The Ghost Map Study Guide

The Ghost Map by Steven Johnson

BOOKRAGS

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Summary

The Ghost Map tells the story of the cholera epidemic of 1854 in Victorian London. It also describes the investigative work accomplished by two Londoners who were determined to find the source of the scourge. Victorian London was over-crowded and had not established a waste system that separated clear drinking water from sewage. There was a shadow world of scavengers who trudged through the contaminated Thames River where the sewage from three million people wound up. When the sewage contaminated clear water it was the precursor for the spawning of the cholera bacterium.

Thomas and Sarah Lewis lived in Soho on Broad Street within an area that was known as the Golden Square. Most of the residents of London Square were middle and upper class Londoners who tended to look down on the Soho residents. Soho was located in the central part of the Golden Square and was a cross-mixture of the classes and a place that attracted artists and socialists and even drew the interest of a Prussian immigrant named Karl Marx who lived there with his young family.

In August 1854, the five-month-old daughter of Thomas and Sarah Lewis became ill. The source of her illness was unknown at the time. She had diarrhea that required a constant changing of her diapers. The soiled cloth diapers were soaked in vats of water and then washed. The wash water was disposed of in a local cesspool that fed the Broad Street pump, a source of clear water that many in the neighborhood relied upon for the drinking and cooking water. Her waste accumulated in the cesspool and bred the cholera bacteria that ultimately contaminated the water and caused the cholera outbreak. Cholera bacteria breeds in human excrement and infects the small intestine of those who ingest it. The person sheds massive amounts of water diarrhea and becomes so dehydrated that the heart works overtime to keep circulation up. Eventually the organs shut down and the heart stops.

Dr. John Snow was a physician an anesthesiologist who had done pioneer work on the application of ether and chloroform to dull the pain of surgical procedures. Prior to his work, surgery patients had to grin and bear it. Queen Victoria was one of the first patients to use chloroform. She summoned Snow to administer the anesthesia during the birth of her eighth child. Snow was also interested in cholera epidemics and had done extensive research on an early outbreak in London.

During the Soho Epidemic, also known as the Broad Street Epidemic, Snow was intrigued by the sources and causation of the epidemic. From his prior work and knowledge about epidemics, he became certain that the disease was waterborne. He had to fight off critics who ridiculed him over his thesis. The cause that was popularly held by most scholars and scientists at the time was that cholera was an airborne disease caused by the stench from the contaminated Thames River.

Snow ignored his skeptics and remained resolved to prove his theory. One of his skeptics was a local Soho curate from St. Luke’s who knew the people and geography

of Soho. The young curate, Henry Whitehead was dedicated to visiting the sick and dying during the epidemic and bringing as much comfort as he could to them. He began to see signs that told him that cholera was not airborne and ultimately was swayed to ascribe to Snow's waterborne theory. Together Snow and Whitehead proved the waterborne theory and discovered who patient zero was.

Monday, August 28: The Night-Soil Men

Summary

The vast underclass of 1854 London was so large that it had virtually formed its own city. The toshers waded in the Thames River trying to dredge up coins with their long canes. Following them closely were the mud-larks who would grab the debris that the toshers stirred up but didn't want – wood, coal and other scraps. Others of the underclass collected dog excrement or foraged the carcasses of any dead animals. In the sewers below others slogged through the City's wasteland in search of debris they could sell. These scavengers lived in a world of excrement and death.

While there are still homeless in today's society, they do not have to depend on scavenging in order to survive. Scavengers performed an important service – they removed the refuge from a large population. Recycling isn't a modern innovation; it has been going on for centuries since the days of Ancient Greek and Rome. Recycling has proven to be a crucial element for the success of a culture. Waste management can be seen in nature as in the successful perpetuation of coral reefs.

Although there was a large isolated and even underground segment of the population that comprised the underclass and the scavengers of 1854 London and lived in the shadows, the stench of the area told everyone that they were there. The unbearable odors emanated from the sewers where deadly pockets of methane developed from the "millions of micro-organisms diligently recycling human dung into a microbial biomass." This mass released the vicious gases that literally smelled up the entire city of London. Human scavengers were in a territorial battle with the bacterium.

Near the top of the scavenger lot were the night-soil men who were hired by property owners and landlords to clean up the cesspools in their buildings. Mayhew described in the Morning Chronicle in 1849 a house at No. 1 London Street where choler had first appeared seventeen years before. There was also the problem of privately run burial grounds. The Islington location had 80,000 packed into an area that was intended to hold 3,000 bodies. Although the odor from the decaying bodies was abhorrent, they did not cause disease.

The fear of disease caused Victorian London to make some fateful and wrongheaded decisions about keeping the public safe. The fear of death has long been a part of the human experience. The Earl of Craven owned a plot of land that he used as a final resting place for those who were suffering from the Great Plague of 1665. For two generations no one would build anything upon the grounds, fearing contamination. Eventually, fears were alleviated and ground for residences were needed and the land became the fashionable neighborhood known as Golden Square. Most of the people in the square were aristocrats and Huguenot immigrants. In 1854, when another plague broke out, tales of those buried long ago came to mind.

The Soho area was initially an elite site where artists and writers like Percy Shelley and philosophers like Edmund Burke lived. Soho was a poor island in the exclusive West End where the working impoverished lived in the midst of the foul-smelling air from the heavy concentration of industry. The elite artist enjoyed the ambiance of the economically diverse neighborhood that appeals to new urbanites in modern times. A young Karl Marx was also on the scene. City Planner John Nash designed Regent Street to be the great divide between the poor in Soho and the well-to-do in the neighboring Mayfair. On the Soho side there were narrow streets and smaller houses, also referred to as “mean” houses that were occupied by the working gentry. The wealthy actually thought that the design of the city would keep them safe from disease and keep in concentrated in the poor section.

In the 1840s, a police officer named Thomas Lewis moved his family to 40 Broad Street. The house had been designed for one family and servants, but it had been turned into a boarding house where a dozen families lived. The couple lost a sickly son while living there. They had a daughter while living there who appeared to be healthy but contracted cholera in August 1854 when she was not quite six months old. Although there was already an outbreak, the Soho and Mayfair areas of the Golden Square had been spared. Mrs. Lewis tossed water that was contaminated from washing the child’s diapers into the building’s cesspool. This is how the deadly cholera outbreak in London in 1854 began.

Analysis

This day in the chronology of the 1854 cholera epidemic in Victorian London describes the two Londons that existed at the time. There were the royals, the upper crust, the middle class and there was the underclass who lived in the shadows. The scavengers waded through the contaminated water of the Thames River that had been polluted by the disposal of human waste looking for valuables to sell. Although the upper class didn’t acknowledge these scavengers, they were constantly reminded of their presence from the stench that rose from the River.

London’s population had exploded beyond anyone’s imagination. It was a bustling and exciting city with many successful people who were happily settled into their comfortable homes and raising families. But the city officials had no plans in place to handle an indelicate but very important matter for the continued growth of the city and the health of its people – the disposal of human waste. As a temporary solution, sewers were directed toward the Thames where the refuge was dumped. The city was in dire need of a long-term solution.

In a poor area called Soho located in the middle of the Golden Square, a largely upscale district, a young couple, Thomas and Sarah Lewis who lived on Broad Street were concerned about their baby daughter. She had fallen ill with a nasty case of diarrhea. Sarah washed out her dirty diapers and dumped the wash water into the cesspool located near the Broad Street pump which the neighborhood relied on for clean drinking water.

Vocabulary

quagmire, impromptu, fulminate, vagabonds, symbiotic, foraging, cesspool, entrepreneurs, virulence, pestiferous, inexorable, macabre

Saturday, September 2: Eyes Sunk, Lips Dark Blue

Summary

For two days following the Lewis baby's outbreak with cholera, things were quiet. Twenty-eight year-old Henry Whitehead, a curate at St. Luke's church, worked as a missionary to the underclass in Soho. Whitehead would typically visit parishioners in their homes, inmates at the Workhouse and the 150 employees at the Eley Brothers factory. There were dozens of other places and hundreds of other people that were part of his familiar routine.

Forty Broad Street where the sick Lewis baby suffered was on his beat. Hundreds of people would pass that way seeking water from the Broad Street pump. The pump had earned a reputation of being a source of clear, debris-free water. Many Soho residents who lived closer to other pumps, preferred to walk the greater distance to the Broad Street pump because of its promise of healthy water. The Eley brothers kept two full vats of drinking water for its employees. The Eley brothers even sent bottles of water to their mother for her and her guests.

Unlike other life-changing events like wars or revolutions, those trapped in the throes of an epidemic have no historic perspective on what is occurring. They are merely trying to get through it and are unaware that the epidemic and those trying to survive it will be scrutinized for decades and centuries to come. A certain measure of one's imagination has to be employed to try to understand the epidemic, the lives it impacted and the environment in which it wreaked havoc. A few days after the baby fell ill, Mr. G., the tailor on Broad Street, began to feel slightly ill.

London had gone through the Great Plague and Great Fire. Londoners blamed cholera on the Industrial age and imported products. There had been no trace of the disease in London prior to 1831. Little was known about it and its sources although the disease had been on the planet for centuries. Mr. G. may have begun to panic later when he began to vomit uncontrollably and experience spasms and sharp pains. Water poured out of the bowels of cholera victims. The discharge was devoid of odor and color and contained small white particles. Those struck with the disease remained mentally alert. Therefore, Mr. G. was undoubtedly aware of the dire nature of his condition and that he would probably die. Mr. G. died twenty-four hours after first feeling ill.

The transformation of Mr. G, a healthy man, into a cadaver in a day's time occurred on a cellular level. Bacteria rules supreme on Planet Earth and they have an important role in the production of air. They consume nitrogen from the air and are able to withstand harsh and extreme conditions. The bacterium processes all molecules of life making it an essential provider of energy for the planet and its chief recycler. For the victim to fall ill from the cholera bacterium, it must be ingested and make its way to the intestines.

The influx of uncontaminated water into the victim is the simple cure. A British physician, Thomas Latta, had success by injecting the veins of the ailing with salty water. However, in the panic to find a cure among thousands of doctors and other experts, his simple cure was lost. Scores of notices appeared in daily newspapers touting treatments and home remedies to cure the disease. The medical field and its researchers had not attained the level of respect enjoyed in modern times. The number of quack remedies reached an astonishing level.

Due to the desperation to find a cure for cholera, people would literally pay any price for the promise of a remedy. Thus the price gouging of medicinal cures was born during the epidemic. The debate over the cure-all raged in the newspapers of the day. These discussions included opinion statements by physicians and scientists and letters from people who had not received the magic remedy they'd been promised.

