

A BRIEF HISTORY OF QUARANTINE

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Quarantines have been employed for thousands of years as safeguards against the spread of disease. Early in the history of human civilizations, isolation and confinement of ill persons were the predecessors of quarantine. As an understanding of diseases and employment of quarantines evolved, documentation regarding their use increased. This paper focuses most heavily on the latter history of quarantine, as more primary sources exist from those time periods. This article aims to better define quarantine within the parameters of human technology and, therefore, to gain a deeper understanding of its uses in relation to advancements made in science and medicine. Quarantine, as a technology, will be examined only in the context of Europe and the United States up to the year 1850, as scientific advances made following the Industrial Revolution led to rapid and varied medicinal responses to disease outbreaks besides traditional quarantines. In addition, due to the prevalence of

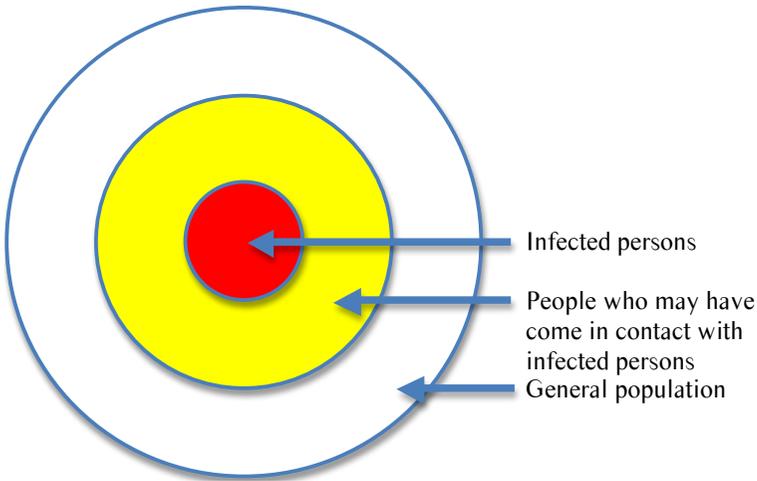
quarantines following the Black Death, only a few case studies after that plague will be discussed.

QUARANTINE AS A TECHNOLOGY

Quarantine differs greatly from isolation; it requires a theoretical knowledge about the causes and methods of disease transmission. However, for the purposes of this article, isolations will be examined as a precursor of true quarantines. Throughout much of early epidemiological history, isolation, not quarantine, was the primary method of halting the spread of pandemics, because people did not understand the concept of an incubation period.¹

The historical significance and impact of quarantine cannot be understood without distinguishing the scientific principles that quarantine employs. The key concept utilized in true quarantine is germ theory, which holds that

1. "Quarantine and Isolation," *Centers for Disease Control and Prevention*, last modified October 24, 2011, accessed December 5, 2011, <http://www.cdc.gov/quarantine/>.



Isolation is established when those people who belong in the red circle are restricted in their movements. Quarantine occurs when those people who belong in the yellow circle have their movement restricted as well.¹

1. Centers for Disease Control and Prevention, "Quarantine and Isolation." Last modified October 24, 2011. Accessed December 5, 2011. <http://www.cdc.gov/quarantine/>.

microscopic organisms called bacteria are the cause of disease. Germ theory, first postulated in the mid-nineteenth century, was supported by the work of Louis Pasteur, who published his findings in 1861.² In 1876, German physician Robert Koch "traced the life history of the organism responsible for anthrax, a disease of cattle and sheep."³ Six years later, in 1882, Koch successfully traced tuberculosis, "first human disease microorganism."⁴ Though Koch's discovery was monumental in retrospect, germ theory did not become part of scientific

and medical canon until the early twentieth century.⁵ Koch's contemporaries were trained to believe that, "most diseases were caused by miasmas, undisciplined lifestyles, and anything other than tiny *living* organisms."⁶

An important offshoot of germ theory and an idea pivotal to the technology of quarantine is the notion of the incubation period of disease. Anyone who carries a pathogen responsible for a disease is considered infected, though not all carriers may be symptomatic (*figure 2*). Symptoms of a disease are not always caused by the pathogen itself. Sometimes, the symptoms occur due to the response of the immune system in its attempt

2. Charles De Paolo, *Epidemic Disease and Human Understanding* (Jefferson, NC: McFarland & Company, Inc., 2006), 154.

3. Jo N. Hays, *The Burdens of Disease: Epidemics and Human Response in Western History* (Piscataway, NJ: Rutgers University Press, 1998), 150.

