PART I

Infectious Diseases

CHAPTER 1

The Black Plague: A Paradigm for Today

We begin this book on world event trading by going back into the past and setting our time travel device for the beginning of the fourteenth century. This may appear to be a strange place to start, but we go back to show that diseases have consistency over time. The types of diseases may change, but their core characteristics and how they influence society remain consistent.

The bubonic plague, or Black Death, is going to be our base case for many of the diseases that tear through the population today. Therefore, to understand an outbreak and its impact on the world, you must know the state of civilization and the nature of the disease. Keep in mind that the basic rules of supply and demand still worked even back then and will guide us in understanding disruptions to the markets. It's these disruptions or anomalies that generate the opportunities.

By the way, we still have outbreaks of the plague today. At the end of the chapter, we review an outbreak that occurred in 1994.

IT WAS CALLED THE DARK AGES FOR A REASON

Clearly, the fourteenth century was a gloomy time for people throughout the world, especially for those unfortunate enough to be living in medieval Europe. Daily life was a struggle, and it was about to get worse. Economic conditions fluctuated wildly, with surges of inflation occurring whenever large deposits of gold or silver were found.

To counter this, governments attempted to impose price controls, but were opposed by the powerful landowners or feudal lords. As landowners raised rents to counteract the price controls, farmers were forced to increase planted acreage and farm productivity dropped as poorer land was worked and yielded less. As populations grew and more workers appeared, wages fell with the additional labor supply. From the small city-states of Italy to the large kingdoms of England and France, fiscal problems increased and bankruptcy was constantly on the horizon. David Hackett Fischer describes the situation this way in *The Great Wave*: "Great kingdoms and small city-states teetered on the edge of bankruptcy. They struggled to survive by borrowing heavily at ruinous rates of interest, and by debasing their money, thereby introducing powerful instabilities into the price system of Western Europe."

And then things really started to deteriorate. This is a common characteristic throughout disease outbreaks over time: When the area is the most stressed is usually when the outbreak can cause the most mischief and death. The medieval world would soon be severely stressed and hungry as well.

THE GREAT FAMINE OF 1314–1316

In the 1300s, farming was the most critical industry for society. The society that could successfully produce food could successfully have division of labor. Division of labor can lead to a more stable society and rapid technological progress. Unfortunately, in early 1314 in Europe it began to rain hard and it didn't seem to let up until 1317. This weather ruined the crops for three years in a row and caused widespread hunger.

This underscores the insular nature of the economies at this time. There was no world market from which to import grain or foodstuffs to offset the localized production problem. People were highly dependent on what was happening in their region. This is precisely why international trade and trade development were critical at this time and remain so today. World trade helps smooth out supply disruptions and price volatility. (Developed and fully functional international financial markets were not in existence to help hedge the underlying risks, either.) Without international trade, disasters can happen when nature intervenes.

According to Fischer, stormy weather lashed the continent for months. Dikes collapsed in England and the Low Countries. Entire fields washed away in France. Villages were destroyed by rising rivers in Germany. Once again grain and fodder crops failed. This was not merely a set of local shortages. It was, in the worlds of historian Henry Lucas, "a universal failure

of crops in 1315 . . . from the Pyrenees to Slavic regions, from Scotland to Italy." The rains caused rivers to jump their banks, dams to break, and entire towns to be washed away. The rains flooded farmland and took away critical acreage for planting.

Sadly, this was occurring through most of Europe and brought about a major drop in food supply. Humans weren't the only ones impacted, as animals couldn't be fed and therefore couldn't be raised. Prices for poultry and livestock went up dramatically in addition to grain prices. Governments got involved early with precisely the wrong policy, which would make matters worse. This is another common theme in outbreaks: Governments initially do the wrong thing at the critical time to further accelerate the outbreak or compound the economic problems. The English Parliament asked King Edward II in 1314 to impose price controls to stem the rapid rise in the cost of food. As we now know, limiting the price of a commodity usually means that less of that commodity will be produced. The price controls of the 1970s in the United States are a nice modern example of this concept in action.

In 1315, the famine was in full swing as peasants struggled to survive and ate anything available, even cats, rats, reptiles, and insects. In 1316 when these ran out, they turned into cannibals. They ate the newly dead and the not so newly dead, going so far as to dig up bodies from burial grounds and cut down criminals from the gallows to eat. For a world that was already unstable, the famine proved to be devastating. It is estimated that 10 percent of the population died during this period.

BLACK DEATH

As if things weren't bad enough, wars broke out in clusters among France, England, Scotland, Germany, and other small city-states, further weakening the population and food supply. The wars wrought additional human and economic devastation.