Physicians were far from agreement on what would stem the tide of cholera. Some doctors treated victims with leeches to remove blood that was thickened due to the dehydration process. Some physicians prescribed castor oil and rhubarb. Brandy was recommended by some doctors despite its alcoholic content that was dehydrating. Some home remedies seemed to rally the patient but their successes were usually attributable to the placebo effect. John Rogers, a medical officer, was working in the area and making Herculaneum efforts to find the root cause of the disease believing that it was largely due to the lack of sanitation. Baby Lewis died and was one of the epidemic's early victims.

Analysis

Curate Henry Whitehead is introduced in this section. He was a young curate who worked as a missionary from St. Luke's Church. His beat was the Soho district. The cholera epidemic had begun to attack its first victims. They were many of the same people that Whitehead ministered to. He was aware that the Lewis baby had fallen ill.

London had gone through many other trials including the Great Plague and the Great Fire. They blamed cholera on the Industrial age believing that it had been brought into the country on board a foreign ship that was bringing goods to Great Britain. No one blamed their water source as the cause of the disease. A British physician named Thomas Latta had successfully treated patients during a previous bout with cholera by injecting salty water into their veins. But his remedy was largely ignored by the medical community and government officials who sought a different solution.

There were many theories about how the epidemic started and the proper treatment for it. Some believed the disease was a result of the lack of sanitation. Others believed it was in the air. Baby Lewis died and was one of the epidemic's first victims.

Vocabulary

prodigious, tumult, quotidian, ornithologist, minutiae, anomaly, electrolytes, solemnity, placebo, pestilence, fulminating

Sunday, September 3: The Investigator

Summary

By the Sunday morning after the first outbreak, Soho was eerily quiet. Seventy had died on Saturday with hundreds near death. Among the only people to appear on the streets were priests and doctors doing what they could to treat and comfort the sick and dying. Cholera was reaching into other areas of the city. The Broad Street strain of the disease had been astonishingly virulent having taken so many in a single day.

The disease had largely been contained to a five square block area in Soho. But the rest of Soho was on red alert. John Snow had been following the events in Soho from his residence on the edge of the district. He was a physician who had received both an apothecary and surgeon's license at the Hunterian School of Medicine in Soho. The sober-minded young doctor did not have a friendly bedside manner but he did achieve a successful practice. Snow was a pioneer in the research and use of ether and chloroform in anesthetizing surgery patients.

Snow focused on the cholera outbreak of 1848-1849 which was the most severe in a decade. There were nearly as many theories about cholera as there were victims. The contagionists believed that the bacteria were contracted through contact, like the flu. The miasmatists believed the bacteria existed in unsanitary places. By the late 1840s most physicians were on the side of the miasmatists. Since cholera first surfaced in London in 1832, no one had considered that contaminated water might be the source of the disease.

Snow studied the occurrence of the disease in 1848 which ultimately took 50,000 lives. His investigative skills told him that the source of the bacteria could have been a ship that hailed from Germany where there was an outbreak. For Snow that bit of news eliminated the miasma theory. However, he found weaknesses in the contagion theory and did not ascribe to it either. There was evidence that cholera was not contagious because healthy doctors did not contract the death despite their close proximity to dying patients. He also noted that a person could contract the disease without being near a sick person.

Snow conducted wide-ranging research including the interviewing of chemists who had studied the stools of cholera victims. By 1849, he felt confident in his emerging theory and went public with it. He believed that an unknown agent was ingested by cholera victims in contact with waste matter either directly or through contaminated drinking water. The bad air in London had nothing to do with cholera. Cholera was not inhaled; it was swallowed.

In one case, he found that a water channel connected to the sewer ran behind the houses where a number of victims lived. A crack in the drain provided the opportunity for the water and sewage to blend together. He also discovered that the neighborhood

most impacted by the cholera outbreak received its water from the Thames where sewage was dumped. Statistics supported his theory; the vast majority of deaths from cholera were those of people who lived south of the Thames, three times the amount of fatalities in other areas of the city. A map of the infected area clearly showed that the most serious outbreaks shared water supplies.

After Snow presented his theory in a thirty-one page monograph entitled, “On the Mode and Communication of Cholera” and in an article in the London Medical Gazette, his “waterborne” theory began to gain support. Snow’s theories were generally well received but there were still skeptics who wanted to hang on to their pet theories like toxicity in the air.

Snow continued to study cholera and its causes for the next five years. With the breakout in Soho, Snow journeyed to the affected area in hopes of learning more about the source of the disease. He took samples of water from various neighborhood pumps. He learned that many people chose to walk further to get the clear water of the Broad Street pump. He took water samples from all the pumps for analysis in his home laboratory. Snow’s initial glance at the water samples revealed that the Broad Street water was the clearest. The others were all murkier.

While Snow was busy analyzing his samples, Susannah Eley who lived in Hampstead far away from Broad Street fell ill and died after drinking the Broad Street water. In Soho, Whitehead learned that fifty more died in just a day and new cases were occurring at an alarming rate.

Whitehead and Snow were both trying to pin down the source of the cholera bacteria and both focused on the Broad Street water but with different views.

Analysis

Seventy people had died the day before. Shock had settled over the small neighborhood. The people of Soho felt ambushed by the culprit and had no idea why the virulent killer had targeted their community and was taking their friends and loved ones. Dr. John Snow was a physician who had a great interest in cholera and had studied and conducted research about past epidemics.

Snow had developed a “waterborne theory” which held that water contaminated by sewage was ingested by victims. The cholera bacteria then glommed onto the small intestines of the victims where it reproduced at rates that ultimately killed its victims.

Snow began monitoring the current epidemic with great interest. Snow immediately suspected that a water source may be behind the epidemic. From his prior work on the disease, he had learned that water source contaminated with human waste had been ingested by many of the victims. Snow decided to see the epidemic up close and traveled to the Soho area to knock on doors and learn details about the sickness from victims and their families.

At the same time Whitehead was ministering to his parishioners, praying for their recovery and trying to bring comfort to the dying. Both men were working from different perspectives but both were determined to help the people of Soho and discover the cause and origin source of the cholera bacteria.

Vocabulary

apprenticed, impoverished, ravages, practitioner, excruciating, seminal, teetotaler

Monday, September 4: That Is to Say, Jo Has Not Yet Died

Summary

On Monday the Golden Square was like a ghost town. The Eley Brothers factory was in mourning over the two dozen workers they lost and the news that Susannah Eley had died. The pattern of disease in the area was hit and miss. None of the 80 workers at the nearby Lion Brewery had fallen ill. Residents of Green's Court, a filthy, overcrowded area, were also spared. The poor and destitute on Poland Street were largely spared while the wealthy who lived in the area surrounding the street had lost half of their population.

Some people blamed the epidemic on sewer excavation that had disturbed a 300-year-old graveyard and tainted the air. The sewers were responsible for the epidemic but not for what they put in the air but what they deposited into the water. Newspapers were slow to report the Soho deaths, and therefore the rest of the population had been in the dark for days. Word of mouth rumors exaggerated the epidemic bringing terror to outlying areas.

Snow was convinced that the source of the cholera bacteria was the water. Whitehead had no such theory to help him through the hours he spent with the sick and dying. There was a feeling shared by many that the city was heading for a climactic finale that would reverse the growth and success that London had enjoyed for centuries.

The city's success had fostered the conditions that were causing its end. There were other dire predictions for the ultimate demise of London by its own hand. In 1813, Sir Richard Phillips compared it to the demise of Babylon, Rome and Alexandria. Stuffing the relatively small London area with three million people was a death knell for the city. Many believed that building a city to the scale that London had achieved was a huge mistake and was about to be corrected by the cholera epidemic.

Snow found nothing in the Broad Street water sample. He was certain that the water had somehow been contaminated. Filippo Pacini, a scientist at the University of Florence, at the same time had discovered a comma-shaped organization in the mucosa of a cholera victim. It was the first time a human had viewed the V. cholerae. People were not ready for such a discovery. Their mindset saw cholera as something in the air as opposed to a living organism. Snow died before Pacini's discovery was embraced by the scientific community.

Snow took another sample from the Broad Street pump. This time he found white particles in the water. Through further analysis, it was determined that the water contained remnants of decomposed organic matter. Still, there was no connection to cholera in the sample. He decided to try to find a solution by studying the pattern of life

and death in Soho. He had studied the patterns of outbreaks of cholera over the years during other epidemics.

Snow had an ally for his theory in fellow physician, William Farr, who was also the city's chief demographer. Farr urged physicians and surgeons to report causes of deaths from a list of twenty-seven fatal diseases that he was tracking. It was the first method that the medical profession had to recognize broad patterns of disease in Great Britain. Like Snow, Farr believed in the science of statistics but parted ways with Snow in that he believed in the miasma theory.

Farr's numbers showed that after the 1849 outbreak, people at higher elevations were safer from the disease than those who lived at ground level because they tended to have safer water. Farr ascribed to Snow's contention that contaminated water was a pathway for the cholera bacteria; however, he did not believe that the disease was strictly waterborne. He believed that it was nearly impossible to prove Snow's waterborne theory. However, Farr did begin accumulating data about water sources.

Using Farr's statistics, Snow believed that he at last would be able to connect the outbreak of cholera with contaminated water supplied by Lambeth. But slicing the data into sub-districts proved to be a problem for Snow. He tried going from door to door talking to the people directly about their water. However, most of those he asked didn't know where the water came from. Snow's solution was to obtain a sample of their water and test it for salt content. S&V, the other company supplying the area south of the Thames, provided water with a higher salt content than Lambeth's water. When the epidemic struck Golden Square in 1854, Snow had been chasing the cholera source for a year. He knew this was his opportunity to resolve the mystery.

Analysis

The path of the cholera bacteria was puzzling. It seemed to be hit and miss. None of the workers at a brewery were infected yet dozens of workers at a nearby factory had expired from the epidemic. Areas that were overly crowded and lacking in high sanitation standards to some seemed like apt targets for the disease, yet they were untouched.

There were fingers of blame pointing in different directions. Some blamed the recent excavation of a 300-year-old graveyard believing that churning up the corpses had released a poisonous element into the air. Doom and gloom had taken over the entire city of London. Some believed allowing London to take on so much population was a mistake and that the cholera bacteria was about to make a correction.