4. Hayes, *The Burdens*, 150.

5. Charles De Paolo, *Epidemic Disease and Human Understanding*, 155.

6. Sheldon Watts, *Epidemics and History: Disease, Power and Imperialism* (Wiltshire, United Kingdom: Redwood Books, 1997), xii.

to fight off the infection. An excellent example of an immune response symptom is a fever, which is the body's attempt to control the spread of harmful microbes through internal temperature regulation.⁷ Many microorganisms exhibit a small tolerance range for heat; by increasing the temperature of the environment in which they grow (the body), the immune system attempts to kill invading pathogens.⁸ Pathogenic bacteria take time to grow and multiply within their host. Until they do so in sufficient numbers, they are often overlooked by the immune system. The time between when a pathogen enters the body and when it first causes symptoms is the incubation period.⁹

An example of a disease with an incubation period is Acquired Immune Deficiency Syndrome (AIDS). The organism responsible for AIDS is Human Immunodeficiency Virus (HIV), which is transmitted through the exchange of bodily fluids, such as blood, semen, and vaginal fluids.¹⁰ When HIV enters the body, the virus infects cells that belong to the immune system, known as lymphocytes. As the virus replicates, it slowly

destroys the body's ability to protect itself from infection, cell by cell. Eventually, the immune system is overwhelmed and the individual develops AIDS.¹¹ "The median incubation period [for adults] from HIV infection until development of AIDS is estimated at approximately 10 years."¹² At any point during those ten years, an HIV positive individual is considered infectious and able to pass on the disease to others.¹³

Rudi Volti, author of *Society and Technological Change*, defines technology as "a system based on the application of knowledge, manifested in physical objects and organizational forms, for the attainment of specific goals."¹⁴ It is important to note that by such definitions, technologies are employed even when the users have theories regarding how to attain their specific goals based on false information. Therefore, though for thousands of years people had no knowledge of germ theory or the true methods of disease transmission, they employed quarantines as a technology against the spread of epidemics. With the work of Koch and Pasteur, the scientific basis for why quarantines work was finally unveiled, though quarantine as a technology remained unchanged

7. Rudi Volti, *Society and Technological Change* (New York: St. Martin's Press, 1995), 6.

8. Robert Benoit, "Honors General Microbiology Lecture" (lecture, Virginia Tech, November 15, 2011).

9. MedicineNet, "Definition of Incubation period," last modified November 6, 2001, accessed December 5, 2011, <http://www.medterms.com/script/main/art.asp?articlekey=18956>.

10. "HIV/AIDS," *Mayo Clinic*, last modified October 20, 2011, accessed December 5, 2011, <http://www.mayoclinic.com/health/hiv-aids/DS00005>.

11. Michael Madigan, John Martinko, Paul Dunlap, and David Clark, *Biology of Microorganisms* (Glenview, IL: Pearson Education, Inc., 2009), 995-996.

12. Dennis Osmond, "Epidemiology of Disease Progression in HIV," *University of California San Francisco*, last modified May 1998, accessed December 5, 2011, <http://hivinsite.ucsf.edu/InSite?page=kb-03-01-04>.

13. Madigan et al., *Biology of Microorganisms*, 996.

14. Volti, *Society and Technological Change*, 6.

as a correct understanding for how a technology works is not necessary for the definition of technology.

