Health and Globalization

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Introduction

From stories of the avian flu to advances to digital medical records, the news is filled with stories about the impact of globalization in healthcare. In this Issue in Depth, will take a examine two health-related topics:

- How globalization is promoting both the rapid spread and the effective treatment of highly contagious diseases.
- The growing debate over the use and future of genetically modified organisms (GMOs).

Four diseases in particular have become extremely important concerns throughout the world., . Two of these diseases, HIV/AIDS and tuberculosis (TB), are found across the globe; the other two, cholera and malaria, primarily afflict poorer countries. If you would like to learn more about what these diseases are and the specific sets of problems they create, please check out the supplementary material in the section on "Four Global Diseases" that provides detailed information about each of them. You will see that people trying to combat each disease face different sets of challenges.

How Does Globalization Relate to Health?

It isn't difficult to imagine how increases in international commerce and in the movement of people—two defining features of globalization—might influence health. More goods go more places today than at any point in history. More people travel farther, more frequently, and come in contact with more people and goods, than at any point in history.

This increased movement of both goods and people increases opportunities for the spread of disease around the world. And it's not just goods and services that can travel across oceans and state borders—so can diseases like AIDS, malaria, or tuberculosis. The outbreak of BSE, or "mad cow disease," in several European countries is only one example of how trade can promote the spread of dangerous diseases. Mosquitoes that carry malaria have been found aboard planes thousands of miles from their primary habitats, and infected seafood carrying cholera bacteria have been shipped from Latin America to the United States and Europe.

But just as globalization increases the frequency and ease with which diseases can move around the world, it also can improve access to the medicines, medical information, and training that can help treat or cure these diseases.

Drug companies and governments now have the ability to ship drugs to remote parts of the world affected by outbreaks of disease. Institutions and professionals seeking to put medicines, or other treatments, in the hands of needy people can now make use of the product distribution networks, communications technologies, and transportation technologies that have promoted globalization over the past decade.

Diseases and Human History

Travel by people and the transportation of goods across regions of the world contributed to the spread of infectious diseases long before anyone had conceived of globalization. In fact, a great deal of human history has been written by disease. In the second century A.D., measles was spread between Rome and Asia along caravan routes. In the following century, these same trade routes were responsible for carrying smallpox, which wiped out as much as one-third of the population in affected areas.

"Epidemics of cholera follow major routes of commerce. The disease always appears first at seaports when extending into islands or continents."

- John Snow, "On the Mode of Communication of Cholera," 1849.

The next truly massive epidemic occurred in the 13th and 14th centuries, when Mongol horsemen carrying infected fleas brought bubonic plague from northern Burma to Eastern Europe, and then rats helped carry the disease throughout the rest of the continent. All of the travel and trade that were taking place in Europe made the continent a veritable petri dish for infectious disease.

After enduring wave after wave of epidemics, the disease-hardened descendants of these caravan traders, horsemen, and sailors brought about an unprecedented human catastrophe when they began traveling to the Americas after 1492. The indigenous population of North and South America, which had lived in comparative isolation, then became victim to perhaps the greatest mass loss of life in human history.

http://www.nrp.org.uk/cms_images/Strept1.gif

In the two hundred years following the arrival of Columbus in the Americas, historians estimate that the Native population of the Americas declined by 95 percent (from a total population of perhaps 100 million), mostly due to imported diseases. The new microbes brought by Europeans included smallpox, measles, typhus, diphtheria, chicken pox, and influenza.

Soon afterward, Europeans began the African slave trade into the Americas, bringing laborers to replace the many indigenous people who died. And with the trade ships and human cargo that crossed the Atlantic came new epidemics of diseases from Africa, including malaria, yellow fever and dengue fever.

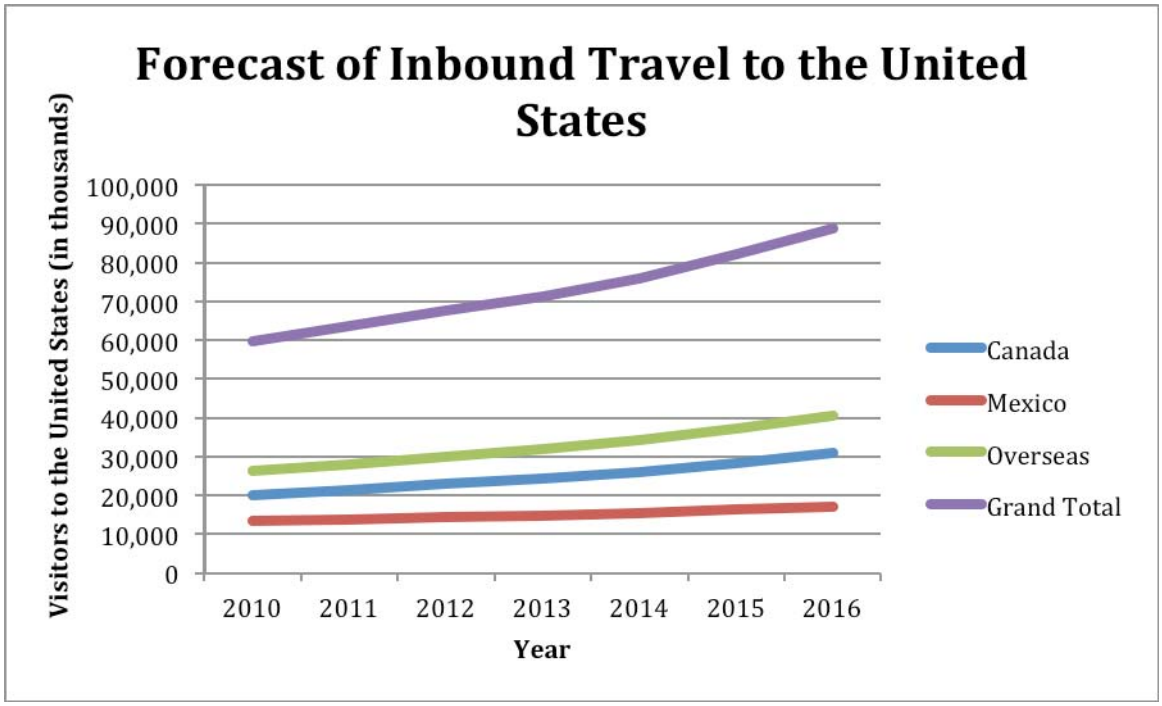
The opening of the Americas by Europeans beginning at the end of the 15th century created, for the first time in the world, a substantial economic linkage between Europe, North and South America, and Africa. Some health authorities have also referred to this as the "microbial unification of the world" (Berlinguer, cited in Aginam).