Despite the ridicule and lack of support that Snow experienced, he was undaunted. He continued to canvass the neighborhood to learn the most he could about the epidemic. He was determined to find the source of the disease and was confident that his waterborne theory would bear out to be the solution.

Vocabulary

apothecary, entrepreneurial, proximity, garrulous, taciturn, excruciating, hypothesized, palliative, apogee, linchpin, omnipresent, atrophy, agrarian, curate

Tuesday, September 5: All Smell Is Disease

Summary

Henry Whitehead began to feel that there was hope. He had tended to several people who recovered from the disease. A delegation from the General Board of Health led by its new president, Sir Benjamin Hall, visited the Golden Square area. The Board observed that the outbreak of new cases may have diminished a bit but the disease was still taking lives at a breakneck rate.

The tragic irony was that while Snow worked tirelessly to prove his waterborne theory the Board of Health was, at the same time, enacting practices that would deliver cholera bacteria directly to the mouths of Londoners. The death toll from cholera followed the same trend line as the growing amount of waste that was being deposited into the river. By the end of the outbreak, 15,000 Londoners had died from the disease. Why did the dumping of sewage into the Thames continue even though the city officials knew that it was impacting the water quality? The only answer was that the authorities believed that banning residential cesspools would remove the odor from the air and, according to the miasma theory, keep the people safe from cholera.

There were many holes that could be exposed in the miasma theory. They had only to observe the sewer-hunters, the scavengers in the sewer, to learn that they were not affected by wading through the waste. Mayhew admitted that their relative good health puzzled him. Snow saw that of the people sharing the same environment and breathing the same air some contracted cholera and some did not. Therefore, there had to be another agent that was responsible for the infection.

With so much evidence against the miasma theory, why was it accepted by so many authorities? It could just go down as one of many false leads and canards in the history of errors made by mankind. Some of the forces that kept the miasma theory alive included ideology, social biases, conventions and failures to adequately analyze the evidence. There was even a religious element to the miasma theories. Henry Whitehead believed that the Golden Square outbreak was God’s will and His way to prepare man for global changes.

These strong elements in the brain can override overwhelming evidence and man’s intellectual, logical response to an emergency. The link between the olfactory senses and the amygdala creates an alert system that creates a powerful desire to stay clear of a foul smell. When attempting to eat spoiled meat, the smell will ward off most diners. The brain devised an alarm system that is set off whenever decomposition microbes that create the odor are present and if they were to be swallowed would make the person ill. The system protects the individual from disease. Odiferous smells weren’t a problem in the days of the hunter-gatherers because there were so few people. As

populations grew, especially in big cities like London, the smells also grew and lingered in the air.

The miasmatists relied on their olfactory senses and amygdala to solve the problem of cholera's source and discounted hard facts and figures. The sense of smell was the superior sense when it came to detecting microbes and molecules – things that were strictly invisible to the eye. "Smelling was believing." Miasma was supported by statistics in some cases because neighborhoods with contaminated water also had bad air. The miasmatists also pointed to the predisposition to disease. The upper crust believed that the lower class was more susceptible to disease and the poor areas generally had bad water. The miasma theory was kept alive as long as it was due to a combination of half-truths, misunderstandings and the "willing suspension of disbelief." A natural political divide developed between the conservatives and liberals. The conservatives thought the poor were predisposed to contracting cholera and the liberals blamed the high incidence of cholera among the poor on the conditions they were made to live under.

Miasma was what Freud termed a case of "overdetermination." There were so many conflicting theories that miasma seemed to be almost a logical compromise. None the less, Snow maintained his belief that cholera was waterborne and continued his door-to-door surveys. Snow needed a direct link between cholera and the water supply. Body counts were not enough.

Analysis

While Snow worked tireless to prove his waterborne theory. There was urgency to his work knowing that once his theory was accepted, future cholera outbreaks could be prevented or thwarted in their infancy. The forces were working against Snow. While he worked to gather evidence in support of his theory, the Board of Health was enacting practices that would literally put the cholera bacteria in the mouths of Londoners.

Snow had to confront head-on the prevailing theory that most officials and even scientists and physicians ascribed to. Miasma was the gathering of bad air that emanated from a contaminated source like Thames River or decaying, rotting carcasses or even unsanitary practices. The belief was that if this putrid air were inhaled by an individual, that person would be likely to contract cholera.

Snow immediately recognized the folly of the miasma theory. There were perfectly healthy individuals who contracted cholera and who inhaled the same putrid air as other perfectly healthy individuals who did not fall ill. He knew there had to be another agent behind the epidemic and rapid spreading of the cholera. He was confident he knew what that agent was. Now it was his job to prove it to his skeptics.

Vocabulary

pallor, circumspect, viscerally, omnipresent, utilitarianism, austere, byzantine, olfactory, canard, ubiquitous

Wednesday, September 6: Building the Case

Summary

Snow determined that deaths on Broad Street occurred in most every house near the pump. The deaths in the nearby areas were more sporadically located. But this would not be enough evidence to convince the miasmatists – they'd believe a pocket of bad air over the street was responsible. He needed some aberrations, some exceptions to the rule. He needed to find healthy residents who were not expected to die but succumbed to cholera. When Snow arrived at the tailor's apartment, it was too late – the whole family had died.

Snow had imagined drawing maps of the Golden Square to create a visual representation of the patterns of disease and death. There would be a boundary around the Broad Street pump at the center of the map where he would expect to see the most cases. Those residences outside the boundary had other pumps located closer to them. Snow learned that ten deaths occurred outside the boundary. Eight out of the ten were deaths of people who used the Broad Street pump.

Snow was confident of his theory. He had to dissuade the authorities from their belief in miasma. Snow was a brilliant and determined man but he was also able to see the whole picture and not be lured by the overwhelming support of the miasma theory. His independence was partly attributable to his study of ether and chloroform. He had seen enough subjects placed under these anesthetics to learn that people generally responded the same. Further, he applied the law of the diffusion of gases developed by Scottish chemist Thomas Graham to miasma: if there were poisonous air on Broad Street, the gas had been greatly dispersed and rendered harmless.

Snow asserted before the Board of Health that the factories they blamed for polluting the air and causing cholera were not at fault. Since their workers, who were subjected to a much denser collection of the odiferous air, did not fall ill it would have been impossible for people further away from the source to suffer. As a physician he knew that breathing a substance into the lungs had no connection to the intestine which was the organ that cholera attacked. Therefore, it was obvious to Snow that cholera bacteria was ingested not inhaled. He maintained that water was the main source of infection.

Whitehead encountered well-to-do citizens in Golden Square who bitterly blamed the poor for the outbreak. Whitehead was convinced that one's constitution had nothing to do with contracting cholera. Whitehead dismissed the idea that Broad Street water had any connection to the outbreak. He knew people who drank the water and didn't fall ill. Whitehead himself had a glass a few nights before.

By Wednesday, the epidemic slowed but so had the use of the Broad Street pump. It was also likely that the bacteria had not been able to survive more than a few days in the dank underground beneath the pump. The bacteria may have reproduced so quickly that it ran out of victims. Another possibility is that another organism a viral phage that uses V. cholerae to reproduces its own may have overwhelmed it. The bacteria gathered in a small pool of water underground. The bacteria that were pumped out made it to the small intestines of human victims and reproduced by the trillions.

Whitehead continued to find people who had drunk small amounts of Broad Street water. And he found people who claimed that drinking the Broad Street water cured them in the first stages of the disease. But Whitehead learned that these people drank the water after Saturday. Most of the people who drank the water before Saturday were dead indicating that the bacteria had died off or were swept away by an influx of water before the weekend.

Snow learned that of the 83 deaths reported by Farr, 73 lived closer to the Broad Street pump than any other. Of those victims, 61 were regular drinks of Broad Street water. Only six did not drink Broad Street water at all. The other six were mysteries. Of the victims that lived outside the imaginary boundary most had a connection to Broad Street.

Snow had conducted an amazing investigation. He was fearless in the face of the deadly disease. Perhaps Snow's intense canvassing of the neighborhood scared people away from drinking from the Broad Street pump. Or he may have warned people not to drink there. The timing indicates that new cases dropped off several days after he started his rounds. Still the rate of death was terrifying and Snow felt he had found the source.

Analysis

Snow began to see a pattern that centered around the Broad Street pump. It was a pump used by most of the people in the small Soho neighborhood because it was reliably clear and safe. The vast majority of the houses surrounding the pump had cholera victims. Beyond the area, the number of victims was geographically more sporadic. Snow continued surveying the houses in the region. Any scrap of evidence to support his case could be an enormous help.

Snow not only had to prove his theory but he had to prove that the miasma theory was sheer bunk. The Board of Health members and other city officials were stuck in place on the miasma theory. It just made sense to them that the putrid air had to be the source of the epidemic. But Snow felt confident – he was dealing with facts, figures and actual case studies – they were depending on knee-jerk reactions, emotions and on their sense of smell.

Whitehead was still ministering to the sick and dying. He had ascribed to the miasma theory and initially rejected Snow's waterborne theory. He was sure that the Broad

Street pump had nothing to do with the outbreak. He had drunk some of the water himself. But later Whitehead recognized that people who drank the water after Saturday remained healthy. The epidemic had died out after that.

Both Snow and Whitehead were undaunted in pursuing their goals on Broad Street. Snow was bent on proving his theory to ward of future epidemics. Whitehead wanted to bring prayer and comfort to his parishioners but a curiosity was growing within him. He wanted to know the source of the epidemic, too.

Vocabulary

taciturn, intelligentsia, catastrophic, etiology, vectors, calumnies, copious

Friday, September 8: The Pump Handle

Summary

On Thursday evening, the Board of Governors of St. James Parish met to discuss the cholera outbreak. John Snow had asked to speak before them and told the group that he had discovered the source of the outbreak. He provided a cursory summary of his work and how he had determined that the source of the bacteria was water from the Broad Street pump. The Board was skeptical; the Broad Street water was known for its high quality. They were also aware of the horrid odors that lingered over the area and felt they were more responsible. But the Board didn't want to take any chances – what if Snow was right?

The pump handle was removed on Friday, September 8, a week after the outbreak. Deaths continued for another week. But after several weeks, the epidemic was over. Nearly 700 people who lived within 250 yards of the Broad Street pump had died. Never before had such a small area in the city suffered so greatly.

The removal of the pump handle was symbolic of the battle between urban centers and Vibrio cholerae. It was the first time that a government authority had intervened on an epidemic based on scientific theory. There were no superstitions, or quack remedies or theories about weak constitutions or putrid air. The removal of the pump handle signaled that there were invisible yet deadly bacteria that lay below and that it wouldn't be unleashed on the populace.