EARLY USES OF QUARANTINE AND ISOLATION

One of the earliest mentions of isolation is found in the Biblical book of Leviticus, the third book of the Jewish Torah. Though there is no exact date regarding the age of Leviticus, most biblical scholars agree that it was written between the fifth and eighth century BCE.¹⁵ Because Leviticus was added to continuously over the period of several centuries, the relevant chapters could have been written as early as the twenty-first century BCE.¹⁶ Jewish knowledge regarding the usefulness of isolation shows up in the thirteenth chapter, in response to a skin disease (most likely leprosy, caused by *Mycobacterium leprae*).¹⁷ Jewish Rabbis certainly had no knowledge of the bacteria, but they did know the value of isolation:

The priest is to examine the sore on the skin, and if the hair in the sore has turned white and the sore appears to be more than skin deep, it is a defiling skin disease. When the priest examines that person, he shall pronounce them ceremonially unclean. If the shiny spot on the skin is white but does not appear to be more than skin

deep and the hair in it has not turned white, the priest is to isolate the affected person for seven days. On the seventh day the priest is to examine them, and if he sees that the sore is unchanged and has not spread in the skin, he is to isolate them for another seven days.¹⁸

Technology, as previously defined, is a vast field, but it does have restrictions. Supernatural means of attaining specific goals, such as prayer or belief in the divine intervention, do not incorporate technologies. As historian Maurice Richter states, “technology requires that natural means be employed: we shall not allow... for a technology of prayer.”¹⁹ Leviticus offers an excellent example of both the expansiveness and the boundaries of the definition of technology. In the fourteenth chapter, Jewish Rabbis were instructed to:

Bring [the afflicted] for their cleansing to the priest at the entrance to the tent of meeting, before the Lord. The priest is to take the lamb for the guilt offering, together with the log of oil, and wave them before the Lord as a wave offering... In this way the priest will make atonement before the Lord on behalf

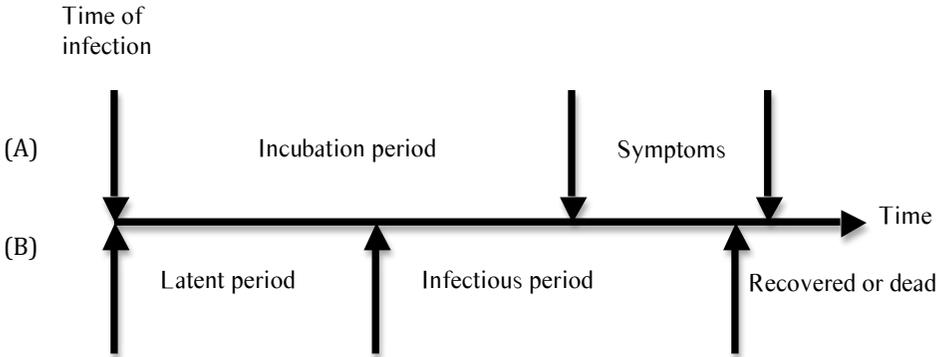
15. Mary Douglas, *Leviticus as Literature* (New York, NY: Oxford University Press, 1999), 7.

16. Douglas, *Leviticus*, 8.

17. “Leprosy,” *World Health Organization*, last modified February, 2010, accessed December 5, 2011, <http://www.who.int/mediacentre/factsheets/fs101/en/>.

18. “Leviticus 13 (New International Version),” *Bible Gateway*, accessed December 5, 2011, [http://www.btiblegateway.com/passage/?search=Leviticus 13&version=NIV](http://www.btiblegateway.com/passage/?search=Leviticus%2013&version=NIV).

19. Maurice Richter, *Technology and Social Complexity* (Albany: State University of New York Press, 1982), 10.



“The sequence of events during a simple, directly transmitted disease. The dynamics of the disease are shown in A and the dynamics of infectiousness in B. The victims may cease to be infectious before the end of the symptomatic period.”¹

1. Susan Scott and Christopher Duncan, *Biology of Plagues: Evidence from Historical Populations*, (Cambridge, United Kingdom: Cambridge University Press, 2001), 22.

of the one to be cleansed.²⁰

Rabbis trusted that their God would cure the afflicted and protect the uninfected. Such methods of disease prevention do not fall within the definition of technology, and thus do not qualify as quarantine, or even isolation.