Diseases "Go Global"

Source: PicApp

According to one estimate, by the time of the European colonization of the Americas, plagues such as smallpox and measles could travel around the world within the span of a year. Today, of course, with international air travel, an infected person can carry a disease from almost any point of the globe to any other point in less than 36 hours.

One of the particularly threatening aspects of this compression of time is that people can now cross continents in periods of time shorter than the incubation periods of most diseases. This means that, in some cases, travelers can depart from their point of origin, arrive at their destination, and begin infecting people without even knowing that they are sick.



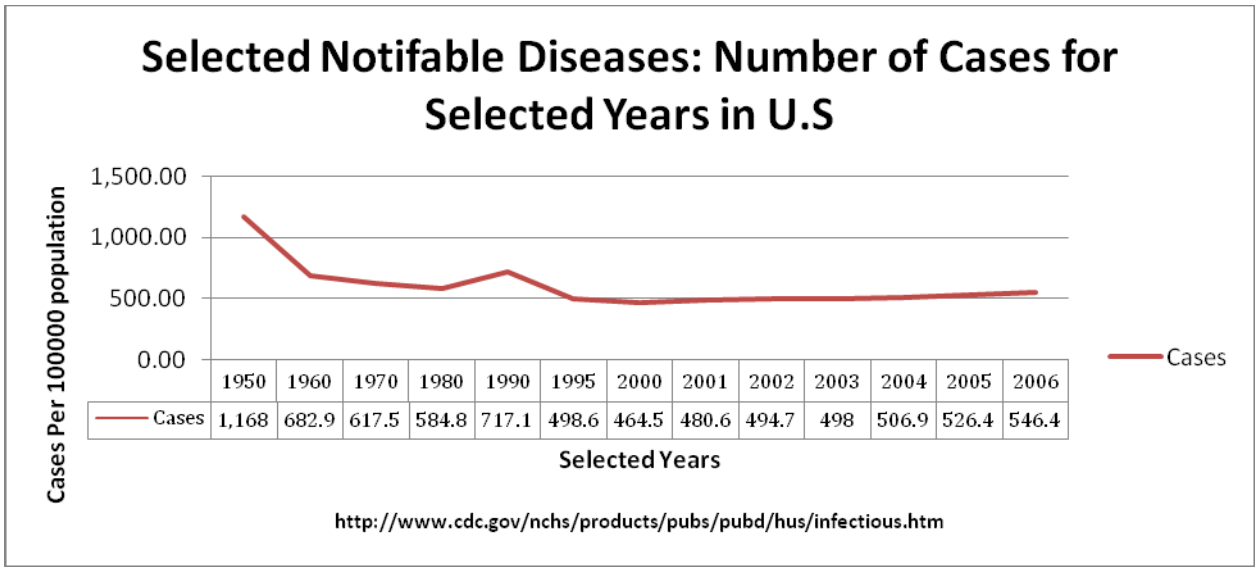
Source: Office of Travel & Tourism Industries (2011)

The new ease with which infectious diseases can be transmitted globally is having a direct and dramatic effect on morbidity and mortality around the world. Annually, an estimated 16 percent of all deaths worldwide result from infectious diseases.[1] Infectious diseases also account for 30 percent of all disability-adjusted life years (DALYs) worldwide, 1.5 billion total DALYs per year (1 disability-adjusted life year is 1 lost year of healthy life), hence their impact is even larger. [2]

[1] http://www.smartglobalhealth.org/issues/entry/infectious-diseases.
[2] World Health Organization. The world health report 2004-changing history. Geneva: The Organization; 2004.

According to the United Health Foundation, within the United States, there has been a large decrease in the incidence of infectious disease between 1990 and 2010, dropping from about 40 percent to 17.5 percent.[3] However, the *World Health Report 2007* states that worldwide infectious diseases are currently spreading faster and emerging quicker than ever before: "Since the 1970s, new diseases have been identified at the unprecedented rate of one or more per year."

Several new infectious diseases, including severe acute respiratory syndrome-associated coronavirus (SARS-CoV), henipaviruses (Hendra and Nipah), avian influenza virus, and the H1N1 virus (Swine influenza) are some of the newest diseases that have received much attention, due to their rapid spread around the world. Other historic, infectious diseases, such as West Nile fever, human monkeypox, dengue, tuberculosis, and malaria are reemerging as well.[4] Other well-known, historic infectious diseases, such tuberculosis, are also unfortunately making a comeback; in the United Kingdom, which had almost completely eradicated tuberculosis from the British Isles by 1953, about 9,000 new cases of the disease are reported annually.[5]



	1950	1960	1970	1980	1990	1995	2000	2001	2002	2003	2004	2005	2006
Cases	1,168	682.9	617.5	584.8	717.1	498.6	464.5	480.6	494.7	498	506.9	526.4	546.4

The dangers posed by these diseases go beyond simple medical concerns. In 2008, Pentagon Reports (Storming Media) issued a statement, describing the vast consequences of the global spread of infectious disease. The report asserted that:

> The global community has suffered recently from newly emerged infectious diseases, including HIV/AIDS and severe acute respiratory syndrome (SARS), and from reemerging diseases once thought to be in decline. Additionally, it is increasingly recognized that infectious disease can pose a significant threat to U.S. and world security. To best understand and mitigate this threat, U.S. policy makers require adequate and timely information about the occurrence of infectious disease worldwide.

