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### The global distribution of disease and death

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# The Global Distribution of Disease and Death

JEFFREY COLMAN SALLOWAY, PH.D.

HEALTH MANAGEMENT AND POLICY

## Introduction

Disease. It is an ever-present shadow in our lives. There are diseases that we call endemic. These are a part of our everyday lives and we have come to expect them as routine: The winter cold, an occasional influenza, an oral herpes. Everyone gets them, everyone accepts them as part of life.

Occasionally diseases are epidemic. Their rates climb above our expectations for endemic disease. There is an outbreak of a virulent flu. Ebola strikes a village in Africa. The number of tuberculosis cases in Manchester, NH climbs unexpectedly. Hepatitis C, a chronic inflammation of the liver begins to rise in incidence.

And then, in occasional historical epochs, pandemics strike. In 1918 a rogue influenza circulated the globe in a worldwide outbreak—the classic pandemic—and took more than twenty million lives. Most of these were young, healthy people who succumbed. Even today, we see a gathering pandemic of AIDS which has ravaged Africa, will ravage southeast Asia, and looms over Eastern Europe, a gathering cloud of pestilence.

Where does disease come from? What purpose in nature does it serve? What precipitates sudden epidemics? Does the arrival of a global community affect the diseases which afflict us? And does it affect you? This is a brief, beginning answer to these questions.

## Where does disease come from?

Disease is a normal part of our ecology. In an odd way, without disease we might be far less well off. Disease eliminates the weak and vulnerable from a population. It limits the uncontrolled expansion of species which might otherwise outstrip the environment's ability to sustain rising numbers. Though each human life is precious to us, a world in which the human population grew exponentially would be an untenable world. Disease? It is at once our enemy and our friend.

Most of the infectious diseases which afflict people are zoonoses (zo-o-noh-sees). These are microbes which have made the leap from animals to humans. Jared Diamond, in his prize-winning, *Guns, Germs, and*

*Steel*, argues that European populations have historically kept lots of domestic animals—cattle, pigs, dogs, cats, horses, geese, ducks, sheep and goats. As a result, these people caught numerous diseases which were endemic in their domestic animals and developed immunities over time. When the Europeans came to the New World to colonize it, they found a population of native peoples who had no such immunities—and who suffered dramatic plagues which nearly wiped them out. Infectious disease is a partner to our domestic agriculture.

Sometimes zoonoses are carried to us from wild animals as well. The deer tick is a carrier of Lyme disease. It sucks the blood of deer mice and deer and harbors a bacteria which is transmissible to humans. These tiny ticks find a susceptible hiker on a balmy summer day and attach themselves in search of a blood feast. In the process of dining they pass on the bacteria.

Other diseases often come from toxic exposure. A pathogen—a source of disease—exists in our environment with dire health consequences. There are always such toxins in the environment and you have encountered many of them—poison ivy, ozone in the air, chemicals in the drinking water. These toxins are often a product of new technologies.

In addition, there is a host of diseases which are genetic. Sometimes these are inherited directly from our parents—and we know that we are at risk. Huntington's disease is a dominant genetic disease with devastating effects on the nervous system. It strikes in adulthood and leads to death. The child of any parent who has the disease has a fifty percent chance of developing it themselves. Other genetic diseases lurk in our DNA and emerge unexpectedly.

## Population and Disease

When we consider infectious diseases and genetic diseases, we begin to see that the very fact of people moving about implies that their diseases move with them. The example of European colonization of the New World is telling. We brought to the Americas smallpox, malaria, influenza, measles—diseases which devastated

native peoples. That process has not ended. Consider for example, Mdebe Odunukwe.

#### **Case #1: Mdebe Odunukwe\***

Mdebe Odunukwe lived in a well-to-do suburb of Chicago. He worked as a white collar professional in a high-tech industry and his job carried with it enrollment in one of Chicago's best health management organizations. He came down with a fever and flu-like symptoms and went to see his primary care physician. The family practitioner was well trained and listened carefully to Mr. Odunukwe's symptoms. The doctor reached a diagnosis of flu. Treatment was lots of fluids, Tylenol for fever, and bed rest. After a few days of no improvement, the patient returned.