During one war in 1346, the Genoese town of Caffa was being besieged by a Tartar army. Caffa was a walled city and the Tartars were making little headway in their attempt to take it over. Even worse for the invaders, some of them were stricken with an unusual disease that made their tongues turn white and their skin turn black.

Bubonic plague is the medical term, but it is known as the Black Death. It still exists today, and the name is somewhat of a euphemism. The following sections, taken from the Centers for Disease Control and Prevention web site (CDC, www.cdc.gov/ncidod/dvbid/plague/info.htm), describe it in greater detail. I realize this may seem odd to have a detailed description of a disease in a book on trading. However, over the years I have learned that

you can only construct a winning strategy if you fully understand the nature of the disease.

General

Plague, caused by a bacterium called Yersinia pestis, *is transmitted from rodent to rodent by infected fleas.*

Plague is characterized by periodic disease outbreaks in rodent populations, some of which have a high death rate. During these outbreaks, hungry infected fleas that have lost their normal hosts seek other sources of blood, thus increasing the risk to humans and other animals frequenting the area.

Epidemics of plague in humans usually involve house rats and their fleas. . . . Domestic cats (and sometimes dogs) are readily infected by fleas or from eating infected wild rodents. Cats may serve as a source of infection to persons exposed to them. Pets may also bring plague-infected fleas into the home.

How Is Plague Transmitted?

Plague is transmitted from animal to animal and from animal to human by the bites of infective fleas. Less frequently, the organism enters through a break in the skin by direct contact with tissue or body fluids of a plague-infected animal, for instance, in the process of skinning a rabbit or other animal. Plague is also transmitted by inhaling infected droplets expelled by coughing, by a person or animal, especially domestic cats, with pneumonic plague. Transmission of plague from person to person is uncommon and has not been observed in the United States since 1924 but does occur as an important factor in plague epidemics in some developing countries.

Diagnosis

The pathognomic sign of plague is a very painful, usually swollen, and often hot-to-the-touch lymph node, called a bubo. This finding, accompanied with fever, extreme exhaustion, and a history of possible exposure to rodents, rodent fleas, wild rabbits, or sick or dead carnivores, should lead to suspicion of plague.

Onset of bubonic plague is usually two to six days after a person is exposed. Initial manifestations include fever, headache, and general illness, followed by the development of painful, swollen regional lymph nodes. ***[My note: This is an important point, as fever can act as an early warning indicator for bubonic plague. SARS***

has similar characteristics, and therefore the ability to quarantine people with high fever was a contributing factor toward ending the SARS outbreak. Influenza does not have this short incubation period, nor does it show itself via the high fever.] *Occasionally, buboes cannot be detected for a day or so after the onset of other symptoms. The disease progresses rapidly and the bacteria can invade the bloodstream, producing severe illness, called plague septicemia.*

Once a human is infected, a progressive and potentially fatal illness generally results unless specific antibiotic therapy is given. Progression leads to blood infection and, finally, to lung infection. The infection of the lung is termed plague pneumonia, *and it can be transmitted to others through the expulsion of infective respiratory droplets by coughing.*

The incubation period of primary pneumonic plague is one to three days and is characterized by development of an overwhelming pneumonia with high fever, cough, bloody sputum, and chills. For plague pneumonia patients, the death rate is over 50 percent.

Treatment Information

As soon as a diagnosis of suspected plague is made, the patient should be isolated, and local and state health departments should be notified. Confirmatory laboratory work should be initiated, including blood cultures and examination of lymph node specimens if possible. Drug therapy should begin as soon as possible after the laboratory specimens are taken. The drugs of choice are streptomycin or gentamycin, but a number of other antibiotics are also effective.

Those individuals closely associated with the patient, particularly in cases with pneumonia, should be traced, identified, and evaluated. Contacts of pneumonic plague patients should be placed under observation or given preventive antibiotic therapy, depending on the degree and timing of contact.

Preventive Drug Therapy

Antibiotics may be taken in the event of exposure to the bites of wild rodent fleas during an outbreak or to the tissues or fluids of a plague-infected animal.

Here are some quick comments on this description by the CDC and why it's important to include this information in the book. Note the high death incidence or mortality rate of those infected with the plague who contract

pneumonia: 50 percent die today. The rate for the medieval period must have been closer to 100 percent, as there were no medicines (antibiotics) available at that time to help. The swelling of the lymph nodes around the neck and armpits were bluish-blackish in color and gave rise to the name the Black Death. As you'll see in the next chapter, pneumonia is the true killer associated with plague or influenza after the initial infection weakens the body's immune system.