The Board of Health ordered an investigation into the removal of the pump. Fans of Broad Street water didn't understand why they were cut off from it. The Board of Health issued a list of guidelines and tasks to be accomplished; only two items on the list addressed Snow's waterborne theory. After the careful, dedicated work that Snow performed, the contravening message from the Board of Health was an example of how popularly held concepts could repress the truth. Hall was stacking the deck against Snow's theory.

Whitehead thought that the removal of the pump was ridiculous and believed he could disprove the waterborne theory. Whitehead would prove to be Snow's most able adversary. Snow rewrote his cholera monograph of 1849 to include the data he collected from his new investigation. He also wrote several articles for medical journals discussing the epidemic and his findings.

Whitehead wrote a 17-page monograph entitled, "The Cholera in Berwick Street." His words were written for the general public and were a summation of what occurred in the Soho area during the epidemic. In his writing, there was a strong sense that Whitehead was struggling with his faith in describing the devastating impact of the epidemic. In his mind, it was God's will that the people had been subjected to the scourge. St. Luke's, his parish, had been hit particularly hard. He later wrote that God was punishing the city

for its filth, dirt and overcrowded conditions. God caused the epidemic to shed light on the plight of the impoverished. It was true that the cholera would not have been as devastating had the neighborhood around the source, the Broad Street pump, been less crowded.

There were three problems with the waterborne theory that Whitehead still had to overcome. The Broad Street water was pure and odorless; Snow was not a local; and, his personal observations of people stricken with the disease drinking Broad Street water and recovering. Additionally, the Paving Board proclaimed that there was no method for the bacteria to access the pump. Snow answered the first problem with his obvious dedication and hard work. He passed his revised monograph onto Whitehead in early 1855 in which Snow stated that the water was contaminated by the evacuations of the sick not by some faraway source. If that were true, Whitehead concluded that there had to be one original source of the bacteria – the epidemic's first victim, patient zero.

Whitehead was determined to find out who that person was. He ultimately determined that baby Lewis who died on September 2nd at the age of five months had symptoms similar to those of cholera victims. Whitehead believed that the baby met the criteria for patient zero. The baby's evacuations were deposited in the cell pool near the Broad Street pump. Whitehead conveyed the Vestry Committee who agreed to take another look at Broad Street.

Snow and Whitehead became very good friends. Snow believed that their work would ultimately end cholera outbreaks. The Vestry Committee issued their findings. They debunked other theories, particularly the miasma theory, and fully supported Snow's waterborne theory. The miasma theory was not abandoned immediately. But eventually cooler heads prevailed and the work done by Snow and Whitehead were seen as the pivotal turning point in eradicating cholera.

Analysis

Most of the membership of the Board of Governors were miasmatists and put no stake in the waterborne theory. However, they second-guessed themselves. What if they were wrong? The public would be outraged if Snow turned out to be right and they had taken to action to protect the public. Therefore in a symbolic gesture that turned out to be a pivotal moment in identifying the source of cholera bacteria. They ordered that the pump handle on the Broad Street pump be removed. The message was clear – the city officials believed that there was bacteria in the pump water and they were not going to allow it to be unleashed on the people.

The Board of Health launched an investigation into the removal of the pump and issued a report that Snow's waterborne theory didn't hold water. The members of the Board were so stubbornly committed to the miasma theory that they would not even consider evidence that refuted it. The Board members were self-centered and self-serving. They covered themselves by removing the pump handle but didn't really believe that it was necessary.

Whitehead was also a miasmatist and initially believed that he could disprove Snow's theory. He set about to do so but he was an open-minded person and began to see the merits of the waterborne theory. Snow and Whitehead ultimately began to work together to solve the mystery of the deadly epidemic.

Vocabulary

noxious, pestilence, paradigm, demographic, retribution, vexing, dialectical, efflorescence, fortuitous, exponential, surreptitiously

Conclusion: The Ghost Map, Part 1

Summary

After the removal of the pump handle, an engineer named Edmund Cooper launched an investigation of the Broad Street epidemic for the Metropolitan Commission of Sewers. He was sent to investigate rumor that corpses had been unearthed during the evacuation. He doubted that hundreds of years old corpses would have any impact on the people's health. He needed a way to represent the patterns of the deaths caused by the outbreak. He made a map that the layperson could understand.

On the map he showed new sewer lines and the locations of cholera deaths and the original site of the plague pit which he indicated was centered over Little Marlborough Street. It was obvious that there was another source since there were only few deaths near the plague pit. If the source was a noxious gas, those living immediately on top of the spot would surely have perished. The Board of Health used Cooper's map and expanded it. The superb details crowded onto the map were overwhelming and took the focus off the connection between the Broad Street pump and the surrounding deaths.

In the early fall of 1854, John Snow began developing his own map. It mimicked Cooper's map with two minor changes: each death was marked with a thick black line which made a more dramatic impact. This map, this ghost map, has come to represent the entire Broad Street outbreak. Unlike other maps illustrating the reaches of an epidemic, this map was unique in that it blended information design with a valid scientific theory of the disease's transmission pathway. Snow published his map with the Vestry Committee's report and in a separate monograph on cholera.

There was resistance to Snow's waterborne theory and to his map. However, as his theory became more and more accepted, the map grew in importance. The map became a visual interpretation of Snow's theory. The map was reproduced and spread out among the common people who came to embrace the waterborne theory and thus understand the nature of the villain that had taken so many of their loved ones.

It is likely that Snow's map greatly influenced Whitehead and swayed him to support the waterborne theory. It had to be striking for him to see an artistic rendering of the footpaths that he had followed when tending to the sick and dying. Whitehead's detective work in determining the index patient was crucial in convincing the Vestry Committee that the Broad Street pump was the purveyor of the bacteria. The Vestry Committee's adoption of the waterborne theory was its first official endorsement.

Snow and Whitehead were credited with finding the culprit behind the Soho epidemic. John Snow identified the pump as the source and Whitehead supplied important evidence to support it. Neither man was scientist or a professional investigator. It was their determination that solved the mysteries surrounding the epidemic and proved to be far more powerful than credentials. In many ways the two men couldn't be more

different. However, they brought their best to the table and created a powerful partnership that exposed and defeated the enemy.

There was sluggish yet steady acceptance of Snow's theory over the six years following the epidemic. He was treated somewhat dismissively by the scientific community some of whom still clung to the miasma theory. His words were always augmented with statistics and analyses. The miasmatic air that loomed over the city was called "The Great Stink" and was considered the worst air ever yet the death rate didn't spike. Snow may have enjoyed the defeat of the miasma theory but his joy was cut short by his death later that month.

With "The Great Stink" virtually debunking the miasma theory, authorities finally addressed the problem identified by Snow – the contamination of the Thames water from sewer lines that deposited waste directly into the river. Led by engineer Joseph Bazalgettee, the city planned one of the most challenging projects of the nineteenth century. Two sewers would be erected, one that would carry sewage away from Central London and one that would carry surface water away. The sewer project was a great achievement and represented a turning point for highly populated urban communities. It demonstrated that government could solve serious environmental and health problems that faced a city. The work wasn't easy since it involved erecting a new sewer system in an already complicated underground of pipes and rail stations and infrastructure. At its completion in 1865, London's sewage system was the most advanced in the world. Eighty-two miles of sewers had been constructed in the London underground. In today's prices the cost would have been $250 million. The sewer system has been maintained over the years and remains London's key to waste-management.

Analysis

City engineer Edmund Cooper was hired to oversee the construction of a new sewer system and a new safe water system. He wanted to present a schematic of the sewer lines and water pipes and decided to create a map to do so. Snow had imagined for many years developing a map that would illustrate the source of the cholera bacteria and the path that the disease took in its path of death.

Snow developed a based roughly modeled after Cooper's map. It was the first "ghost map" which he fashioned in a dramatic manner so that it would be more impactful to those who viewed it. His main goal was to prove that the Broad Street pump was the source of the bacteria and he did so by showing how the disease radiating out from it in all areas directly surrounding it.

Snow and Whitehead were both credited with tracing down the cholera bacteria and identifying the source and the identity of the index patient. Acceptance of the waterborne theory was slow but steady. Finally, the miasma theory was totally debunked with "The Great Stink" which was considered the worst air ever to linger over London failed to sicken anyone.

Vocabulary

effluvium, amorphous, empirical, iconic, stalwart

Conclusion: The Ghost Map, Part 2

Summary

In June 1866, a husband and wife in East London fell ill with cholera and died a few days later. Their deaths were followed by a major cholera outbreak. By the end of August, 4,000 had died. William Farr thought of his old adversary, John Snow, and decided to emulate the investigative work that he did during the Broad Street epidemic. Farr discounted the miasma theory and focused on the water supply. He learned that the dead had been customers of the East London Water Company. He was certain that the water was contaminated. He had immediately ordered notices be posted warning that the water was contaminated and should not be drunk. In an address before Parliament about the epidemic, Farr lauded John Snow's dedicated work in his development of the waterborne theory. Snow was also given credit for his work in an editorial in the Lancet that had once ridiculed his theory.

In 1883, German scientists Robert Koch isolated the Vibrio cholerae during field work in Egypt. It was the same discovery that Pacini had made 30 years before but at the time had been ignored. Koch was credited with identifying the agent that had caused so much death and fear. In 1965, Pacini was finally credited with being the first to discover the organism which was named Vibrio cholerae Pacini 1854. While the construction of electrical grids got more attention around the turn of the century it has been sewer lines and fresh water pipes based on Bazalgette's model that have kept people safe and healthy.

The new sewer system had unexpected benefits. Fish returned to the Thames; the putrid smell was reduced; and the drinking water was safe and appetizing. Since the outbreak in 1866, London has not experienced another cholera epidemic. The world's largest and most densely populated cities in 2015 include Tokyo, Mumbai, Dhaka, Sao Paul and Delhi. Underdeveloped areas of these cities are referred to as "squatter cities" because they lack the infrastructure and creature comforts of development regions. However, many of these areas are experiencing economic and social advancements.

People of these regions need to be aware of the dangers of contaminated water. Over a billion people lack clean drinking water and adequate sanitary conditions. Two-million children in these backward communities die of diseases, including cholera, each year. People who live in the squatter cities can devise means on their own to safeguard against disease but governments need to establish long-term solutions.