The physician took some blood samples to do a lab work-up and now prescribed a broad-spectrum antibiotic in hopes that this would stave off the disease while the lab tests were being done. Too late. Mr. Odunukwe went critical and died in a local community hospital. On autopsy, he was found to have Lassa Fever, a rare African disease. No one, it seems, had noticed that Mr. Odunukwe was African. No one thought to ask if he had been travelling lately. Two weeks prior to his death, Mr. Odunukwe had returned to Nigeria to bury his uncle who had died of Lassa Fever. While one can lament that an American family practitioner ought to have asked the critical question about foreign travel, the fact is that at the time of this death, it had not occurred to medical educators that global travel required training physicians to look for disease from remote corners of the world. Mr. Odunukwe died less from Lassa than from a new global world.

### **Genetics, Globalization, and Disease**

Moving populations carry not only infectious agents such as the virus which causes Lassa, they also carry genes. In this case, the source of the disease is not in the blood stream, it is in the reproductive tract. Thus, for example, Africans transported to the New World carried with them an occasional gene for Sickle-Cell Disease. This disease, which is carried as a genetic trait, does not express itself unless both a person's parents have the trait. If both parents have the trait and pass it on, their offspring has red blood cells which are shaped like crescents and which form painful clots during disease episodes. In Africa, the trait seems to be protective against malaria. In the US, practitioners occasionally see—and diagnose—Sickle Cell Disease. We have learned to look

for it. Sometimes, we are not as alert. Such was the case with Nora Iliotis.

#### **Case #2: Nora Iliotis**

Nora grew up in New Hampshire. She was a slender, lovely woman of fair complexion. At UNH she was a superior student. However, she did poorly on her exams in Epidemiology. Feeling badly about it, she came to see the instructor and explained that she had not been feeling well. The primary care physician found her to be quite anemic and was prescribing iron supplements. The instructor asked with some curiosity what her ethnicity was. Greek! she replied. Mother? Father? he continued. Both! OK, Nora. How would you like to do an extra-credit paper for the course? Due next week. Topic is thalassemia.

Nora returned the next week with paper in hand. It described a genetic disease found among eastern Mediterranean peoples. Thalassemia is a genetic disorder which is accompanied by a persistent anemia. Treatment with iron supplements does not help and can be detrimental. This is what I have, isn't it? she said. It was.

Nora's parents were both descended from Greek families. Though they had met here, neither suspected that they might carry the gene for this disease. Though practitioners in Greece would have been quick to identify the problem, an American trained physician would never note that the immigration of Greeks to New Hampshire would bring with it the risk of thalassemia.

Nevertheless, with globalization has come the mass movement of populations. A key feature of the European Union has been the opportunity for labor to move effortlessly among the member countries. What diseases do they bring with them, either as infections or as genetic traits? Are we prepared to deal with disease not as a set of endemic risks to health in our local communities but as risks that arrive from all over the world?

As American communities become host to populations from remote corners of the world, do we encounter infectious diseases and genetic diseases which we are unprepared to recognize?

### **Technology, Globalization, and Disease**

Rene Dubos was one of the brilliant science minds of the twentieth century. In his books, *The Mirage of Health* and *Man Adapting*, he argues that as our technologies develop, they bring with them new risks of disease. In fact, we have actually invented new diseases. Observe the phenomenon of radiation sickness. Exposure to radiation became a health risk only as we began to use it as a

*\*Names have been changed, but cases are based on fact.*

weapon, a source of energy in nuclear power plants, and—and—as a tool in medical treatment!

There are some more mundane illustrations as well: Carpal tunnel syndrome from computer keyboards; facial burns from exploding air bags; exposure to MtBE, a gasoline additive in our drinking water. But our technology, driven by globalization has had some remarkable health impacts. As recently as fifty years ago, it took several days to travel from one part of the world to another. Today it is a matter of hours. Over days, carriers of disease sicken or die. Over hours, they often do not.

### **Case #3: Lexie the Horse**

Lexie was the nickname for the Texas Lexus, a prize American Quarter Horse. Lexie was put down (euthanized) a couple of years ago when he was devastated by West Nile Fever. In 1996 there was an outbreak of epidemic deaths among flamingoes at the Brooklyn Zoo in New York. The zoo vet was perplexed and contacted the NYC Health Department to see if there was anything funny going on. Sure enough, there were a handful of unexplained deaths among humans from some kind of encephalitis—an inflammation of the brain. The vet did some research and discovered that the flamingoes had died of West Nile Fever. But this was impossible—or so it seemed. West Nile Fever is a disease common to the eastern Mediterranean. The particular strain of WNF which killed the flamingoes was the same strain which had recently been identified in an outbreak in Israel. Moreover, the human deaths in NYC were from the same virus! Where did it come from?

