these peculiar masks, plague doctors wore leather cloaks, boots, and gloves over their bodies (Bertucci). Although the reasoning behind the masks does not remain scientifically sound today, this early attempt at utilizing personal protective equipment (PPE) is considered the first known

recognition of the possibility of patient-physician transmission of the disease. Plague physicians developed an iconicity of sorts, as victims realized that the presence of a physician dressed in such attire meant that they were incredibly likely to die. Media outlets at the time published images of plague doctors in local newspapers alongside accounts of “Dr. Beak of Rome,” comparing physicians to the Grim Reaper or scavengers. In a translation from Eugen Holländer and associates, the poem reads, “You believe it is a fable/What is written about Dr. Beak/Who flees the contagion/And snatches his wage from it/He seeks cadavers to eke out a living/Just like the raven on the dung heap/Oh believe, don’t look away/For the plague rules Rome” (Stuttgart). Europeans were quick to associate plague doctors with the plague’s suffering, sadness, and death, as their progressions in protection equipment were not joined by advances in treatment, meaning that the physicians accomplished very little to benefit the overall health of plague patients. This reality only enabled the negative progression of physician reputations. Poems such as Holländer’s depict such a reputation, suggesting that doctors benefitted from the suffering and death of others while seemingly escaping the illness themselves. Although the attribution of disease to God’s anger with society was still a prevalent aspect of plague culture in the 1600s and 1700s, such a shift in the societal perception of illness was a defining marker of this period.

### ***Plague in the 1800-1900s***

The 17th and 18th centuries brought upon some of the most significant advances in modern medicine to date. In 1849, English physician John Snow’s research during an outbreak of Cholera in Soho made the revolutionary discovery that the illness was waterborne, providing the first significant evidence denying Miasma Theory. It was not until the work of scientists Louis Pasteur and Robert Koch that Germ Theory began to take form. In the 1870s, Koch’s research



discovered the presence of microorganisms in the blood of cows that died from Anthrax that was not there in the blood of healthy cows, marking his discovery of the bacteria that is responsible for Anthrax, which Pasteur then used to find a vaccine for the disease (National Academy of Sciences). The groundbreaking research of these influential medical community members paved the way to widespread acceptance of Germ Theory as a legitimate explanation for disease and the eventual discovery of the microorganisms responsible for plague infection. In 1894, *Yersinia pestis* was isolated and identified by French physician Alexandre Yersin through his experimentation on buboes obtained via autopsy during an outbreak of the disease in Hong Kong, China (Butler). This discovery changed the field of medicine and its approach to the plague indefinitely, providing healthcare professionals with a legitimate starting point for effective treatment methods for patients. In 1947, the antibiotic streptomycin was found to treat *Yersinia pestis* infection, a progression that effectively lowered the mortality rate from 66% to 11% when treated on time (Centers for Disease Control). However, these advances in clinical medicine would not have had the same magnitude of positive effect if they had not been coupled with significant improvements in public sanitation standards. During the Summer of 1858, London faced what is known as 'The Great Stink.' Sanitary conditions in the city were so poor that the famous Thames River was overflowing with the waste of English citizens. 1858 was a scorching summer, and the excessive heat caused the waste in the river to decompose, creating a horrid stench that overtook every corner of the city, for once impacting everyone, including the English Parliament that met right next to the Thames (Lemon). This urged policymakers to act swiftly on the poor conditions of the river and led to the implementation of city-wide sewage systems, nearly eliminating outbreaks of waterborne illnesses like Cholera and improving the standard of sanitation throughout the whole city. Designated systems for sewage and trash

management reduced food sources for rats, therefore cutting down on the vector to human transmission of plague. Systemic improvements in environmental quality and drastic medical advancements facilitated the immense improvement of the state of public health to the level exhibited in modern times.

## **Modern-Era Plague**

### ***Plague in the United States***

To the average citizen of a first-world country, the plague is not a health condition they will ever encounter, let alone consider a threat to their health. This is no different for those living in the United States. According to the U.S. Centers for Disease Control, plague occurs most commonly in New Mexico, Colorado, and Arizona (Centers for Disease Control). However, even cases in these higher-risk areas are considered incredibly rare. In 2019, only one case of plague infection occurred in the United States (Centers for Disease Control). Health officials recommend the avoidance of wild animals that may carry plague-infected fleas and suggest close monitoring for symptoms if an individual suspects exposure to the plague. Antibiotic treatment for illness within 1 to 3 days from the onset of symptoms is incredibly effective. There are no reports of cases of antibiotic-resistant infection in the United States, providing no cause for widespread public attention or panic in present times. However, public health officials' continual monitoring of plague cases and infection response to antibiotics is critical to remaining proactive in the event of the emergence and spread of an antibiotic-resistant strain of *Yersinia pestis*.