One last point: Try to put yourself in the shoes of a peasant at this time. Imagine you encounter someone who is infected and has the black swellings around the neck and armpits. It must have been a terrifying sight, and the first response would be to run. Your next response would be to avoid going anywhere that you may encounter those who have the plague. This mind-set is important for understanding the impact on society and the economy.

WINNING THE BATTLE, LOSING THE WAR

Getting back to the war, the frustrated Tartars did something truly innovative. They gathered up a few of their dead, loaded them into the catapult, and tossed them over the wall into Caffa. This was one of the first recorded uses of germs as a weapon and it worked well—a little too well. As the disease spread and killed, Caffa was abandoned and the inhabitants fled in their ships. The Tartars had won battle, but the world was about to lose the war as this siege and diaspora helped begin the spread of the Black Death. This is another common development that occurs with most outbreaks: The population attempts to flee the infected area and ends up spreading the disease wherever they go.

The bubonic plague or bubo rapidly spread throughout the trading routes from Genoa. In 1347, it spread to Sicily, Sardinia, Corsica, Africa, and elsewhere in Europe. By January 1348, it had entered Venice and Marseilles. In December, it reached England. Scotland and Scandinavia were hit the following year.

The disease was remarkably efficient in its ability to spread and kill. One bite from either the infected fleas that lived on the rats or the rats themselves could prove deadly. The plague was also quite democratic as it killed children, parents, the old, the young, and animals. One of the problems was that family pets like cats and dogs were equally affected and helped bring the disease into the home. This efficient disease distribution was catastrophic to a population already under duress from famine. Population data from villages in England showed dramatic drops in numbers of men between the ages of 18 and 25.

Today, it's hard to comprehend the full psychological impact this series of events had on individuals and society at that time. The Black Death fundamentally altered the social fabric of society all the way down to the most basic components. It shredded it. When family members became infected, they were often abandoned—in the home. The other family members would flee and leave everything behind. Many of those afflicted died of starvation. Not that they were doing any good anyway, but physicians weren't readily available because most of them had died from the disease. The ones who did survive charged heavily for a visit. Therefore, even back in medieval times, a house call by a doctor was expensive. In desperation, people turned to the church for guidance, hope, and burials.

GRIM REAPER WINNERS AND LOSERS

For the financial markets, here's where things get interesting. Population numbers from back then were imprecise. However, historians estimate that Europe lost between 25 and 40 percent of its inhabitants to the disease. This depopulation created peculiar crosscurrents in prices that swirled around death. Any servants, including priests and friars, agreeing to take care of the ill saw their wages rise significantly. Obviously, the funeral business boomed as long as there were people willing to get close to the bodies. Merchants selling burial cloths and spices also did well.

Due to the worries over contracting the disease, people stopped frequenting certain public meeting places like markets, inns, and taverns. However, churches and apothecaries remained open and flourished. Hope was big business. Another oddity of the time: strictly enforced noise ordinances. Churches were discouraged from ringing bells for funerals and they were prohibited from crying out announcements of the dead. Since these were occurring frequently, the bells and town criers were a constant reminder of death and had a depressing effect on the townspeople.

Due to the Great Famine and price controls, the price of food was still rising rapidly during the early epidemic years. Then the Black Death kicked in and the massive die-off of the human race began. This was where things got weird. As the population declined, the demand for food declined , and the supply of labor declined as well. This had the simultaneous effects of prices declining for foodstuffs, but rising for services of artisans and craftsmen. To help the modern reader relate, it was like trying to find a contractor to do an addition on your home during the U.S. real estate construction boom of 2002 to 2005. If you could locate one that was available, that contractor was very expensive, was not likely to do quality work, and played golf every Wednesday.

What's interesting is that these medieval contractors pretty quickly figured out they were the only game in town. Unions weren't around at the time, but this didn't stop them from going on strike and demanding higher wages. They understood the laws of supply and demand on price. There weren't many of them left to do the work, the rest of society needed them to do the skilled labor, and therefore the price for their work had to go up. Just when things looked like they couldn't get worse, local governments attempted to limit trade and worker movements between cities. This is a perfect example of why the statement "We're the government and we're here to help" strikes terror into most free marketers. The actions were precisely the wrong policy; they hampered trade and exacerbated the wage inflation already in process.

At this time, banking systems were put under severe stress as both the king of England and the king of France defaulted on their debts. In *A History of Interest Rates*, Sidney Homer and Richard Sylla explain that this default generated new financial regulations and reforms. As an example, Venetian banks were prohibited from speculating in commodities and were required to hold their assets in safer instruments like public debt. Subsequently, interest rates for loans to princes rose, with some borrowing at 80 percent and others pawning their gold coronets for a loan of 50 percent of their value.