The threat of political instability—which can be defined as war, ethnic conflict, and violent regime transition—is most likely to endanger developing countries. In these nations the burden of disease can strain already meager national budgets, set off competition for resources, and result in the death or disability of important government officials.

[3] http://www.americashealthrankings.org/Measure/2010/zUS/Infectious%20Disease.aspx.
[4] http://www.medscape.com/viewarticle/501856
[5] http://www.hpa.org.uk/infections/topics_az/tb/menu.htm

In many African countries in particular, the most skilled and wealthiest segments of the population are often the most likely to become affected by the HIV virus. This tends to be the case because the wealthier segments of the population are often more mobile and have more opportunities for sexual partners.
Similarly, the armed forces of some African countries are estimated to harbor infection rates of between 10 and 60 percent. Losses of key military leaders and senior officers can lead to breakdowns in the chain of command, and make it more tempting for younger officers to launch coup attempts.

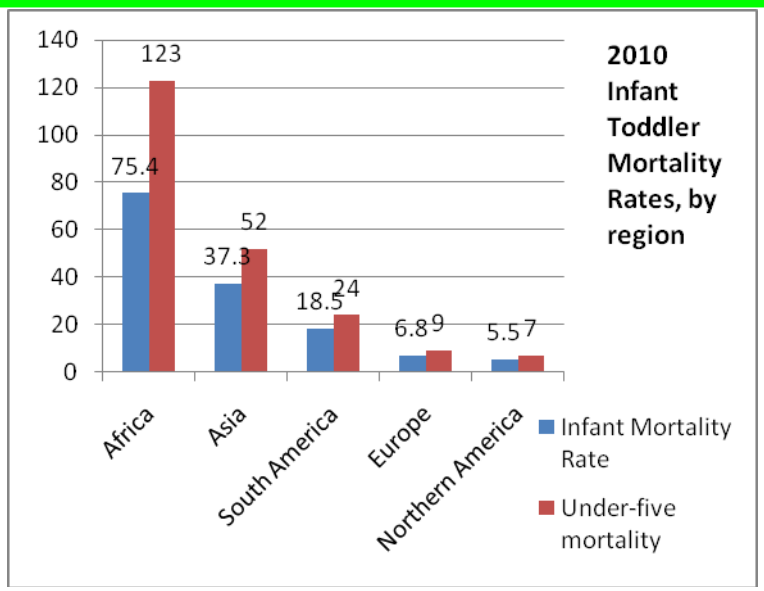
"....the concept of [domestic] as distinct from "international health" is outdated. Such a dichotomous concept is no longer germane to infectious diseases in an era in which commerce, travel ecologic change and population shifts are intertwined on a truly global scale."

-U.S. CDC, "Addressing Emerging Infectious Disease Threats: A Prevention Strategy for the United States," p .12

Of course, the problems of health and instability are not limited to Africa or to the HIV virus alone. Political instability is most likely to arise in the presence of broad social upheaval. A study by Ted Robert Gurr, et al. indicated that "the causes of state instability in 127 cases over a 40-year period ending in 1996 suggests that infant mortality is a good indicator of the overall quality of life, which correlates strongly with political instability." The National Intelligence Council evaluated all 127 cases for the presence of certain variables or indicators of social and political turmoil. Out of the 75 factors they analyzed, three factors proved to correlate the most significantly as predictors of political instability. These three most powerful determinants were:

- incomplete democratization,
- low openness to international trade
- infant mortality

In particular, they found that high infant mortality within a state that is only partially democratic is most likely to produce instability.



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, http://esa.un.org/unpp

Questions for Discussion:

The aforementioned study on political instability found that incomplete democratization, low openness to international trade, and infant mortality are the three strongest predictors of political instability. Do you think these three predictors are related to each other? How?

Why does the spread of infectious disease lead to political instability?

If the spread of infectious disease has been around for centuries, why does it seem like this is a relatively new phenomenon? What do you think has drawn increased attention to global diseases?

Do you think there is a connection between infectious diseases and economic development?

Infectious Diseases and Global Public Health

What accounts for this resurgence in the study of infectious disease? The past century brought forth tremendous changes whereby further linking the world's populations together. The transition from subsistence farming to industrialization also generated profound changes in social and cultural relationships, and altered many people's connection with their natural environment. All of these factors have had implications for global health.

The most important ways that infectious diseases are affected by globalization include:

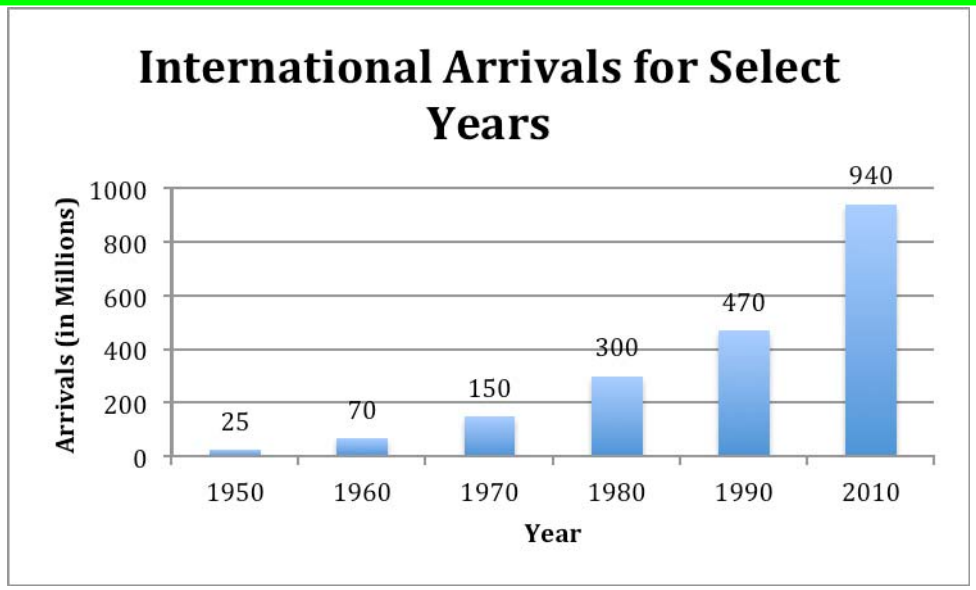
- Increased Global Travel
- Increased Trade in Goods
- Food-borne Illnesses
- Urbanization
- Climate Change
- Other Environmental Concerns
- Microbial Drug Resistance
- Breakdowns in Public Health Systems