### ***Plague Outside of the United States***

In stark contrast to the nearly plague-free United States, Madagascar remains at constant war with outbreaks of plague infections, with a yearly plague season typically lasting from October to April. In more recent years, cases of the plague have neared 3000 infections (BMC Public Health). While not the direct result of any individual factor, these outbreaks are exacerbated by the Malagasy people's living conditions on the island. According to the Borgen Project, nearly 75% of people in Madagascar lived on under \$2.00 a day in 2019 (Bazilian), one of the highest rates of poverty in the world. Such high poverty rates ultimately lead to poorer living conditions that are often overrun with rodents, with few affordable solutions available to residents of these areas. The majority of Madagascar's citizens live in remote, rural villages, making traveling to receive healthcare inconvenient and often impossible in times of emergency (Roberts). According to UNICEF, the COVID-19 pandemic has placed significant strain on the Malagasy healthcare system as providers are forced to manage coronavirus infection while treating and identifying those who require the specific antibiotics needed to treat the plague (UNICEF). In addition to systemic issues such as resource accessibility, healthcare providers in Madagascar are often confronted by cultural differences and severe stigma against the plague within the communities they serve. For example, traditional Malagasy burial practices involve exhumation and rewrapping of plague victims, a method strongly advised against by the World Health Organization due to *Yersinia pestis*' ability to remain alive long after the death of its host (Mead). Despite this, many individuals carry out the traditional ceremonies of their culture, resulting in significant amounts of contact tracing leading back to funerals for plague victims. Due to the stigma surrounding a diagnosis with the plague in Malagasy communities (Mead), many individuals will avoid seeking medical treatment until their condition has progressed

beyond antibiotics' abilities, ultimately resulting in untimely death. While Madagascar's public health conditions have improved in recent years, most of the country's population goes without proper medical treatment for even routine healthcare, let alone for acute plague treatment.

### ***Yersinia Pestis* as a Bioterroristic Threat**

Despite the plague's overall retreat from prevalence in the modern healthcare scene, the bacteria responsible for the infection, *Yersinia pestis*, remains a significant threat to public health and national security. Leaders in healthcare and national security such as the Centers for Disease Control and the U.S. Department of Homeland Security have classified the bacteria as a Category A bioterror threat, based on the infection's high contagion and mortality rates and the level of advanced planning required to be prepared in the event of a biological attack (U.S. Department of Homeland Security). As drastic as these measures may seem, historical context repeatedly proves that such precautions are more than necessary. Utilizing the bubonic plague as a weapon can be traced back to a battle in 1347 as a part of the Hundred Years War. During this battle, Mongolian forces used catapults to throw plague victims into the walls of the seaport city Caffa, then located in what is now Ukraine, resulting in overwhelming infection of the city's inhabitants, the spread of plague to Western Europe through the trade routes, and the beginning of the first modern-era pandemic, one that decimated Europe's population by nearly two thirds. (Britannica). During World War II, Japanese soldiers dropped fleas infected with *Yersinia pestis* over China, resulting in over 50,000 deaths and countless more infections (U.S. Department of Homeland Security). In the modern medical age, infection from *Yersinia pestis* is rarely life-threatening, so long as the disease is identified and treated with the proper antibiotics within 1-2 days of the onset of symptoms. This directly correlates to the meager mortality rate among

plague patients, specifically those living in wealthy countries such as the United States. However, as with any bacterial infection, a topic of particular concern is the possibility of mutations that make the disease more virulent or attain antibiotic resistance. Through the excavation of mass burial sites of plague victims, researchers have found evidence suggesting that the original strain of *Yersinia pestis* underwent a mutation that first gave it the ability to infect the lungs through the production of Pla protein, before seeing a second one that allowed for the infection to enter the body with more ease through open wounds (Fessenden). While at present, these mutations do not interfere with treatment via antibiotics, the bacteria remains one mutation away from reclaiming its status as the most lethal disease known to man. Were an antibiotic-resistant strain of *Yersinia pestis* to be isolated and reproduced in a lab setting, the discovery would have the potential to be utilized as a powerful yet horrific weapon of mass biological destruction.

### **Public Health Warnings From an Ancient Plague**

Looking back on the plagues of the past, the possibility of historical repetition must remain at the utmost concern of public health officials and individuals alike. Reflecting on Medieval plague response leaders' missteps allows the opportunity to address holes in epidemiological response plans and find ways to prevent the massive casualties seen with outbreaks of the Bubonic Plague. Despite the generally widespread knowledge of the suffering and destruction that widespread illnesses are capable of inflicting upon a society, attaining the trust and support of citizens continues as a primary struggle for leaders in the public health field. Perhaps the most significant barrier to properly containing the COVID-19 pandemic, specifically in the United States, is the high distrust in healthcare present amongst citizens, resulting in the

inability to manage the public health crisis effectively. When the Bubonic Plague tore through the world, an unfathomable number of lives were lost preemptively to misconceptions and lack of the necessary medical advancements, barriers to achieving health that no longer rule medicine. The mistakes made by health leaders of the past had lethal consequences, placing the highest of responsibility on those who have the opportunity to analyze and learn from these wrongdoings to prevent such a tragedy from occurring once more.