The Brooklyn Zoo is not far from Kennedy International Airport—about as far as the range of a mosquito. Did a Mediterranean mosquito hitch a ride on a plane from Israel to the US and then search out a blood meal at the Brooklyn Zoo? Did an arriving passenger harbor the disease and suffer the bite of a home-grown mosquito in Brooklyn?

It took only a couple of years for the virus to enter the stream of migratory birds that flies over the eastern seaboard. It took only a couple of years for dead crows to begin to appear in New England. It took only a couple of years for the virus to become endemic in the United States. It took only a couple of years for an infected mosquito to find Lexie, a prize American Quarter Horse. And those mosquitoes are out there now.

## **Air Travel and Disease**

Air travel in particular has become a source for the spread of disease. It is not only the speed at which hu-

mans can arrive at very new locations, it is the travel process itself. In 2003 a form of severe lung infection showed up in Asia. Its onset was so sudden and so acute that it was immediately dubbed Sudden Acute Respiratory Syndrome—SARS. Overnight it showed up in Hong Kong, Singapore, and Vietnam as travellers carried it with them.

Commercial airplanes pack several hundred people into a small space for trans oceanic flights that last hours and hours. To save energy, they recirculate cabin air. It only takes a single person with a respiratory infection to expose hundreds.

Within a few weeks SARS showed up in Toronto, Canada. The cases of this highly infectious disease spread so quickly that the health authorities designated a single hospital as the isolation unit for the disease. Health care professionals were at particular risk. Not only were they catching the disease, they were taking it home to their families, Nurses and physicians had to assess their ethical responsibilities and make heavy decisions. Many elected to live at the isolation hospital for the duration of the outbreak rather than risk their families health.

Like many outbreaks SARS burned out. With excellent public health management, the epidemic was contained and it disappeared with some thirty deaths in Toronto and many more in Asia. It was a speeding bullet. We dodged. This time.

Air travel is one of thousands of technologies which have become sources of illness. As we have globalized we have also lost our ability to regulate products which enter our country. Produce from other countries may carry disease-causing microbes. Manufactured goods may contain phthalates or brominated chemicals which are toxic. These products are clever and cheap. Is the risk of global trade worth the cleverness and the cost?

## **Globalization and a Changing Ecology**

The global market for beef is a hot competition. In the 1980s Great Britain was in a price war with Canada, the US, and Argentina for cheap burgers. One problem was that the British pound had fallen against world currencies. The British had typically purchased protein supplements for their beef cattle in the forms of soy from Asia and fish powder from Chile. But with the falling pound, the prices of these supplements were driving up the costs of British beef and killing their market.

The British beef industry came up with a creative solution. They had a problem with their sheep. Many died of a disease called Scrapie, a degenerative neurological

disease. Why not simply grind up these downer sheep and feed them to the cattle as protein supplement? And so they did—substituting animal protein for the vegetable and fish protein they had relied on previously. This was a major ecological shift. Cattle, who like to think of themselves as herbivores or grazing animals, were being fed—meat! The risk was that this would introduce a new pathogen into the ecology of cattle farming. By the early 1990s the impact was apparent. Cattle in Britain were developing a new disease called bovine spongiform encephalopathy or Mad Cow Disease. The globalization of cattle markets and feed markets had introduced a new disease into the world. Worse, the disease began to appear in humans who worked in slaughterhouses—and some who ate infected beef.

Are there other ecological changes brought about by globalization? Gambian rats were imported into the US as exotic pets. They brought with them a disease called monkey pox. Iguanas imported from tropical climates carry salmonella. Imported fruit and vegetables often carry *E. Coli* bacteria. These are new agents brought from afar.

## What Are Your Risks on a College Campus?

### *Case #4: Jeri—Romance and the Gift that Keeps on Giving*

Jeri, a college student, showed up at the Planned Parenthood Clinic in a major midwestern city with a problem. Shortly after a romantic encounter with a Belgian flight attendant in NYC, Jeri had developed a nasty genital sore. Jen, the practitioner, was suspicious of the sore. It was large and festering. While it looked like a chancre, a sexually transmitted disease, there was something about Jeri's problem that was suspicious. Jen cultured it and sent the results to the Centers for Disease Control in Atlanta. They reported back that Jeri had contracted lymphogranuloma venereum, LGV, a virulent, drug-resistant infection which had been common in Africa, hopped to Belgium and the Netherlands and now, via the flight attendant, was securely fastened to Jeri's genitals. This is a new agent in the US and it is a risk. A sexually active college student is a target for a disease which once was confined to a distant continent.

Are there other risks on a college campus? Certainly. Foreign nationals who come to college campuses as students or as faculty bring with them biological traces of their home ecologies. Students who study abroad, expose themselves to these foreign pathogens as well.