Nearly a thousand years later, in 541 CE, the first recorded outbreak of what came to be known as bubonic plague took place. Originating in Arabia and Pelusium, the plague “inundated Syria, Persia and Palestine with sudden outbreaks of fever followed by collapse, emergence of buboes, delirium, vomiting of blood, and death.”²¹ Known as the Plague of Justinian, the disease reached the Byzantine capital of Constantinople in 542. According

to the historian Procopius of Caesarea (c.490/507-c.560s CE), the disease killed “up to ten thousand daily and wiped out 40 percent of the capital city.”²²

Emperor Justinian I (482-565 CE) contracted the plague, but he survived and became immune to its effects. Realizing the magnitude of the outbreak, he quickly set up procedures for disposing of the many corpses in his capital. Public money was set aside for the payment of gravediggers, and boats contracted to dump bodies at sea.²³ In addition, a series of laws were enacted against those individuals he believed to be most responsible for the epidemic, including Jews, Samaritans, pagans, heretics, Arians, Montanists, and homosexuals.²⁴ These laws created

20. Leviticus 14 (New International Version).

21. Mary Ellen Snodgrass, *World Epidemics: A Cultural Chronology of Disease from Prehistory to the Era of SARS* (Jefferson, NC: McFarland & Company, Inc., 2003), 20-21.

22. Snodgrass, *World Epidemics*, 21.

23. Jo N. Hays, *Epidemics and Pandemics: Their Impacts on Human History* (Santa Barbara: ABC-CLIO, Inc., 2005), 26.

24. Lester Little, *Plague and the End of Antiquity*:

an artificial (and very porous) quarantine around Constantinople.

Justinian's discriminatory laws created a sort of quarantine, though he had no knowledge of what caused the disease to spread. People who were considered different from the Christians of Constantinople were accused of causing the terrible outbreak. As a result, Justinian attempted to halt their movement. These minorities were no guiltier in their role as plague carriers than the Christians who had the disease, but racism and aggression against dissident groups of Justinian's reign played a major role in their branding as the source of the epidemic.²⁵ The quarantine enacted by Justinian proved virtually useless and did nothing to stop the spread of the plague. However, it still qualifies as a quarantine technology, a failed technology, but a technology nonetheless.

THE BLACK DEATH

The use of quarantine rapidly expanded during the Black Death of the fourteenth century. Originally appearing in the Far East, the disease that would come to be synonymous with plague first emerged in Europe as nothing more than a rumor in 1346. Over the next five to ten years the plague exploded onto the Western world, killing millions and altering the fabric of every society it touched.²⁶ Italian author Giovanni Boccaccio

(1313-1357) wrote one of the most famous descriptions of the Black Death in his *Decameron*:

For in the early spring of the year we have mentioned, the plague began, in a terrifying and extraordinary manner, to make its disastrous effects apparent. It did not take the form it had assumed in the East, where if anyone bled from the nose it was an obvious portent of certain death. On the contrary, its earliest symptom, in men and women alike, was the appearance of certain swellings in the groin or armpit, some of which were egg-shaped whilst others were roughly the size of the common apple... Against these maladies, it seemed that all the advice of physicians and all the power of medicine were profitless and unavailing... few of those who caught it ever recovered, and in most cases death occurred within three days from the appearance of the symptoms we have described, some people dying more rapidly than others, the majority without any fever or other complications.²⁷

For years medical historians debated the true cause of the Black Death. The most common pathogen proposed by modern researchers is *Yersinia pestis*, which causes bubonic plague.²⁸

The Pandemic of 541-750 (New York: Cambridge University Press, 2007), 113.

25. Little, *Plague*, 113.

26. Philip Ziegler, *The Black Death* (Wolfeboro Falls, NH: Alan Sutton Publishing, Inc., 1991), 1-3.

27. Giovanni Boccaccio, *The Decameron*, translated by G. H. McWilliam (London: Penguin, 1972), 50-51.

28. "Plague Fact Sheet," Centers for Disease Control and Prevention, last modified March 30, 2005, accessed December 5, 2011, <http://www.cdc.gov/ncidod/dvbid/plague/facts.htm>.