Increased Global Travel

In 1993, it was estimated that 500 million people crossed international borders on airplanes. By the year 2010, international tourist arrivals reached an estimated 940 million people. This was a 6.6 percent increase from 2009. Although the recent economic crisis affected these numbers in 2009, the 2010 statistic made up for the decrease and was higher that 2008's peak.[6]

In the same way that ancient caravans and seagoing vessels carried illnesses from city to city, modern transportation systems do the same thing, only at a vastly greater speed. According to the World Tourism Organization (WTO), by 2020, the number of people crossing international borders is expected to increase even more, exceeding 1.5 billion per year.

[6] http://mkt.unwto.org/en/content/tourism-highlights.



Source: **UNWTO Highlights 2011 Edition**

An example of this rapid diffusion could be seen in the early 1990s, when a particularly dangerous strain of streptococcus pneumonia, first detected in Spain, was subsequently tracked to have spread throughout the world within only a few weeks (NIE, 2000).

Increased international travel is also believed to have played a major role in the spread of HIV/AIDS. Some virologists suspect that the HIV virus originated in West Africa. Some evidence suggests that the virus was present there, at very low levels, for perhaps as long as one hundred years before the disease reached epidemic proportions and was officially isolated by scientists in 1983 (Krause). And with the building of the trans-continental highway from Point-Noire, Zaire (now the Democratic Republic of Congo) to Mombasa, Kenya, came vast new opportunities for the spread of the disease. Epidemiologists speculate that truck drivers along this highway carried the virus into the general population.

Global travel is a factor not only because of the increased dispersion of contagions, but also because transit itself often contributes to the spread of disease. Many health professionals are concerned that the confined, re-circulated air on airplanes may pose a significant threat to passengers for contracting diseases such as tuberculosis, which is both airborne and extremely contagious.

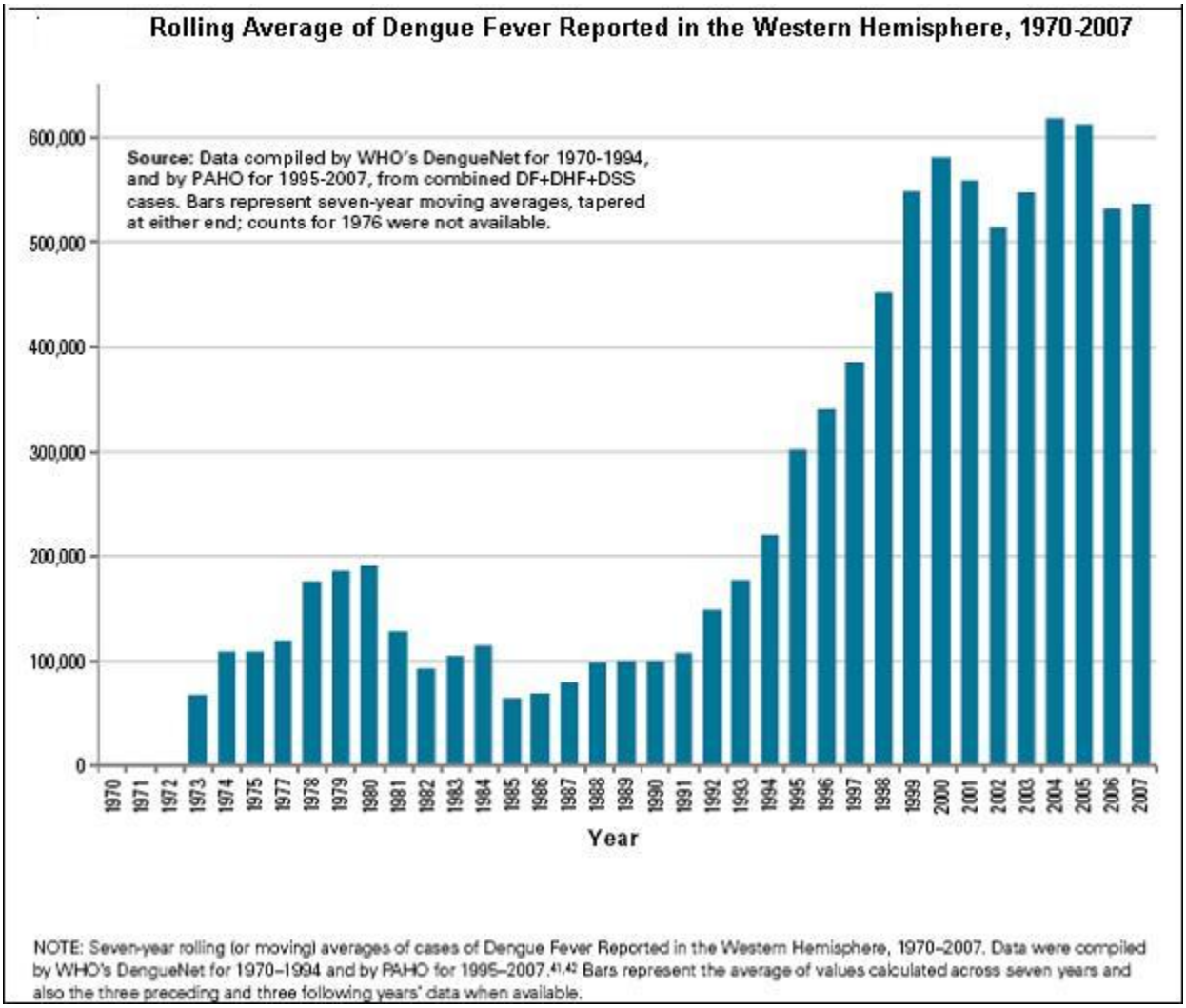
It is important to note that the transmission routes of infectious diseases do not run exclusively from poorer countries to richer ones. In fact, when measured in terms of the impacts on populations, the reverse is more likely to be the case. Historically, when people of developed countries begin to come into contact with traditional or developing societies, it is the health of people from the traditional or developing states that tends to be impacted most severely.