Personal loans saw similar high rates. The odd contradiction was that commercial loans had started the century at rates of 15 to 20 percent and declined by the end of the century to 5 percent. This may have been due to an overall drop in economic activity and therefore a drop in demand for money in commerce.

YOU CAN'T TAKE IT WITH YOU, UNLESS...

Clearly, the best trade available at this time was to stay alive. If you pulled that off, you were either very lucky or already very wealthy and could hire people to take care of you should you fall ill. Without question, the fourteenth century was limited in financial instruments to trade at that time. However, there are some broad areas of investment that would have done quite well.

Obviously, any business related to death was fantastic. From selling the cloth for shrouds, to making special clothes for mourning, to selling spices and candles for funerals, merchants who engaged in these businesses made handsome profits. Home health care providers were big winners, if they could stay alive. As the population decreased, the peasants or laborers

saw their wages rise, and the selling prices of the goods and services they produced rose as well. The trick was finding enough workers to produce the goods.

Also, it was a good idea to avoid making loans or buying debt from anyone who was dependent on the population for revenue, such as kings. Why did the gilded class have problems? As the populations fell, so did the tax base for the kingdoms of France and England. Without a change in their spending habits, these kingdoms eventually defaulted on their loans and wiped out some banks in Italy. Also, loans based on real estate values were not a good investment, as demand dropped for farmland with the decline in population.

Last, trading in commodities was hot. Unfortunately, there weren't many financial products at the time to buy or sell to take advantage of the price swings. During the Great Famine, prices rose dramatically even through the initial years of the Black Death. Then they fell rather crisply as the population decreased and demand fell. During the same time frame, metals trading would have been interesting as well. Gold and silver production had reached a peak early in the century and contributed to the rise in inflation. Subsequently, production fell off with the loss of population (labor) and contributed to the drop in prices. Although coins were debased from time to time, gold and silver were essentially a nation's money supply during this time frame. If the supply of gold and siver rose, business activity rose, as did inflation. If the supply fell, the opposite occurred.

The bubonic plague pandemic was an event of truly catastrophic death and social change. In essence, the awesome killing power of the disease brought this period in history to an end and almost caused the collapse of medieval Europe. However, it is an excellent paradigm or structure by which we can learn how to view the subsequent infectious diseases that impacted our world. As you will see in subsequent chapters, there were themes back then that would remain consistent over time with disease outbreaks.

First, diseases generally break out at the worst time for a population when it is either unprepared or stressed or poor. It's usually a combination of two out of the three.

Second, the population will attempt to leave the infected area, and in the process it spreads the disease. This is why quarantines are most likely an exercise in futility at first as panic to flee sets in quickly and the disease is distributed before a quarantine can be imposed. Keep this in mind when we discuss severe acute respiratory syndrome (SARS) and bird flu.

Finally, the government pursues policies that initially make things worse from either a disease standpoint or an economic standpoint. Hurricane Katrina, the Superdome, and FEMA quickly comes to mind as a modern-day examples.

CASE STUDY: 1994 RODENT RAIN

For those of you questioning the relevancy of the plague in today's modern world, let's travel to India in August of 1994. The Surat and Beed district pneumonic plague outbreak is almost too perfect an example of how not to handle the initial outbreak of an infectious disease. It's estimated that the outbreak cost India $600 million at a time before the Indian economy could handle such a setback. The economic areas impacted were the usual suspects: tourism, international travel, and exports. It got so bad that the United Arab Emirates was reported to have cut off postal links with India out of fear that the plague would spread via mail.

It is also eerie how the conditions prior to the outbreak mimic what was occurring in the fourteenth century. According to Indian government officials at the time, only 13 percent of India's 900 million people had access to proper sanitation and only 60 percent of the garbage generated each day in India's three largest cities was picked up. The population was under duress or stress from the earthquake that had occurred in September 1993. In the Indian state of Maharashtra between 10,000 and 20,000 people died from the earthquake. The reason for the wide range in estimated loss of life is that many of those who died were very poor and the number of deaths of the poor are only estimated in India. Unfortunately, many of these dead were not buried properly, which provided an ample source of food for rats.