The concepts that were in their infancy during the Broad Street crises including epidemiology, public infrastructure design, waste management and planning are well-known entities to all nations in modern times thanks to globalization and the Internet. Maps that focus on the pathways of disease which are modeled after Snow's original map can be found on the Internet. The data behind these maps are feed to organizations from health providers and government officials – no more going from door

to door to learn about the impact of disease. The ProMED-mail email provides a daily picture of all known disease outbreaks across the globe.

Although technology has advanced the process, the impact of the maps remains the same as when Snow first developed his. It is more dramatic and enlightening to see a visual of a disease's pathway. The difference today is that the map has gone from a neighborhood to the entire globe. Internet forums provide platforms for specific information about cities and neighborhoods. Each corner in a large city may have hundreds points of interest about it on the Internet. Large metropolitan areas provide environments that are encourage specialty stores and small niches of interest. City governments are making use of advancements in map-making technology. New York City developed a 311 app that provides a way to get help in non-emergency matters and provides information about city services and events.

Broad Street was renamed Broadwick in 1936. Much has changed on the street; neither Snow or Whitehead would recognize much. A pint of beer can still be purchased at the pub on the corner of Cambridge Street near the site of the infamous pump was once located. The pub's name has changed. It is now called The John Snow.

Analysis

John Snow's legacy lived on when another outbreak of cholera struck London in 1866. William Farr who remembered the work of Snow emulated his investigation and quickly found the water source that was behind the epidemic. There has never been another cholera outbreak in London since then. The new sewer and clean water systems that were established after the Broad Street outbreak were a great success and have been maintained through current times.

The author warns cities with mega-populations and overcrowded conditions to make sure that their sewage problems do not interfere with their clean water sources. He suggests that the governments of these cities learn from the mistakes of Victorian London and not repeat them.

The maps that were innovated by Cooper and Snow have been recreated and improved upon in the intervening years since the Broad Street epidemic. The maps of course are now computerized and available on the Internet. These maps focus on new outbreaks and the pathways that diseases take. They cover the entire globe and are updated every day.

Although it took years for Snow to convince city officials of the veracity of his waterborne theory, the people of Soho "got it" before the city leaders did. They renamed one of their local pubs, "The John Snow" which remains its name in current times.

Vocabulary

manifold, symmetry, preponderance, ambient, ubiquitous, intangible

Important People

John Snow

John Snow was born to a labor class family in Yorkshire. He was quiet and serious and had an ambitious streak that made him want more than his family had. At the age of 14, he was an apprentice to a surgeon where he first saw the ravages of cholera. He became familiar with the unsanitary conditions that the poor were subjected to. Even at his young age, Snow believed that there was an outside source that caused the epidemic and not the unsanitary conditions that the poor lived under. Snow went on to medical school and became a surgeon. He was also interested in pharmaceuticals and became a licensed in apothecary.

Although Victorian principles held him back, Snow had shed any belief in superstition or dogma. He was a solitary figure who used his free time writing for medical and public-health journals. He became an investigator of diseases, attempting to break the mysteries of their origin, how they are spread and most importantly their cures. Before he delved into his investigation of cholera, he tackled the more common complaint and less deadly matter of pain management.

Snow became a pioneer in the safe use of ether and chloroform and became a respected anesthesiologist who was even called upon by Queen Victoria to ease the pain of labor during the birth of her eighth child. But Snow never forgot his interest and questions about cholera and began to study and conduct research on the disease.

When the cholera outbreak of 1854 occurred, Snow was determined to find the cause and source of the bacteria. He walked door to door in the infected area to learn as much as he could about the people who were infected, those who died and the habits of the people who lived within the Soho area. Through his tireless work, Snow developed the theory that the disease was waterborne. He was ridiculed and scoffed at by fellow scientists and physicians who were certain that the cause of the epidemic was miasma. He was undaunted, however, and continued to amass evidence that he was right.

Snow found a colleague in curate Henry Whitehead who at first were among his critics. When Whitehead began to see the evidence pointed to the accuracy of the waterborne theory, he joined forces with Snow and together they proved the theory and uncovered the identity of the index patient.

Henry Whitehead

Henry Whitehead was a curate at St. Luke’s Church in the Soho district of London’s Golden Square. He was a friendly clergyman who made it his practice to visit his parishioners in Soho and minister to them. The dedicated churchman had been born in Ramsgate and got his early education in the elite Chatham House where his father was

headmaster. He attended Lincoln College at Oxford where he was known for his sociability and kindness, traits that would be part of him the rest of his days.

Whitehead had no idea that a serious cholera outbreak was underway when he followed his normal routine visiting his parishioners, who were mainly poor, talking and praying with them. He never mentioned his personal fear in his writings. Did his religious beliefs keep the fear away? Or did his personal pride keep him from admitting to his fear? After learning that there was an outbreak, Whitehead was on the side of the miasmatists who believed that cholera as well as other diseases was contracted through putrid air that emanated from raw and decaying sewage. It was understandable that so many believed in this theory from the horrid smell that enveloped most of London. It had been the practice for years to dump human excrement into the Thames River which is what eventually caused a permanent stench to hover over the city.

The cholera bacteria was raging and gaining strength. It was taking many of the good people who Whitehead ministered to. He was determined to combat the dreadful disease. Although he at first dismissed Dr. John Snow's waterborne theory, he began to see evidence that miasma was not the cause of the spread of the cholera bacteria. He was eventually convinced that Snow was right. He and Snow teamed up and dedicated themselves to proving the theory and convincing the authorities to take the necessary steps to prevent another outbreak. Their work also led to learning the identity of the index patient and where and why it all began.

The London Underclass

In Victorian London in August 1854 when a virulent cholera epidemic was poised to breakout and terrorize the city, especially the Soho district, an entire population that lived in the shadows was at work. Collectively, they were called the underclass or scavengers. Individually, they were known as bone-pickers, rag-gatherers, pure-finders, dredgermen, mud-larks, sewer-hunters, toshers and night-soil men. To quote author Steven Johnson, these people lived in "in a world of excrement and death."

Charles Dickens

The legendary author Charles Dickens lived in Victorian London. He came from an impoverished family with a father who was sentenced to debtor's jail. Many of his works reflect his personal pain of being poor including Oliver and Great Expectations. He monitored the raging epidemic with great concern. He wrote in his book Bleak House about the poor and the unsanitary and crowded conditions in which they were forced to live: "… a hemmed-in churchyard, pestiferous and obscene, whence malignant diseases are communicated to the bodies of our dear brothers and sisters who have not departed…"

Queen Victoria

Queen Victoria was a trendsetter by being one of the first patients to have an anesthesiologist put “under” with chloroform during the birth of her eighth child in early 1853. Her choice of physician was Dr. John Snow who went on to discover the cause and source of cholera.

Karl Marx

As a young man, Karl Marx lived in Victorian London with his young family. Marx and his wife were Prussian immigrants who lived with their four children and a maid in a two-room attic in Soho and were present when the Broad Street epidemic broke out in a section of Soho.

Lewis Family

Thomas Lewis and his wife, Sarah, moved into 40 Broad Street in the late 1840s. They had a sickly little boy who died when he was ten months old. In March of 1854, Sarah had a baby girl. The little girl whose name is unknown contracted cholera and died when she was five months old. After the investigative work of Dr. John Snow and St. Luke’s Curate Henry Whitehead, it was determined that this baby was patient zero in the Broad Street epidemic. Her evacuations were deposited into the Broad Street water source which then spread the cholera bacteria throughout the neighborhood ultimately becoming an epidemic.

Henry Mayhew

Henry Mayhew was a well-known journalist and sociologists who lived in London during the time of the Broad Street cholera outbreak. He wrote a pioneering work in 1844 entitled, London Labour and the London Poor, in which he focused on the unsanitary conditions that the underclass were subjected to and the filthy work that they were forced to do. Mayhew was fearless in his willingness to report the truth about the people who lived in the shadows despite the shame and guilt that some may have experienced because of his words. He also underscored that the jobs these scavengers did were important ones for the success of the city.

Thomas Latta

Dr. Thomas Latta was a British doctor during the Victorian Era. He had developed a successful cure for cholera in 1832, which entailed his injecting salty water into the veins of the ailing. Miasma was a prevailing theory about the cause of cholera and Latta’s cure got lost in the chaos of scholars and scientists trying to figure out a cure for cholera but were certain that water had nothing to do with it.

John Rogers

John Rogers was a medical officer who was based in the Soho area. He made a valiant effort to reach and treat those sickened by cholera. He had experience with other cholera outbreaks but he saw that this one was different. He had never seen the disease explode throughout the population in an area as quickly as this one was raging. The stench coming from the “gully hole” in the area nearly knocked him over. He had initially been the first doctor to treat baby Lewis. When he returned to check on her she was already dead.

William Farr

William Farr was an analyst and London’s main demographer during the cholera outbreak of 1854. He was a miasmatist who collected data on the cholera outbreak and compiled tables of death caused by the disease which Dr. Snow used to prove that Farr’s theory was wrong. Farr also issued a publication entitled Weekly Returns of Birth and Deaths in London which was part of his duties as city demographer.

Edwin Chadwick

Edwin Chadwick was strong advocate of the miasma theory. Chadwick was a cantankerous and unpopular man who alienated many colleagues with his harsh personality. He preceded Benjamin Hall as the head of London’s Board of Health. Although Chadwick stepped down as head of the Board of Health, he maintained a strong influence on its practices and policies. There is evidence that some of the decisions he made or was party to were directly responsible for deaths from cholera in the 1850s.

Chadwick believed that big government could provide solutions to most societal problems. More than any other Brit, Chadwick had shed light on the horrific sanitation conditions that the poor communities were forced to live under. However, some of his programs served to exacerbate the problems of the poor. Thousands of cholera deaths in the 1850s can be directly connected to Chadwick’s policies and decisions he made. He believed that by removing the noxious smells that permeated London would vastly improve the health of its citizens. He equated smell as tantamount to disease in a speech before Parliament.

Benjamin Hall

Sir Benjamin Hall was named the new head of London’s Board of Health during the same month in which the cholera epidemic of 1854 struck. Although Hall issued a litany of tasks to be performed by his investigative team looking into the spread of cholera, he stubbornly refused to consider Snow’s waterborne theory and did not include instructions for his team to investigate water sources. Several years after the epidemic,

John Snow appeared before Hall’s committee and made controversial remarks about those who supported the miasma theory.

Objects/Places

“London Labour and the London Poor”

Journalist and sociologist Henry Mayhew lived in London during the Victorian Era. He wrote about the scavengers of London in his pioneering 1844 work entitled, London Labour and the London Poor.” He wrote in great detail about the tasks that scavengers of the day like bone-pickers performed each day.