Increased Trade in Goods

In the same way that increased global travel makes it easier for pathogens to spread quickly around the world, the increased transit of goods also creates new opportunities for the transmission of disease.

The tropical disease dengue, which causes severe pain in the bones, high fever, chills, vomiting, diarrhea, and severe exhaustion, infects up to 100 million people each year. Dengue mostly affects people in urban areas of the tropics.

However, the disease has become widely spread by several especially hardy breeds of mosquitoes that brought the illness to many new populations. According to the World Health Organization, "*The incidence of dengue has grown dramatically around the world in recent decades. Some 2.5 billion people – two fifths of the world's population – are now at risk from dengue. WHO currently estimates there may be 50 million dengue infections worldwide every year.*"[7]



NOTE: Seven-year rolling (or moving) averages of cases of Dengue Fever Reported in the Western Hemisphere, 1970–2007. Data were compiled by WHO's DengueNet for 1970–1994 and by PAHO for 1995–2007.[41,42] Bars represent the average of values calculated across seven years and also the three preceding and three following years' data when available.

Source: NRDC Issue Paper, July 2009

[7] http://www.who.int/mediacentre/factsheets/fs117/en/

http://www.who.int/mediacentre/factsheets/fs117/en/

The Asian tiger mosquito has found a new home in the Western Hemisphere, bringing dengue with it. These mosquitoes can now be found in Latin America to as far north as Chicago. The insects thrive in small pools of water such as flowerpots, gutters, birdbaths and plastic covers, and are believed to have been originally transported around the world by shipments of used tires.

The worldwide trend toward urbanization is also believed to have propelled the spread of dengue. Epidemiologists have tracked the disturbing growth of this epidemic in the Western Hemisphere:

- Small outbreaks of dengue have been reported in several American cities, including Houston, over the past decade
- A large outbreak struck Puerto Rico in 1994, sickening 20,000 people.
- A more severe illness associated with multiple exposures to dengue, known as dengue hemorrhagic fever, spread rapidly in Latin America over the last two decades. The World Health Organization (WHO) reports that in 2007 alone, there were over 26.000 reported cases of dengue hemorrhagic fever in the Americas.

Food-borne Illnesses

In the same way that international travel by people can lead to the exposure and transmission of infectious diseases, infectious agents can also be "imported" into the United States through the food trade. This issue is growing in importance thanks to a vast increase in the international food trade. From 1997 to 2007, for example, food imports to the U.S. nearly doubled, from $36 billion in 1997 to more than $70 billion in 2007 (Centers for Disease Control and Prevention). This increase is partly due to consumer preferences, cheaper foreign production and the increased access to foreign markets because of trade agreements.

The globalization of food supplies raises questions about safety standards for food production and processing. Many other countries, especially developing ones (where much of the new food imports originate), do not possess the same health and sanitary safeguards that some developed countries have. This raises the potential for the transmission of goods infected with pathogenic microorganisms into the more developed states.

In 1996, a shipment of strawberries from Guatemala that was infected with cyclospora bacteria led to an outbreak of illness in the United States that sickened more than 2,000 people. The infection was believed to have originated in the fields of Guatemala, where the picked fruit was sprayed with contaminated water.

http://www.pccnaturalmarkets.com/pcc/sites/default/files/2218/Chandler_strawberries.jpg

A decade earlier, Guatemala had never grown strawberries—for either domestic consumption or for export—and the cyclospora bacteria had almost never been seen in the United States. Strawberry production was introduced to Guatemala during the 1980s by the U.S. Agency for International Development, as an assistance project aimed at helping subsistence farmers. In addition, to help ensure access to the benefits of global trade, the Reagan Administration's Caribbean Basin Initiative helped cut or eliminate tariffs on many imports from the region. These factors helped establish Guatemala as a significant strawberry producer and exporter to the United States.

However, the Guatemalan producers contest the allegation that they were the source of the bacterial contamination in the incident. Tests by the U.S. Center for Disease Control of their facilities failed to show any sign of cyclospora. A leading Guatemalan exporter charged, "We find a tremendous possibility that people in California are using this as a very dangerous tool for protectionism. Protectionist forces find bugs or whatever to protect their market. It's a commercial war."

A food safety official in the United States countered, "Where we see a safety issue, they see a trade issue." (Source: *New York Times* and other articles)

Concerns about foreign foods are not confined to developing countries, of course. The outbreak of Bovine Spongiform Encephalopathy (BSE), or "mad cow disease," led to a mass slaughter of cattle in Britain and cost the British beef industry between $10 billion and $40 billion. Other EU countries declined to import cattle from Britain over a period of almost two years as a result of the BSE. (The damage was not limited to the economy either: criticism over the handling of the crisis helped contribute to the fall of the government of then British Prime Minister John Major.)

Aside from concerns about foreign foods, the mass processing and distribution of food has itself provided new outlets for the transmission of harmful microbes. Massive outbreaks of salmonella and e.coli bacteria, for instance, have been linked to central food processing centers. These processing centers, in turn, could never have affected so many people without mass distribution capabilities. The spring of 2008 witnessed a salmonellosis outbreak, linked to the consumption of certain types of red raw tomatoes and serrano peppers, as well as fresh cilantro (or certain products containing said vegetables). The New York Times reports that “in the months since the outbreak was first detected in April, the agency [CDC] has identified 1,017 people who were infected with the same strain, Salmonella Saintpaul.”