At that time in the neighboring state of Gujarat, many of Surat's 1.5 million inhabitants lived outside the city limits in squalid shantytowns, according to Judith B. Tysmans in her article "Plague in India 1994—Conditions, Containment, Goals":

> *The conditions of these slums in August 1994 were typical of shantytowns all over India: Open sewers, tightly clustered shelters made of cement or plastic sheets, rotting animal carcasses, heaps of garbage, and pools of stagnant water filled the alleys. Floods in early August heightened the horror as the human waste and refuse, mixed with slush and mud, were washed up and left on the riverbank, creating ideal conditions for the spread of infection. Cows, dogs, and pigs stand on top of high piles of garbage while people sell vegetables from rickety wooden carts alongside; rats thrive in such a setting.*

Now, that's what I call stress.

The local authorities did get an early warning sign, but for some reason chose to ignore it. The sign goes by the wonderful name "rat fall," which is derived from rats falling from rafters and dying on the floor. Take a moment and visualize this. Okay, got it? This is what was occurring in Mamala village

in Maharashtra in mid-August. In "Learning from Plague in India," T. Jacob John describes the situation:

> *There are in fact two epidemics, both in the mid-western region [of India]. The first was in the Beed district of Maharashtra State beginning in August and the second in Surat in Gujarat State in September, 500 km away. Whether the epidemics are linked epidemiologically is unknown. However, the key point is that they progressed undetected and unchecked mainly because of the lack of epidemiological alertness, skill, and interventions. For example, although the warning signs of rat fall in Mamala village, Beed district, were clearly apparent by mid-August, no investigations seem to have been conducted. . . . By mid-September, 10 percent of the village population had developed bubonic plague.*

This is something we'll see over time with infectious disease outbreaks: governments initially unable or unwilling to act to prevent the spread of the disease.

The government's inaction or inability to deal with this outbreak created fear among the population inside and outside the country. The lack of accurate information regarding the outbreak caused the population in those areas affected to panic and leave the areas. This movement ultimately spread the disease and caused a spike in the morbidity and mortality rates.

Why did this occur? According to Judith B. Tysmans,

> *A financial reason for minimizing the incidence and severity of plague was the location of factories (Surat is India's diamond-cutting and silk-production center) in the area of the slums. The "cordon sanitaire" sealing the epidemic off from the rest of the city would have prevented workers getting to the factory, cutting off their income, as well as slowing production.*
>
> *One major political reason for making efforts to deny the outbreak was the holiday season to begin only one month hence, with much visiting of family members from other countries, as well as large conferences with international guests invited to present papers and draw thousands of international tourists. Tourism is one of India's major financial businesses. India had much to lose by allowing news of a plague epidemic to reach the international press.*

As you'll see in Chapter 4 (SARS), China had a similar dilemma in 2003.

Now we get to the crux of the problem: poor information, poor sanitary conditions in the hospitals, and poor people dying of the disease. Insufficient

coordination among health care officials and institutions meant that the World Health Organization guidelines for dealing with the plague were either ignored or not enacted properly. This meant specifically that a quarantine was neither set up properly nor enforced properly. Patients with the disease were not tracked, nor were the family members with whom they had contact. The disease would spread and not be contained, and once the outbreak was known to the public, the public panicked and spread the disease further. It has been estimated that 25 percent of the 1.5 million people fled the area.

And Indians weren't the only ones panicking. From Russia to the United States, tour agencies canceled their Indian itineraries. The *Washington Post* reported, "'Once Delhi and Bombay got the plague cases, then everybody reacted,' said a spokesman for the Indian Association of Tour Operators. 'The setback to tourism because of the plague could be worse than it was after Ayodhya [the communal riots] and the Bombay blasts.'"

Worse yet, several countries put restrictions on travelers from India, with Moscow imposing a six-day quarantine for all visitors from India and banning all travel to the country. Estimates for business losses for the city of Surat alone were over US$260 million. When the BBC and CNN media agencies reported on the plague situation, global depositary receipts (GDRs) fell for Indian companies. Locally, agricultural exporters saw their share prices tumble as foreign countries not only denied receiving Indian exports, but some also closed their borders. As mentioned, the plague cost the Indian economy over $600 million.

All this occurred over 56 deaths. This is the point: Fear and panic caused the bigger problems for the financial markets and economy rather than the actual disease.

All three of our disease themes are present and accounted for in this event. Also, the Surat outbreak demonstrates that major modern diseases appear to emanate from poorer areas of the world that have close, prolonged proximity between animals and humans. (Prior to Caffa, the bubonic plague's genesis has been thought by historians to have occurred somewhere in the Far East.) Therefore, along with quarantine, part of the solution to the outbreak is usually the destruction of those animals seen to be carriers of the disease. In the Surat plague, it was the killing of rats. In the China and Hong Kong SARS outbreak, it will be civet cats. In H5N1 bird flu, it will be waterfowl and chickens.