While there were many historical accounts, the symptoms described by contemporary writers sometimes conflicted.²⁹ In addition, modern biologists and epidemiologists have had some “difficulties explaining how either bubonic or pneumonic [a similar disease] plague could have moved with such terrible speed and savagery.”³⁰ In 2011, scientists working at McMaster University confirmed the genetic strain of *Y. pestis* found in London plague victims, proving that the bubonic plague was indeed the disease responsible for the Black Death.³¹

The vector of the Black Death has traditionally been attributed to fleas, specifically *Xenopsylla cheopis*, and the rats that carried them. However, a small group of historians, led by Jean-Noel Biraben, believe that a human flea, *Pulex irritans*, was the true vector of the disease. Others, such as Paul Slack, contend that, “though *Pulex irritans* may transmit plague in certain circumstances, modern work suggests that major epidemics require a rodent epizootic as their foundation.”³²

29. Ziegler, *The Black Death*, 9.

30. Hays, *The Burdens of Disease*, 38.

31. Kirsten I. Bos, Verena J. Schuenemann, G. Brian Golding, Hernán A. Burbano, Nicholas Waglechner, Brian K. Coombes, Joseph B. McPhee, Sharon N. DeWitte, Matthias Meyer, Sarah Schmedes, James Wood, David J. D. Earn, D. Ann Herring, Peter Bauer, Hendrik N. Poinar, and Johannes Krause, “A draft genome of *Yersinia pestis* from victims of the Black Death,” *Nature*, 478, no. 7370 (2007): 506-510, <http://www.nature.com/nature/journal/v478/n7370/full/nature0549.html> (accessed December 5, 2011).

32. Paul Slack, “The Black Death Past and Present. 2. Some Historical Problems,” *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 83, no. 4

Fleas, as the vector of the Black Death, proved essential to the successful use of quarantines. By halting any movement of people and especially clothing, which was often contaminated with pathogen carrying fleas, from plague areas, quarantines achieved limited success against the spread of the disease.

The Black Death took an enormous toll on Europe’s population (figure 3). Though reliable information is scarce, between 1347 and 1351, the “Black Death was darting about, mortality varied from an eighth to two-thirds of a region’s population.”³³ By the time it subsided, 20 million people had died in Europe alone, reducing the population to 80 million people.³⁴ The epidemic completely halted the rise in human population begun in 5000 BCE; it killed so many people that it would take Europe more than 150 years to return to its former population.³⁵

By the late fourteenth century, the effects of the plague were so bad that Italian city-states resorted to desperate measures in an attempt to preserve public health. Without definite knowledge of what caused the disease, Italian health commissioners fell back

(1989): 461-463, <http://www.sciencedirect.com.ezproxy.lib.vt.edu:8080/science?ob=MiamiImageURL&cid=272971&user=513551&pii=0035920389902472&check=y&origin=&coverDate=31-Aug-1989&view=c&wchp=dGLzVlk-zSkWz&md5=8103080c59ec4d7861450a81e3f1a8bb/1-s2.0-0035920389902472-ma> (accessed December 5, 2011).

33. Watts, *Epidemics and History*, 1.

34. Irwin Sherman, *Twelve Diseases That Changed Our World* (Washington, DC: ASM Press, 2007), 68.

35. Sherman, *Twelve Diseases*, 69.

on a common theory that the air itself was infected. In their view, the only way to stop the epidemic was to somehow clean the air. "In their pursuit of corruption-free air, commissioners inspected wine, fish, meat, and water supplies; they worried about sewage; they regulated burials, and decreed the destruction of the clothing of the deceased."³⁶ These measures may have saved lives by cutting down on secondary sources of infection. But besides burning the clothing of the deceased, they did little to curb the rampant spread of the plague.³⁷ More extreme measures were taken by Viscount Bernabo of Reggio, who ordered, "every person with plague be taken out of the city in to the fields, there to die or recover."³⁸

The doctrines of contagion set up in Italy led to two vitally important "forms of public health control... municipal quarantine and isolation of the victims."³⁹ In 1374, both Genoa and Venice began determining the ports of origin of incoming ships, and "turned away any coming from infected areas."⁴⁰ Three years later, in 1377, the first maritime quarantine was established at Venice's trading colony of Ragusa. All ships that visited the colony were required by law to anchor outside the harbor for a period of

thirty days while port authorities inspected the crew and cargo in order to determine any potential health threat.⁴¹ The quarantine law consisted of four tenets:

- (1) That citizens or visitors from plague-endemic areas would not be admitted into Ragusa until they had first remained in isolation for 1 month; (2) that no person from Ragusa was permitted go to the isolation area, under penalty of remaining there for 30 days; (3) that persons not assigned by the Great Council to care for those being quarantined were not permitted to bring food to isolated persons, under penalty of remaining with them for 1 month; and (4) that whoever did not observe these regulations would be fined and subjected to isolation for 1 month.⁴²

Ultimately, the Italian city-states extended their quarantine time requirement to forty days. Originally termed *trentino*, the adjustment to forty days of quarantine caused the name to be modified to *quarantino*, a "term derived from the Italian word *quaranta*, which means 'forty.'⁴³ Some suggest this was based on the "Hippocratic belief that the 40th day distinguished

36. Hays, *The Burdens of Disease*, 54.

37. Hays, *The Burdens of Disease*, 54.

38. Paul Sehdev, "The Origin of Quarantine," *Clinical Infectious Diseases*, 35, no. 9 (2002): 1071-1072, <http://cid.oxfordjournals.org/content/35/9/1071.full>.

39. Hays, *The Burdens of Disease*, 54.

40. Joseph Byrne, *Encyclopedia of Pestilence, Pandemics, and Plagues*, (Westport, CT: Greenwood Publishing Group, 2008), 483.

41. Byrne, *Encyclopedia*, 483.

42. Paul Sehdev, "The Origin of Quarantine," *Clinical Infectious Diseases*, 35, no. 9 (2002): 1071-1072, <http://cid.oxfordjournals.org/content/35/9/1071.full>.

43. Paul Sehdev, "The Origin of Quarantine," *Clinical Infectious Diseases*, 35, no. 9 (2002): 1071-1072, <http://cid.oxfordjournals.org/content/35/9/1071.full>.



Unknown Artist, "Great Plague of London-1665," *Wikipedia Commons*

acute diseases from chronic."⁴⁴ Other authors contend that it was changed due to Christian practices, such as the observation of Lent, the length of the great flood of Noah, or the length of Jesus' stay in the wilderness. Regardless of the reason, the increased quarantine time offered an improvement; it better insured that the ships in question did not pose a health risk to the city.

In addition to establishing a maritime quarantine for incoming ships, Italian health officials instituted a "reactive quarantine – the restriction of infected persons and their families (and often anyone they had been in contact with) to their homes as a

means of preventing further spread of disease."⁴⁵ Often the authorities would assign individuals to guard the homes of the quarantined in order to insure they did not escape. In Milan, "where cases of the plague were first discovered, all the occupants of the three houses concerned, dead or alive, sick or well, were walled up inside and left to perish."⁴⁶ This extreme action appeared to have worked, as out of all the large Italian city-states, Milan was the least afflicted with the Black Death.⁴⁷

In 2007, archeologists working in Italy's Venetian Lagoon discovered a mass grave of more than 1,500 victims of the bubonic plague (see Figure 4). In Venice, those who caught the plague were immediately sent to the small island of Lazzaretto Vecchio. Once there, any physicians brave or foolish enough to tend to the infected treated them until they either survived or perished. Lazzaretto Vecchio may have been the world's first lazaret, or quarantine colony.⁴⁸

The forty-day quarantine was strictly adhered to and maintained for the next 300 years throughout Europe. In northern Italy, the quarantine continued in order to avoid the importation of diseases to their busy commercial ports. In 1652, the city of Genoa quarantined people "who had been in close and

45. Byrne, *Encyclopedia of Pestilence, Pandemics, and Plagues*, 483.

46. Ziegler, *The Black Death*, 38.

47. Ziegler, *The Black Death*, 38.

48. Maria Valsecchi, National Geographic, "Mass Plague Graves Found on Venice 'Quarantine' Island." last modified August 29, 2007, accessed December 5, 2011. <http://news.nationalgeographic.com/news/2007/08/070829-venice-plague.html>.