Coral Reef

The coral reef is focused upon in Johnson’s work because of its efficacy in waste management and efficient recycling work. Corals rely on the tiny algae attached to it that capture sunlight which is turn carbon dioxide into organic carbon, ejecting oxygen as a waste product. Humans don’t think of oxygen as a waste product but to coral reefs it is a useless substance that is discharged into the waters that surround it.

Fear of the Dead

The fear of the dead has been a part of societies dating back to the 17th century and even before. During the Great Plague of 1665 the Earl of Craven secured a piece of land in a semirural area called Soho Field. Thirty-six small houses were built on the land “for the reception of poor and miserable objects” suffering from plague. The land surrounding the houses were used for these “poor and miserable objects” as graves when they succumbed to the disease. London’s upper crust did not want be near the sick when they were alive and especially when they were dead.

Soho

The cholera outbreak in London in 1854 was centered in the Soho district of what was known as the Golden Square. Well-to-do Londoners lived in the Golden Square but the Soho district that was located near its center was a cross-mixture of many classes including the poor. It was on Broad Street in the Soho district that the cholera epidemic of 1854 began. The wealthy in the surrounding areas blamed the disease on the lack of sanitation among the poor and believed that the layout of the city streets would keep them safe from the scourge.

Recycling

Recycling is undoubtedly thought by many to be a modern innovation. However, it has been a hallmark of complex societies for centuries before. The ancient culture of Crete used composting pits 4,000 years ago. Much of the glorious city of ancient Rome was

built from materials that were taken from crumbling buildings and ruins. The famous Coliseum was at one time a quarry that builders relied on for the materials they needed for new construction. Medieval European towns recycled waste, composing and manure, to deal with the explosive population growth.

Night Soil Men

In Victorian London, each residence had its own cesspool before they were eventually outlawed. But during the time when cesspools were common features of a residence, each night men were hired to skim the tops off the pools so they wouldn't overflow. These men were appropriately called "night soil men."

Water Closets

After cesspools in residences were outlawed, upper class families had what were called water closets. These water closets had no flushing ability like modern toilets. The waste, therefore, collected underneath and was taken away by sewer lines. The majority of the waste was deposited into the Thames River a process which, not surprisingly, caused the water to be contaminated and a permanent stench to linger in the air over London.

Ether

Dr. John Snow was a physician and surgeon who was a pioneer in the use of anesthesiology. He did extensive study and research on both ether and chloroform as forms of anesthesia. Despite the advancements made by the British medical community on surgical remedies, they had not discovered a way to dull the pain during the procedures. It was brutally painful and comparable to the worst kind of torture to go under the knife. There were countless testimonials in the papers about the suffering experienced during surgical procedures that saved lives. The use of ether was a way to stem the pain, however, its initial use was administered at an insufficient dosage and its effects would wear off mid-surgery and the pain would be unbearable for the duration of the procedure. John Snow developed a method to administer the right dosage that was safe yet kept the patient out for the duration of the surgery. He also advanced work on the use of chloroform. Snow was summoned by Queen Victoria to be her anesthesiologist to dull the pain of childbirth with the use of chloroform. Snow's research and work in the field of anesthesiology and his high profile patients elevated him to the top of his field in Victorian London.

Consilience

The Cambridge philosopher William Whewell in the 1840s wrote "The Consilience of Inductions," in which he wrote, "takes place when an Induction, obtained from one class of facts, coincides with an Induction obtained from another different class." He went on to state that consilience was a test of the truth of a theory within its occurrence. Dr. John

Snow was considered a consilient thinker because of the cross-information he possessed from his many experiences.

Modern Threat of Cholera

The largest cities by population in 2015 are Tokyo, Mumbai, Dhaka, Sao Paulo and Delhi. There are overcrowded and unsanitary conditions in what are referred as the squatter cities of these huge metropolitan areas. In some ways, these cities mirror the enormous growth that Victorian London experienced. However, thanks to the Internet and globalization people are greatly more educated and are able to learn from the mistakes of others. But the experts have a word of caution. Despite being aware of the importance of pure water that is not polluted with sewage, in a large, over-crowded area, sanitation mores and practices can be lax allowing for the contamination of the water supply. These regions need to take steps to ensure that the water supply remains pristine because cholera is still a deadly killer.

Themes

Cholera

The story of the ten days on Broad Street can be told as a few hundred humans who drank pump water, got sick and died over a few weeks' time. But the entire story is more complex and includes urban development and bacterial life cycles. The cities are the largest footprints on Earth left by man; the microbes are the smallest entity. The fates of the largest and smallest life are dependent upon one another.

The city had afforded the Vibrio cholerae and other bacteria a new way to mass produce. Without the dense population, the bacteria would not have been as devastating and would not have interested John Snow. A wide view of the city, called an epidemiology, was necessary to investigate the origin and spread of disease. John Snow founded the London Epidemiological Society just a few years before the Soho epidemic. Although the science of epidemiology was in its infancy, its goal was to measure the incidence of any event – an epidemic, upsurge of crime, poverty, etc.. In order to understand the cholera epidemic it was necessary to study it in the context of the urban explosion.

The Vibrio cholerae bacteria is a virulent disease that causes terror when an outbreak is suspected. The bacterium reproduces at an astonishing rate creating a dense layer of organisms that cover the intestines. The toxin makes the cells expel water at a remarkable rate. People have been known to lose 30 percent of their water weight within hours after contracting the disease. The exact reason that it causes death is sketchy. However, the body's dependence on water and the dehydration caused by the cholera bacterium undoubtedly contributes to it. The first symptom of profound dehydration is the reduction of blood circulating throughout the body which causes the heart to beat faster in an attempt to keep up circulation. Organs begin to shut down and eventually the heart fails and the victim is dead.

Organisms have no self-awareness yet they are more productive in an environment in which humans ingest the excrement of other humans. The Vibrio cholerae bacteria cannot be transmitted through the air or the exchange of bodily fluids. A very small amount of infection occurs when a cluster of the bacteria is picked up on a finger and transmitted to the mouth.

In modern times, cholera has been kept in check for two reasons: the ingesting of human excrement is not common and taboo in most civilizations; once the root cause of the disease was discovered steps were taken to eradicate it through heightened hygienic standards. However, with the development of large population centers, cramped quarters with too many people and sloppy or non-existent health laws and regulations the populace is vulnerable to the eventual ingestion of excrement. The increase of the international shipping industry from areas like Delhi that have the lowest of sanitary standards has contributed to the reemergence of cholera. Contaminated

drinking water not only provides a pathway for cholera to infect and spread, it bolsters the bacteria and makes it more lethal.

The bacteria multiply at a neck-breaking pace. An organism may live only a single day but in that 24-hour period it can produce a million offspring every hour. The bacteria's DNA is also highly adaptable and can recombine with alien microbes to create deadly new combinations. For the V. cholerae to achieve full effectiveness it must be swallowed by its victims so that it can infect the small intestine. Leaving behind a billion new microbes in a dead body will not cause new infections; the microbes will die in the body. The bacteria must be passed to another human through excrement ingestion. When the bacteria pursues a low-intensity attack, the body will stay alive longer enabling the millions of new microbes to be passed on to new victims.

Waterborne Theory

When cities like London began to gather populations in never-before-seen numbers, city planners were careful about creating mechanisms for the disposal of waste and the maintenance of safe sources of water. But the initial planning was flawed and Londoners were unwittingly reengineering the DNA of V. cholerae and creating a more efficient killer. Ironically, it is water – contaminated water – that spreads the cholera bacteria. And it is water – uncontaminated water – that is the simple cure-all for cholera. Victims of the disease who are given uncontaminated water and electrolytes through IVs along with oral remedies generally survive the disease. With effective treatment, the disease is transformed from a killer into a bad case of diarrhea.

During the Victorian Age in 1832 when cholera was a common occurrence, British physician Thomas Latta came up with an effective cure. He began injecting salty water into the veins of the ailing. Latta's innovative treatment with water was ahead of its times. Neither the medical community nor government officials were willing to ascribe to water as being the source of disease. Sadly, his remedy was lost in the noise of thousands of professionals and other chattering heads who were frantically searching for a cure and were sure that the source of the disease was not water.

It was Dr. John Snow a physician and anesthesiologist who had earned a high profile for his pioneering work with ether and chloroform who was determined to find the source of the cholera outbreak in 1854. Snow was not an expert in the field of epidemiology but as it turned out became one of its founding pioneers. He dismissed the popularly held view of many scientists and experts that the source of the disease outbreak was the stench in the air or miasma. He believed early-on that the source had to be contaminated water. He was ridiculed by colleagues and in newspaper articles about his waterborne theory. But he remained undaunted believing that the evidence supported his theory while emotions and superficiality was behind the miasma and other theories that were all later debunked.

Snow had a colleague in St. Luke's Curator Henry Whitehead's who ministered to the people of the Soho neighborhood. During the epidemic, he comforted the sick and

dying, his evangelism transforming into a death vigil. Four houses that he visited in a row were filled with cholera victims. He noticed that one filthy house where he expected the disease to be in full control had not yet rendered one victim. It made him consider the possibility that sanitation had nothing to do with the spread of the disease. Although Whitehead did not immediately ascribe to Dr. Snow's theory that the cholera bacteria were passed through the consumption of water contaminated with human excrement, he was beginning to at least consider it. Eventually, he fully accepted the waterborne theory developed by Snow and together the two joined forces to gather evidence in support of it and were able to find patient zero who was the source of the contaminated water that caused the epidemic.

Miasma

The prevailing theory in August 1854 in Victorian London about the source and medium of the cholera bacteria was miasma. Miasma is the passage of bacteria and disease through the air, inhaling air that is contaminated with a putrid stench that emanates from filthy and unsanitary conditions. At the time, the Thames was the main receptacle of human waste. Not surprisingly, a horrific odor was generated by the deposited waste and sewage that emptied into the river.

Among the miasmatists of the day were the powerful and influential. Doctors and scholars believed that it was miasma that caused the cholera outbreak as well as other diseases. When Dr. John Snow first introduced his waterborne theory – that cholera infected a person who swallowed water contaminated with it – he was met with contempt. He was roundly belittled in newspaper editorials as well as by his colleagues. Perhaps it was easier to believe that it was the stench of the air that caused the deadly disease because this air was more densely collected in the poor areas. But water flowed to all parts of London and if the waterborne theory was proven to be true, then everyone including the well-to-do and even the royals were all at risk.