Of course, imports of food and the development of sophisticated food distribution networks is a very positive thing for most consumers. Prior to increases in transportation capabilities and refrigeration technology, people living in cooler climates (such as the northern two-thirds of the United States) were unable to eat fresh fruits and vegetables in winter months.

Consequently, at certain times of the year, more than 75 percent of the fresh produce that is sold in stores and restaurants within the United States originates overseas.

One hundred years ago, people living in northern climates considered an orange or an apple as a Christmas present to be an exotic and prized gift. Today, Americans expect to see groceries stores fully stocked with fresh fruits—many of which come from the Southern Hemisphere—at all times of the year.

Fifty years ago, the average grocery store stocked about 200 items, of which 70 percent were grown, produced, or processed within 100 miles of where they were eventually purchased.

Today, the average supermarket stocks close to 50,000 food items. By some estimates, the food Americans eat has traveled, on average, 2,000 miles before it is consumed. (Sources: *Boston Globe* and *Mander*)

Compounding the problems of increased mobility of people and food-borne illnesses is a nexus between these two concerns within the United States. Within the food service industry in the United States, a high percentage of food preparation tasks are carried out by immigrants from developing countries where intestinal infections are endemic, and the new jobs immigrants hold often provide low wages, and little or no health insurance or paid sick leave. This encourages them to continue working, even when they are sick. While less than 0.5 percent of the general population in the United States harbor intestinal parasites, studies of employees of restaurants known to have been involved in outbreaks of food borne illness have found that as many as 18 percent of workers were carrying intestinal infections.

Source: Wikimedia

Questions for Discussion:

If the movement of people, food, and manufactured goods can have such a negative impact on public health, should steps be taken to reduce these flows? What other options are there for lowering the spread of global diseases?

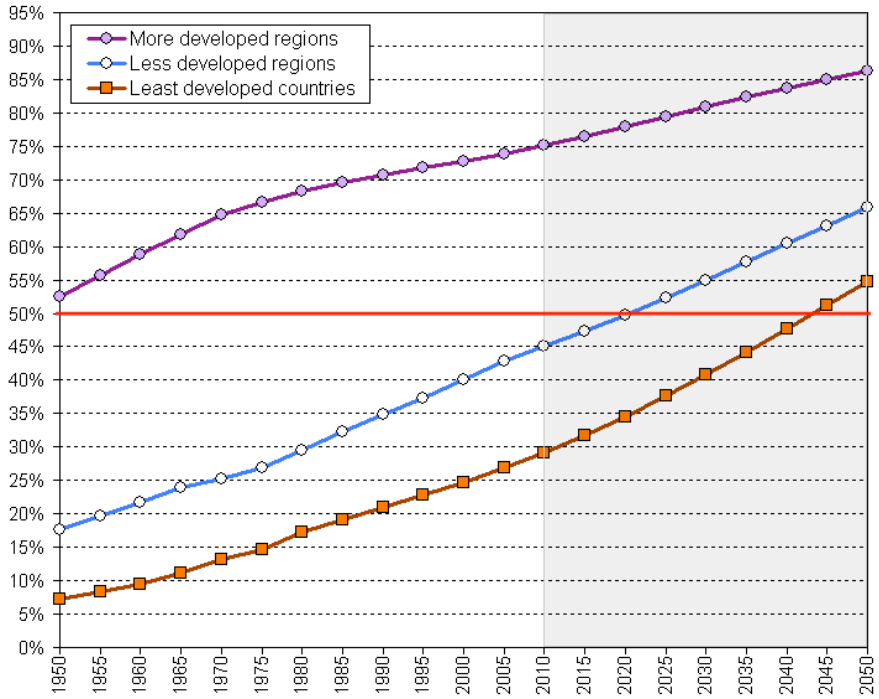
How does increased trade in food lead to the spread of food-borne illnesses? What measures can be taken to reduce the incidence of these diseases?

Urbanization

The percentage of the world's population that lives in urban settings has increased explosively in recent years. In 1950, less than 30 percent of the world's population lived in urban areas. According to the World Bank, in 2003, that proportion had grown to 48 percent. The year 2008 witnessed a remarkable shift: for the first time, the majority of the world population lived in an urban setting. The Population Reference Bureau (September 2007) predicts that by the year 2030, roughly 60 percent of the world's population will live in urban areas.

Because urban populations are characterized by much higher densities of people—meaning that more people are sharing the same spaces—diseases are much more easily transmitted.

Urban Population by major development regions (in per cent of total population)



Source: United Nations, Department of Economic and Social Affairs, Population Division: *World Urbanization Prospects, the 2009 Revision*. New York, 2010

And almost all of the future growth of the world's urban centers will occur in the developing world, where health response systems are weakest. By the year 2050, the total world population is predicted to increase from 6.9 billion people (world population in 2010) to 9.3 billion people.[8] In the same time period, the urban populations of less developed regions are expected to grow from about 2.5 billion to 5.2 billion people. The number of urban dwellers in more developed regions will increase by a much smaller amount: 930 million to 1.1 billion.[9]

Source: http://www.flickr.com/photos/lecercle/2612761536/

This population growth is therefore of particular concern because potential public health problems tend to be exacerbated by poverty in developing countries. Many of these expanding cities are characterized by squalid conditions and sprawling shantytowns.

In 2009, nearly two billion people, the equivalent of nearly 30 percent of the world's population, still lacked access to clean drinking water.[10] High densities of people combined with unsanitary conditions make for almost perfect breeding grounds for pathogens.

[8] http://esa.un.org/unpd/wpp/index.htm.
[9] http://esa.un.org/wup2009/unup/index.asp.
[10] http://www.americares.org/newsroom/news/2008-international-waterday.html

Of course, globalization cannot be said to have caused the move away from subsistence agriculture toward urbanization and industrialization. However, it may be working to accelerate this process in many countries, as international trade and investment create more formal sector jobs in developing countries. The creation of more jobs tends to lead to rising wages levels and inducing more people to move to cities in search of work.