44. Byrne, *Encyclopedia of Pestilence, Pandemics, and Plagues*, 483.

direct contact with infected people or merchandise” for the standard period of forty days.⁴⁹ In addition, maritime vessels had to follow strict procedures: Vessels from England, if they come directly without touching at infected or suspected paces, and with clean bills, are allowed entry after a few days; first, however, goods and merchandise are sent to the pesthouse where they are purified for 20 days, and if they touch any of the above [infected] places they must observe complete quarantine.

Vessels coming from ports uninfected, but under suspicion, are subject to quarantine for 30 or 35 days according to the suspicion held, but nevertheless the goods are sent immediately to the pesthouse.

If perchance any deaths occur or if anyone falls sick during the voyage or during the time the quarantine is being observed, the quarantine is to be extended for 50 or 60 days according to the danger and circumstances; the people and the goods are to be sent to the pesthouse.

Vessels from the Levant are quarantined for 30, 35, 40 days according to information received and if they come with a clean bill; the goods at the pesthouse are purified for the same length of time.⁵⁰

The forty-day quarantine proved to be an effective formula for handling outbreaks of the plague. According to current estimates, the bubonic plague had a 37-day period from infection to death; therefore, the European quarantines would have been

highly successful in determining the health of crews from potential trading and supply ships.⁵¹ The prevalence of a forty-day quarantine throughout the continent suggests one causative agent of the Black Death, further reinforcing the notion that *Yersinia pestis* was the pathogen responsible.⁵²

In England, as in the rest of Europe, the Black Death lingered and tormented people for several hundred years. England’s major cities were particularly vulnerable; poor sanitary conditions and massive overcrowding facilitated outbreaks.⁵³ The last in a long series of pandemics, the Great Plague of London in 1665, killed between 75,000 and 100,000 of the capital city’s citizens.⁵⁴ During the summer months the death rates rose, peaking in September “when 7,165 Londoners died in one week.”⁵⁵

In the English countryside, the small village of Eyam instituted a self-imposed quarantine in 1666, after its citizens began dying of disease. While the cause of the pandemic was traditionally attributed to the Black Death, the rate at which people were killed was far too fast to insure the proper incubation time of *Yersinia pestis*. In addition, the location of Eyam (161 miles north of London) and the type of dwellings produced

51. Scott et al., *Biology of Plagues*, 361.

52. Scott et al., *Biology of Plagues*, 383.

53. Ziegler, *The Black Death*, 119-126.

54. “The Great Plague of London, 1665,” *Contagion: Historical Views of Diseases and Epidemics*, accessed December 5, 2011, <http://ocp.hul.harvard.edu/contagion/plague.html>.

55. “The Great Plague of 1665-6,” *The National Archives*, accessed December 5, 2011, <http://www.nationalarchives.gov.uk/education/lesson49.htm>.

49. Scott et al., *Biology of Plagues*, 382.

50. Scott et al., *Biology of Plagues*.

in the village impeded the spread of the rats necessary to establish an epizootic base for the bubonic plague. Finally, some symptoms of the Eyam disease did not fit traditional plague descriptions, such as “a sickly, sweet cloying sensation in the nostrils.”⁵⁶ One explanation of such symptoms could be the necrosis of the internal organs, which does not fit the profile of the bubonic plague. What no one realized at the time was that if the disease was indeed the bubonic plague as they suspected, the heroic quarantine would “have no effect on a hypothetical rat population which would be free to move to adjacent villages and so continue the spread of the epidemic.”⁵⁷ However, the successful quarantine further reinforced the theory that bubonic plague did not cause the outbreak.⁵⁸

Regardless of the true cause of the Eyam epidemic, at the urging of William Mompesson, the Rector of Eyam, quarantine was imposed in late May or early June of 1666. By mutual agreement, the citizens of the village agreed to confine themselves to “within a circle of about half a mile around the village.”⁵⁹ Nearby towns and various lords left food and other supplies at several pre-arranged points on the boundary of the village. These quarantine methods prevented the disease from spreading outside the parish.⁶⁰ According to the Eyam parish register, within the

village, 260 people died due to the disease. Estimates of the overall population of the community have been anywhere from 350 to 800 people. A comprehensive study of the Eyam outbreak concluded that the total population of the village was between 688 and 800 citizens, meaning the outbreak killed anywhere from 33 to 38 percent of the populace.⁶¹