The word "miasma" is Greek for pollution. The concept of airborne illness dates back to Greek medicine in the 3rd century BCE. Hippocrates was obsessed with air-quality and wrote the treatise, "On Air, Water and Places," advised his readers to consider "the winds, the hot and the cold" in terms of medical treatments. Many of the major diseases at one time or another have been attributed to miasma. The predominance of the miasma theory in Victorian London had its origin in instinct as much as it did in intellect. The stench that lingered over London was a constant reminder of bad air; an emotional response to blame every bad turn on it was natural. Not surprisingly there is a physiological connection between the olfactory system and the brain's emotional region. The amygdala is the brain's fear center and generates instinctual responses to danger.

Even after Snow and his fellow epidemic detective, curate Henry Whitehead, provided evidence that weighed heavily in favor of the veracity of Snow's theory, scientists and government officials still clung to the miasma theory. Even following measures taken to secure a safe supply of water based on Snow's reports, some government and community leaders would not cede their belief in miasma. It was just more convenient

for them to believe that cholera was airborne. Eventually, the miasma theory was completely debunked and faded away. Had Snow and Whitehead not continue to push the waterborne theory, many more lives would have been lost while the experts where relying on cleaning up the air to eradicate the disease.

The Ghost Map

Dr. John Snow created a map of the pathway that the cholera bacteria took from the Broad Street pump to the small intestines of their victims. The maps Snow imagined illustrated patterns and clues that tied the disease to the source which he believed to be the Broad Street pump.

Prior to Snow's mapping out what was in his imagination, an engineer with the Metropolitan Commission of Sewers. Cooper was to oversee construction of the new sewers that would separate sewage from clean water. But he found he needed a way to represent the sewer and pipe patterns that could be understood by his supervisors and the public alike. Cooper used an old map to indicate where cholera deaths had occurred and the lines of the new pipes and sewers. His map was later revised and enhanced for the Board of Health. The maps were well-crafted and done in great detail.

John Snow was finally able to take the time to create the map that he had imagined. He felt it was essential to definitively link the disease with the water source to once and for all convince his skeptics. He modeled his map off of Cooper's map with a few modifications. He indicated deaths with a thick black line that made a more striking impact than Cooper's thin lines. Snow had created a visual aid that dramatically underscored the death and darkness that had beset Broad Street. Snow also made direct links with the foot traffic of people moving back and forth between their homes and the Broad Street pump, the source that Snow had identified as the source of the cholera bacteria. His map clearly showed the cholera radiating from the single point of the pump. Snow modified his original map and published it.

The original map had left a door open to a miasmatic interpretation. He needed to show the behavior of the people in the community to shut that door.

Snow set out to demonstrate the foot traffic around the pump using a Voronoi diagram. It marked the distances between residences and the water pumps in foot-traffic terms. He featured peninsulas of houses marked with the quickest routes between the houses and the closest pumps. The map finally told the tragic story – each peninsula on Broad Street was heavily laden with the black marks of death. The map was not immediately convincing to everyone but was lauded for its originality and ultimate influence. The actual originality of the map was the data and extensive research and surveying that backed it up. It merged a view from 10,000 feet with the on-the-street knowledge gained in his untiring canvassing of the area. It is a map of the intertwined lives of an overly crowded metropolitan community.

John Snow's "ghost map" was the first of its kind in that it mapped out the origin and pathway of a deadly disease. That tradition has been followed over the years and now is commonplace. Everyday maps of disease outbreaks and their progressions are updated and can be found on the Internet. One big difference between Snow's map and modern maps – the latter covers the entire globe while Snow's covered just a neighborhood. But Snow not only solved the mysterious source of cholera he also pioneered a way for man to follow the progress of disease giving him a tool to stop its pathway.

Victorian London

To man, London in the Victorian Era had taken on an energy of its own. It had become a monstrosity, a cancerous presence that the people had lost control of. It was after 1750 that metropolitan London exploded in growth and population. London's expansion was attributable to the improvement of agrarian capitalism; the energy produced by coal and steam power of the Industrial Revolution; and, the new mobility of energy via the railway system. Londoners were benefiting from imported goods from faraway lands. London had not been the result of human choice, it had evolved organically. The increase in population also depended upon the relocation of country people to the city. With farmland being privatized, many rural farmers were drawn to the city for work.

The increase in the population could be at least partially attributed to tea. It was a luxury in the eighteenth century but by the 1850s had become a staple. Brewed tea possessed important antibacterial properties that helped prevent the contraction of waterborne diseases. The tannic acid contained in tea kills off bacteria in the steeping process. When tea became popular in the 1700s, physicians noted a huge drop in dysentery and child mortality. The population made healthier by tea consumption was able to grow and supply a giant work force for the gigantic city. But the huge population presented many other problems that were initially ignored.

One indelicate matter that presented an ongoing problem: how does a society handle huge volumes of human waste that is part of high population metropolitan areas? It was a raging issue in all segments of the government and community. Some believed it should be used as fertilizer – but fertilizer from millions of people was not a practical disposal plan. Journalist Henry Mayhew agreed with the idea to use human excrement as fertilizer and saw it as an economic plus. It was an economic waste to just dispose of it, Mayhew felt. Former head of the Health Board Edwin Chadwick and other scholars agreed that the sewage was "economic bounty." Chadwick's main concern relative to the excessive excrement was the health of the populace.

The solution was felt to be a citywide sewage system that could remove waste in a sanitary manner. There were political and bureaucratic stumbling blocks that would stand in the way of completing such a monumental engineering feat. Legislation was passed governing the disposal of waste but working sewers were essential in carrying them out. Prior to 1815, it was illegal to discharge waste into the existing sewers. Night-

soil men were to be called in to handle the overflowing of cesspools. The Thames was remarkably clear during this time.

But as the population grew and more waste wound up in the sewers, the Thames became murky and contaminated. Chadwick ordered that all cesspools be removed from homes. Since the new sewer system was not in place, all sewage was directed to the river. The Thames became one of the most polluted rivers in the world. City engineers would offer glowing reports about the amount of waste that had been deposited into the river: 29,000 cu yards in the spring of 1848 and 80,000 cubic yards that winter.

There was a large segment of the citizens of Victorian London who lived in the shadows. Actually, many of them lived in the excrement, the sewage that was deposited into the Thames River. The city's population had exploded over a short period to over two million and the city officials and planners were not prepared for growth and had no means to deal with many issues associated with an over-crowded city. One of the most important matters that lacked a solid plan was the disposal of human waste. Sending this waste through the sewer systems and dumping it into the Thames was not only a short term fix it was very short-sighted. The stench that emanated from the river settled in over the entire city. It became the norm, yet city officials continued to turn their heads. They apparently had no solution. Perhaps they thought it would just go away.

London's underclass were known as scavengers and by many other names including toshers, bone-pickers, rag-gatherers, mud-larks, dustmen, night-soil men and many other strange-sounding job titles. These scavengers performed many tasks and services one of which was a very important and crucial service – the removal of refuge from a large population.

The toshers waded through the contaminated water at low tide, carrying eight-foot long poles dredging up the muck in hopes of finding something of value to sell. The toshers were followed closely by the mud-larks who were often children dressed in rags who would snatch debris that the toshers passed up. The pure-finders made a living by collecting dog excrement and bone-pickers looked for carcasses of any kind. The sewer-hunters trudged through the flowing waste below the city streets looking for valuables. The scavengers "lived in a world of excrement and death." Night-soil men cleaned excess sludge off the top of private cesspools each night to prevent dangerous overflowing.

Henry Mayhew boldly wrote about these people and the jobs that they were relegated to do in his book London Labour when no one of the gentry class would dare even mention them. He found that they performed an essential function in that they removed some of the refuge deposited by the growing London population.

Styles

Structure

The structure of the telling of the 1854 cholera epidemic in the Soho district of London is an unusual one. There are basically eight chapters which are designated by dates during the epidemic. Although the cholera bacteria was a virulent strain that spread rapidly, it only lasted a week.

The first chapter is entitled, “Monday, August 28: The Night Soil Men.” In this section, the state of London’s sanitation and sewage problems are described along with the underclass who dealt with the refuge. It also provides an account of patient zero, the first patient who contracted the disease and began the epidemic.

“Saturday, September 2: Eyes Sunk, Lips Dark Blue” introduced curate Henry Whitehead of St. Luke’s Church who knew the people of Soho, many of whom were his parishioners. Whitehead was ultimately instrumental in convincing city officials of the source and cause of the epidemic.

“Sunday, September 3: the Investigator” introduces Dr. John Snow who was a physician and anesthesiologist who had studied the cholera bacteria before and became fascinating with how it was spread. When the 1854 cholera epidemic broke out he was determined to find its cause. It was undaunted in achieving his goals despite the barriers that were placed before him.

“Monday, September 4: That Is to Say, Jo Has Not Yet Died” curate Whitehead was tireless in visiting and ministering to the sick and dying. The upper class began to blame the poor and the poor started pointing fingers at the sewer excavations that had disturbed the dead that had released the deadly miasma into the air. There were many lies, distortions and half-truths that left Whitehead in a state of confusion. Where was the answer?!

“Tuesday, September 5: All Smell Is Disease,” describes how Snow’s waterborne theory which ultimately was proven the right solution to the spread of cholera was blocked by the prevailing theory of the day – miasma. Miasmatists believed that the stench in the air from the Thames created a miasma that when inhaled infected people with cholera.

“Wednesday, September 6: Building the Case” describes how Dr. Snow stood his ground on his waterborne theory despite the criticism and ridicule that he was subjected to. He joined forces with Henry Whitehead who was once a miasmatist but had been swayed by the overwhelming evidence that Snow’s theory was the right one.

“Friday, September 8: The Pump Handle” tells how the city officials ordered the removal of the pump handle on Broad Street the pump that Snow and Whitehead claimed was the source of the cholera bacteria. The removal of the pump handle was a pivotal and symbolic moment in the debate over the source of the cholera.

“Conclusion: The Ghost Map” explains the origin of maps that illustrate the origin and pathway of disease. John Snow was one of the pioneers in the development of these maps. He created a map that dramatically illustrated the attack line that the cholera bacteria followed during the 1854 epidemic. These maps are common place in modern times with updates made daily on the Internet. They depict the pathways of diseases around the globe.