Moreover, once these pathogens have made the journey from there to here, be it by human carrier, airplane-borne mosquito, manufactured goods, agricultural produce, they enter our ecology and become a risk to all of us.

The college campus was once a sequestered micro-ecology where the big health risk was mononucleosis. Today's campus health center is staffed by physicians and nurses who know to ask the key questions: Have you been travelling? Is there anyone among your close friends from a tropical country? Does anyone else in your dormitory complain of similar symptoms?

## Summary and Conclusions

The theories which describe the global spread of disease are interesting—but not as interesting as the phenomenon itself. Be it population movements, technology which makes spread possible, or new agents arriving on our shores, the fact is that our ecological horizon has changed. Where once we lived in micro-ecologies, isolated from one another by time and space, this is no longer the case. We now share a very large macro-ecology created by globalization. Any disease which emerges in any corner of the world is of concern to us. The college campus is itself a focal point of globalization: The forces of population movement, technology introducing new agents, and a shifted ecology all come together in this small world of ours. It is incumbent on us to be aware.

## Want to Know More?

### *Courses you can take at UNH:*

#### **Epidemiology**

HMP501 Epidemiology and Community Medicine

#### **Health Care Systems**

HMP401 US Health Care Systems

HMP505 History and Practice of Public Health

HMP565 Public Health and Human Behavior

#### **Public and Environmental Health**

ANTH 610 Medical Anthropology: Illness and Healing

EC688 Geography of Population and Development

ENE 520 Environmental Pollution and Protection

ENE 740 Public Health Engineering

EREC608 Environmental Economics for Non-Economists

ESCI405 Global Environmental Change  
 GEOG673 Environmental Geography  
 NURS 595 Women's Health  
 SOC 635 Medical Sociology: Organization and Processes of Modern Medicine  
 SOC665 Environmental Sociology

**Nutrition and Public Health**

ANSC405 Food and Society  
 EREC506 Population, Food and Resource Use in Developing Countries  
 NUTR475 Nutrition in Health and Disease  
 NUTR720 Community Nutrition

**Mechanisms of Infectious and Chronic Disease in Public Health**

BIOL420 Parasites and Pestilence  
 BIOL520 Our Changing Planet  
 BIOL541 General Ecology  
 HHS510 AIDS: Health Ethics and Soc. Agenda  
 MICR501 Microbes in Human Disease  
 MICR702 Infectious Disease and Health  
 MICR 713 Microbes and the Environment  
 MICR 714 Public Health and Waterborne Diseases  
 NR 410 Insects and Society  
 NR415 Global Biological Change

**Books you can read:**

R.S. Desowitz, NEW GUINEA TAPEWORMS AND JEWISH GRANDMOTHERS Avon, 1981  
 R.S. Desowitz, TROPICAL DISEASES, Harper Collins, 1997.  
 R. Dubos, MIRAGE OF HEALTH or MAN ADAPTING  
 P. Ewald, PLAGUE TIME, Free Press  
 L. Garrett, COMING PLAGUE, Farrar, Strauss, and Giroux, 1994.  
 L. Garrett, BETRAYAL OF TRUST, Farrar, Strauss and Giroux  
 R.S. Gottfried, THE BLACK DEATH, Free Press, 1983.  
 W.H. McNeill, PLAGUES AND PEOPLES, Anchor, 1976.  
 A. Karlen, BIOGRAPHY OF A GERM, Anchor Books, 2000.  
 R. Preston, THE DEMON IN THE FREEZER, 2002  
 E. Regis, VIRUS GROUND ZERO, Pocket Books, 1996.  
 N. Regush, THE VIRUS WITHIN, Dutton, 2000.  
 B. Roueche, ELEVEN BLUE MEN or MEDICAL DETECTIVES or ANNALS OF EPIDEMIOLOGY or anything else by him.

R. Tierno, THE SECRET LIFE OF GERMS  
 J. Diamond, GUNS, GERMS AND STEEL  
 J. Diamond, COLLAPSE, Basic Books  
 A. Verghese, MY OWN COUNTRY  
 Gina Kolata, FLU

**Majors you can study:**

Health Management and Policy  
 Public Health in Health Management and Policy  
 Anthropology  
 Microbiology  
 Biology

*Jeffrey Salloway: Epidemiology, historically our lives have been lived in micro ecologies. With global migration of populations and species, disease becomes a global rather than a local phenomenon. In a community such as a college campus what are the risks to students when they enter a vast mixing bowl of new diseases?*