QUARANTINE IN THE UNITED STATES

As the Black Death slowly receded, public health concerns turned to other diseases, such as tuberculosis, smallpox, cholera, and yellow fever. In the United States, an epidemic of yellow fever struck the capital of Philadelphia in August 1793. The outbreak lasted until November and killed as many as 5,000 citizens and forced about forty percent (20,000 people) of the population to flee the city.⁶² In response to the epidemic, the Commonwealth of Philadelphia established the Lazaretto Station on the Delaware River in 1799.⁶³ “The 10-acre Lazaretto, built with a hospital, offices and residences on the banks of the Delaware River in Tinicum Township, processed ships, cargo and passengers sailing for the port of Philadelphia for nearly a century.”⁶⁴

Nearly forty years later, in 1832, New York City experienced

56. Scott et al., *Biology of Plagues*, 282.

57. Scott et al., *Biology of Plagues*, 280-281.

58. Scott et al., *Biology of Plagues*, 281.

59. Scott et al., *Biology of Plagues*, 281.

60. Scott et al., *Biology of Plagues*, 280.

61. Scott et al., *Biology of Plagues*, 382, 279.

62. Hays, *Epidemics and Pandemics*, 185-195.

63. “Lazaretto,” *Lazaretto Quarantine Station*, accessed December 5, 2011, <http://www.ushistory.org/laz/>.

64. “History,” *Lazaretto Quarantine Station*, accessed December 5, 2011, <http://www.ushistory.org/laz/history/index.htm>.

a cholera outbreak. Beginning in Asia, in 1824, the disease spread across the world to England and eventually Canada during the next eight years.⁶⁵ On June 15, 1832, a steamboat from Albany arrived in New York City and “brought word that cholera had broken out in Quebec and Montreal.”⁶⁶ That same week, Mayor Walter Bowne instituted a strict quarantine in an effort to protect his city. According to Brown’s proclamation, later certified by the New York Board of Health, no ship could approach “closer than three hundred yards to the city; no vehicle closer than a mile and a half.”⁶⁷

The New York quarantine was a sound idea, but doomed from the beginning. Many English immigrants arriving in Canada held the United States as their final destination and quickly made their way across the border. As individual towns and cities in New England set up their own quarantines, the immigrants simply “leaped from halted canal boats and passed the locks on foot, despite efforts by contingents of armed militia to stop them.”⁶⁸ On Monday, June 26, the first case of cholera was reported in New York City, with several more being reported by the end of the week.⁶⁹ Like a dam, once the tiniest cracks began appearing in the quarantine, it collapsed. By the end of the epidemic, over 3,500 people died,

though that number does not fully represent the full impact of the disease.⁷⁰ 70,000 people fled the city, “carrying cholera into the interior [of the country]” and reducing the city’s population by thirty-five percent.⁷¹ Through the New York City refugees, the epidemic spread, carrying as far south as New Orleans and Mexico.⁷²

CONCLUSION

Beginning as early as three thousand years ago, quarantine and isolation were employed as technologies against the proliferation of disease. As human understanding of disease transmission grew, quarantine sophistication and efficacy improved, until it became standard practice in combating epidemics. Though not always successful, quarantines delayed or contained outbreaks by removing all potential pathogen carriers from the populace. At first lightly used against leprosy and plagues of antiquity, quarantine, as a technology, expanded rapidly in the Western world during the Black Death epidemic. Its initial success against the plague established quarantine as a standard procedure to stopping the spread of epidemics and pandemics.

65. Hays, *Epidemics and Pandemics*, 211-212.

66. Charles Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (Chicago: The University of Chicago Press, 1987), 21.

67. Rosenberg, *Cholera Years*, 22.

68. Rosenberg, *Cholera Years*, 24.

69. Rosenberg, *Cholera Years*, 26.

70. John Wilford, “How Epidemics Helped Shape the Modern Metropolis.” *The New York Times*, August 15, 2008.

71. Geoffrey Marks, and William Beatty, *Epidemics*, (New York, NY: Charles Scribner’s Sons, 1976), 201.

72. Hays, *Epidemics and Pandemics*, 211-212.