Climate Change

Another potential threat that could have a significant impact on global human health comes from the possibility of climate change. The predicted rise of average global temperatures due to human behavior (from the burning of fossil fuels, use of other chemicals, and the cutting down of forests) has been increasingly accepted by international scientists.

A report by the Intergovernmental Panel on Climate Change (IPCC) found that:

> Projected climate change will be accompanied by an increase in heat waves, often exacerbated by increased humidity and urban air pollution, which would cause an increase in heat-related deaths and illness episodes. The evidence indicates that the impact would be greatest in urban populations, affecting particularly the elderly, sick and those without access to air-conditioning.[11]

Many climate models indicate that the world is likely to become significantly wetter as a result of the warming process—meaning that rainfall is likely to increase in many areas.

This rise in temperatures and moisture would significantly expand the natural habitats of mosquitoes, which carry malaria and other diseases. A report by the National Institute of Public Health and Environmental Protection in the Netherlands calculated that the predicted global mean temperature rise of three degrees Celsius by 2100 would double the potential for malaria epidemics in tropical regions, and increase the potential in temperate zones by more than 10 times (cited in McGinn).

Similarly, the southwestern United States has been affected by the emergence of the previously unknown Hanta virus. Mice spread this microbe, which is extremely deadly. The recent appearance of the disease in humans has been linked to an exponential increase in the population of mice in the region brought about by significantly increased rainfalls. The heavier rains have been attributed to the El Nino effect.

Although some scientists question whether the apparently increased severity of the El Nino effect is a result of global warming, the phenomenon is nonetheless believed to provide an accurate model for how rainfall would increase due to overall global warming.

The report by the IPCC also predicts that the increase in global mean temperatures will lead to increased flooding in coastal areas, which "will increase the risk of drowning, diarrheal and respiratory diseases, and in developing countries, hunger and malnutrition."

[11] http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=15

Questions for Discussion:

Have you visited any of the "mega-cities" that are developing around the world (like New York, Tokyo, Mexico City, and Moscow)? What conditions did you encounter?

Assume you were the mayor of Los Angeles. How would you go about reducing the spread of disease in your city? Would you regulate construction? Offer free immunizations against certain diseases? Now assume you were the mayor of Jakarta. Would you be able to adopt the same policies? How would your approach differ?

Localized Environmental Concerns

When land is converted from its natural state into agricultural use, the intersection of old diseases with new farming techniques and crops can lead to new outbreaks of infectious disease.

When humans move into previously unsettled areas, and especially if the local ecology is disturbed, new opportunities are created for viruses to cross from animal to human hosts, and then into general populations. Scientists have identified at least 30 completely new diseases in the past 20 years, many of which are believed to have moved into human populations due to the clearing and settlement of new lands.

http://www.blueplanetbiomes.org/images/pampas_gauchos.jpg

For example, in Argentina beginning in the 1920s, farmers began planting corn on the pampas, where it was not indigenous. This large-scale cultivation of a newly introduced crop led to a huge increase in the prevalence of a once relatively rare species of mice in the area. The abundant population of mice then exposed farmers to the previously unknown Junin virus, and farmers, in turn, spread the virus to their families and other people, leading to nearly 10,000 deaths over the past 40 years.

Large construction projects have likewise been implicated in the spread of diseases like malaria. The development of irrigation projects, dams, and other construction sites often leads to new bodies of standing water, which create ideal conditions for the proliferation of mosquitoes.

For example, a canal built to irrigate Rajasthan, a very dry region in India, provided a spectacular breeding ground for mosquitoes, which previously existed in small numbers. Naturally, increased transmissions of malaria followed. The introduction of new workers to the area provided the insects with a source of food, and the subsequent migration of these workers to other areas led to additional infections.

An independent review of the project conducted afterward concluded, "The ignition wire of construction-related standing water, and the gunpowder of immigrant labor, [created] an explosion of malaria" (McGinn, Transaction Publishers Society).

Microbial Drug Resistance

When a person becomes ill due to the presence of a bacterial or parasitic infection, doctors sometimes prescribe antibiotics to help fight off these microbes (viruses are another kind of microbe, but they are not affected by antibiotics).

However, when anti-microbial substances are used with great frequency, there is an increasing chance that some of the microbes will, through the natural process of genetic mutation, develop characteristics that make them less susceptible, or even immune, to treatment. This microbe may then go on to multiply and generate billions of its own offspring, which acquire the same genetic properties that made the earlier variant immune to the antibiotic. When this happens, the new strain is considered to be “resistant” to treatment.

Physicians have been aware of this effect for some time. In the 1940s, doctors discovered that penicillin was extremely effective in treating infections caused by the Staphylococcus (or “staph”) bacterium. However, after years of penicillin use, resistant strains of the bug began to emerge. These strains multiplied, replacing the weaker versions that were susceptible to penicillin, and they became much more common.

By the 1950s, virtually all of the cases of staph that appeared were of the resistant variety, and penicillin was no longer effective as a treatment. Scientists then had to develop stronger drugs such as erythromycin and methicillin. As the years went by, staph bacteria became resistant to those drugs as well, making the new drugs ineffective. Although some very powerful drugs remain to fight staph, these too are losing their effectiveness, and scientists are struggling to develop new treatments that will be effective.

For this reason, doctors are now becoming aware of a serious global threat from “resistant” bacteria. Some have suggested that so many strains are developing resistance that we may eventually enter a “post-antibiotic” era, where there are few treatment options for these types of infections.

One of the biggest problems contributing to microbial resistance is the abuse of antibiotics. When antibiotics are used improperly or in widespread circumstances, this practice may actually encourage the development of resistant strains. Some doctors mistakenly prescribe antibiotics to treat people who are suffering from viral infections. In addition, many doctors have criticized the mass use of antibiotics as a standard supplement to animal feeds to help prevent infections in livestock.

"In the struggle for supremacy, the microbes are sprinting ahead and the gap between their ability to mutate into resistant strains and man’s ability to counter them is widening fast."