Perspective

The Ghost Map by Steven Johnson is written in the third person narrative. The content of the book is based on the vast research conducted by the author. In “Author’s Note” Johnson describes his work as a “narrative of the events of September 1854” during a severe outbreak of the deadly cholera. There were epidemics that took more victims than this case. However, it was during this outbreak, known as the Broad Street epidemic or Golden Square epidemic, that the source of the disease was discovered. The author states that any direct dialogue used in his book are taken directly from firsthand accounts of the incident. Johnson explains that he did take the liberty as a writer of imagining how the people felt and what they may have thought.

Johnson has made the topic of the cholera outbreak in Victorian London a nearly life-time obsession. He had been preparing the book for twenty years, a work that began as an undergraduate thesis. The rich details that Johnson provides in this complicated account of a tragedy that struck London well over a hundred years before is a testament to that dedication and his knowledge on the subject.

Johnson relied on modern-day experts and scholars to vet his work because he was most concerned with its accuracy and to provide additional details that were not known to him. Over the twenty years that he conducted his research, he uses many sources including the libraries of Harvard, MIT and NYU and the New York Public Library – all sources that help to tell the accurate story of the epidemic, its aftermath and the amazing and dedicated work of two men – Dr. John Snow and curate Henry Whitehead – who determined once and for all the cholera was a waterborne disease.

Johnson provides additional sources for readers who want to learn more about Victorian London during cholera outbreaks an appendix entitled, “Notes on Further Reading.” Johnson obviously found the subject matter fascinating and he assumes that other readers will as well.

Tone

The tone of The Ghost Map by Steven Johnson is a scholarly one as well as one that relies heavily on the disciplines of reportage and scholarship. The author began this work as an undergraduate student twenty years before. He turned what was a work for his senior thesis into a near obsession and then ultimately into this book. He became hooked on the subject matter probably just as Dr. John Snow had been in the mid-

century 1800s during the Soho cholera epidemic that spurred him on to launch an investigation to learn the source and origin of the bacteria.

Johnson's thorough chronicling of the cholera epidemic of 1854, its aftermath and the resolution of its mystery, is written in great detail and is carefully relayed to ensure that the story of the Broad Street epidemic is told in a factual manner. Johnson takes create care in providing an account of the epidemic's many complications and twists and turns that is relayed to the reader in a way that is intriguing and exciting and yet understandable for the lay person who is not an epidemiologist which covers probably just about everyone one will read the book.

Johnson underscores the importance of the work done by Dr. John Snow and curate Henry Whitehead who together proved Snow's waterborne theory and found patient zero. He celebrates these men as courageous pioneers whose work probably saved hundreds of thousands of lives. Johnson obviously views these men and heroes, and from the way he presents the story, he hopes the reader does as well.

Quotes

I found whole areas of the cellars of both hoes were full of nightsoil to the depth of three feet, which had been permitted for years to accumulate from the overflow of the cesspools…. Upon passing through the passage of the first hose I found the yard covered in night soil, from the overflowing of the privy to the depth of nearly six inches and bricks were placed to enable the inmates to get across dryshod."
-- Henry Mayhew (Monday, August 28: The Night Soil Men paragraph 17)

Importance: Human excrement was called nightsoil in 1850s London. When landlords failed to remove the night soil because of the expense to do so, the results were as described above making for a very unhealthy environment.

With houses looking on, one every side, save where a reeking little tunnel of a court gives access to the iron gate – with every villainy of life in action close on death, and every poisonous element of death in action close on life – here, they lower our dear brother down a foot or two: here, sow him in corruption, to be raised in corruption: an avenging ghost at many a sick-bedside: a shameful testimony to future ages, how civilization and barbarism walked this boastful island together."
-- Charles Dickens (Monday, August 28: The Night Soil Men paragraph 41)

Importance: In Bleak House, Charles Dickens describes the burial of an opium-addicted law-writer in a grim setting that was closer to reality than anyone wanted to believe. It is one of the book's most famous passages.

My purpose was that the new street should cross the eastern entrance to all the streets occupied by the higher classes and to leave out to the east all the bad streets."
-- John Nash (Monday, August 28: The Night Soil Men paragraph 57)

Importance: Nash's description of the structure of Regent Street was the brainchild of Nash who planned the street to separate the poor of Soho from the well-to-do in Mayfair. The structure played an important role in the onset of the cholera outbreak.

Most world-historic events – great military battles, political revolutions – are self-consciously historic to the participants living through them…. But epidemics create a kind of history from below: they can be world-changing, but the participants are almost inevitably ordinary folk, following their established routines, not thinking for a second about how their actions will be recorded for posterity."
-- Narrator (Saturday, September 2, Eyes Sunk, Lips Dark Blue paragraph 16)

Importance: Author Steven Johnson compares an epidemic that attains historic proportion to other life-changing events. Those who are unfortunate enough to be part of the epidemic have no perspective on its historic importance – they are just trying to survive.

While the mechanism of life is suddenly arrested, the body emptied by a few rapid gushes of its serum, and reduced to a damp, dead… mass, the mind within remains untouched and clear, -- shining strangely through the glazed eyes, with light unquenched and vivid – a spirit, looking out in terror from a corpse."
-- The London Times (Saturday, September 2, Eyes Sunk, Lips Dark Blue paragraph 22)

Importance: An article in the London Times during the cholera breakout described, in dramatic terms, the unique horrors of cholera.

We sometimes talk about organism 'desiring' certain environments, even though the organism itself surely has no self-awareness, no feeling of desire in the human sense of the word."
-- Narrator (Saturday, September 2, Eyes Sunk, Lips Dark Blue paragraph 34)

Importance: Cholera is an organism that reproduces more effectively in an environment in which humans ingest the excrement of other people. The water that contained human excrement was ingested by the people who lived in the community where the first outbreaks occurred.

Whilst pestilence slays its thousands, fear slays its tens of thousands."
-- Old Saying (Monday, September 4: That Is to Say, Jo Has Not Yet Died paragraph 8)

Importance: When rumors swirled that hundreds of thousands had died in Soho, a total exaggeration, the fear of the disease garnered more victims than did the cholera bacteria.

Almost every house along Broad Street had suffered a loss, but there were only a handful of isolated cases on Cross Street. This is what Snow was looking for now. He could see at a glance that he'd be able to demonstrate that the outbreak was clustered around the pump."
-- Narrator (Wednesday, September 6: Building the Case paragraph 3)

Importance: This was a pivotal point in Snow's investigation. When he was able to determine the clustering of deaths caused by the cholera epidemic he knew he was getting close to making his case too convincing to ignore.

The case of baby Lewis matched the profile of the index case perfectly: an attack of cholera that occurred three days before the first wave of the general outbreak, where the victim's evacuations were deposited a matter of feet from the Broad Street well."
-- Narrator (Friday, September 8: The Pump Handle paragraph 58)

Importance: Curate Whitehead was able to figure out the first victim of the cholera breakout. He determined that a five-month old baby girl was patient zero and that her evacuations that had been deposited in the cesspool near the Broad Street pump was the source of the bacteria that turned into a raging epidemic.

It has been suggested by Dr. Snow, that the real cause of whatever was peculiar in the case lay in the general use of one particular well, situate at Broad Street in the middle of the district…. After careful inquiry, we see no reason to adopt this belief. We do not find it established that the water was contaminated in the manner alleged; nor is there before us any sufficient evidence to show, whether inhabitants of the district, drinking from that well, suffering in proportion more than others of the district who drank from other sources."
-- Benjamin Hall (Friday, September 8: The Pump Handle paragraph 72)

Importance: Even though Dr. Snow had provided evidence that the cholera bacteria was being contracted through water consumption, the Board of Health would not budge from its belief in the miasma theory. Snow and his cohort Henry Whitehead were undaunted by this rejection. They knew they had to convince the authorities so that steps could be taken to prevent another occurrence of the disease.

But Cooper needed a way to represent these patterns in an intelligible manner that both the laypeople of the neighborhood and his supervisors might understand. So he created a map of the outbreak."
-- Narrator (Conclusion: The Ghost Map paragraph 1)

Importance: Engineer Edmund Cooper was commissioned to oversee the construction of London's new sewer and pure water systems. He wanted to depict the pathway of the recent cholera epidemic so he created a map. It was the first "ghost map" and was used by John Snow to create a more detailed map of the disease's movement through the Soho district. Ghost maps are common in modern times. They show the path of disease outbreaks around the world and are updated daily on the Internet.

… the megacities of the twenty-first century will have to learn all over again the lessons that London muddled through in the nineteenth. They'll be dealing with 20 million people instead of two million."
-- Narrator (Conclusion: The Ghost Map paragraph 58)

Importance: The author advises large cities need to pay close attention to Victorian London whose population explosion was unexpected and was not dealt with properly. They had the sewage of two million people to dispose of. The megacities of today have the sewage of 20 million to deal with. His unspoken warning is that a laxity in sanitation practices in a huge population can allow a pathway for a cholera outbreak. Although cholera is not common, it can rear its ugly head again and it is just as deadly as it was in nineteenth century London.

Topics for Discussion

1

Explain what roles that toshers, mud-larks and other scavengers played in Victorian London. Although the underclass in London lived in squalor and in the shadows, what was an everyday reminder of their presence to the middle and upper class of London? What were cesspools and what task did night-soil men perform relative to them?

2

How did the deadly cholera outbreak of 1854 in London begin? What did the upper crust families believe would keep them safe from contracting the disease?

3

What other tragedies had Victorian Age Londoners gone through and survived as a people? What did most Londoners believe the source of the cholera epidemic in Soho to be?

4

What advancement did Dr. Thomas Latta make in the treatment of cholera? Why was his treatment ignored? What were some of the later-debunked treatments that were administered to sick and dying victims of cholera?

5

What is the chief difference between the scavengers of Victorian London and the homeless of today? Discuss the pros and cons of the conditions that the homeless and impoverished faced in the Victorian era and those that the modern day poor and homeless face.

6

Describe how ancient cultures recycled their resources. How is the coral reef a model for recycling? How did Victorian London fail in its attempt to recycle waste?

7

How did John Snow's background and experiences help him in his mission to find the source and cause of the cholera epidemic of 1854? How did Snow's childhood pay a role in his interest in solving the cholera mystery?

8

What were the three issues that kept Henry Whitehead initially reject Snow's waterborne theory? What finally convinced him?

9

Which cities have the largest populations in the world as of 2015? What are the dangers of those who live in "squatter cities" and how do they compare to Victorian London? What can they learn from the Londoners of that era?

10

Describe the map that Edmund Cooper created and the one that John Snow modeled after it. Why was Snow's map important and how did it help support his theory? Describe modern-day maps, what they contain and what there availability it.