The World Health Organization

One of the greatest concerns in international public health has been the emergence of strains of serious diseases such as tuberculosis (TB) that are drug resistant. In many cases, the new bacteria are multi-drug resistant, which are extremely difficult and often very expensive to treat.

Tuberculosis Profile in Selected Countries (2009)				
Country	**Estimated Incidence (all cases; in thousands)**	**Global Ranking (estimated number of cases)**	**HIV Prevalence in Incident TB Cases (%)**	**Multi-drug Resistance (% of new cases)**
India	2000	1	6.4 percent	2.3 percent
South Africa	490	7	60 percent	1.8 percent

Russia	150	12	8 percent	16 percent
				WHO Report 2010: Global Tuberculosis Control

Resistant TB has become an increasingly difficult problem in Russia and Eastern Europe. Within Russia's crowded and squalid prisons, TB has become endemic. As much as 10 percent of Russia's prison population is estimated to have active TB, and 20 percent of those cases appear to be multi-drug resistant. Public health officials are therefore watching the region of the world with great alarm, waiting for these super-bacteria to spread to the rest of the world.

A mini-epidemic of MDR-TB in New York City in 1992 led to a massive and rapid intervention by local and federal public health officials. Health authorities spent $1 billion containing the outbreak, which eventually caused the deaths of 500 people (most of whom had weakened immune systems due to HIV).

A high profile TB case in May 2007, in which a male (Andrew Speaker) with a rare, multi-drug resistant strain of TB took a international airplane despite warnings that he should not fly, raised awareness of the risks of TB and how globalization and the ease of air travel can help spread the disease worldwide.

The World Health Organization reports that in some areas of the world, such as north Western Russia one in four cases of tuberculosis can no longer be treated with standard medicines. An estimated 440 000 people worldwide have MDR-TB, approximately 50 percent of these cases occur in India and China.[12]

Breakdowns in Public Health Systems

Standing out against this backdrop of concerns are the world's public health systems. Very often, small changes in the level of preventative care or treatment that is provided by these systems can combine with other disruptions in the environment or social conditions to create the necessary environments for the explosion of certain diseases.

The growth of shantytowns, squalid living conditions, and inadequate health care services are all conducive to epidemics. Even more dramatically, the disruptions caused by wars, civil disturbances, or economic collapses can lead to the erosion of the public health system.

The most deadly epidemic of the 20th century was the influenza outbreak of 1918, which was fueled by effects relating to World War I. The war led to the concentration of hundreds of thousands of troops in trenches, barracks, and hospitals, many of whom suffered malnutrition and other diseases due to the privations of the fighting. Taken together, these factors formed a combustible mixture that fueled a worldwide epidemic that killed 20 million people.

Health conditions in Russia today are among the greatest concerns of international epidemiologists, where unstable political conditions, severe pollution, large migrations of people and serious economic disruption have accompanied a collapse of the public health system, leading to many new serious epidemics.

Malcolm Gladwell in *The Tipping Point* details an incident within the United States that illustrates well how small changes in the public health system can lead to the appearance of an epidemic:

In Baltimore in the mid-1990s, several small and unrelated events combined to create a serious epidemic of syphilis. Within the inner city of Baltimore, the city had undertaken an urban renovation project and began dynamiting old public

[12] http://www.who.int/mediacentre/news/releases/2010/drug_resistant_tb_20100318/en/index.html

housing buildings. This led to the physical relocation of hundreds of families. Other neighboring row houses began to empty out as well, creating a small diaspora of the local population. At the same time, the city, due to budget cutbacks, eliminated seven of the 17 medical personnel who serviced public clinics in these neighborhoods. As a result of the medical cutbacks, the number of people being treated for syphilis per year fell from 36,000 to 21,000.

Until that time, the number of cases of syphilis per year had been relatively constant, and largely confined to a specific and relatively insular population within these small sections of the city. However, this collision of events—the cutbacks in the clinics and the forced and voluntary relocations—served to disperse the infected population across the city at the same time that access to treatment was curtailed.

The result? An unexpected epidemic of syphilis across the city. The number of cases of children born with syphilis increased by 500 percent over the course of a year, all because of a few small changes in how people lived.

One of the most serious criticisms of globalization pertaining to public health is the allegation that international financial institutions have, in some instances, put economic priorities ahead of public health concerns. Accordingly globalization has augmented the necessity for governmental budgetary oversight, which can cause substantial cuts in public health expenditures. In the end, this process sometimes fails to prove economical prudent, as costs increase in the end and general health declines.

In many cases, the disputes are over short-term versus long-term economic consequences. For instance, a nation's inability to control inflation—which is often caused by too much government spending—can have serious consequences for its long-term growth potential. And the best way to ensure a nation's long-term health is to promote economic prosperity, raising income levels and living standards.

The question often boils down to the specific areas in which the governments in question choose to slash their budgets—for instance, preventative care versus treatment. The matter is sure to remain one of the most sensitive controversies about health and globalization.

Global Disease or Globalization Disease?

Students of globalization often quickly discover that different authors use the term “globalization” to describe many different phenomena. In some cases, the term is used so widely that that it can mean almost any international event or relationship, and pertain to all kinds of economic, social, political, and cultural changes. Of course, when a term is defined so broadly that it encompasses everything, it tends to end up meaning nothing, and becomes useless as a descriptive term.

For this reason, Globalization101.org has described globalization rather narrowly, as "the acceleration and intensification of economic interaction between the people, companies, and governments of different nations," recognizing that this is a process driven by both technology and government policy.

The previous section contained a list of ways that international public health is affected by globalization. Keeping in mind this precise definition of globalization, one may ask whether the concerns stated earlier are in fact globalization issues, or merely health issues that have global significance. Looking at that list again, we can see that some of them fall into the first category, some into the second, and others somewhere in between:

- Increased international travel
- Increased transit of goods
- Food-borne illnesses
- Urbanization
- Climate change
- Localized environmental concerns
- Increased drug resistance by microbes
- Breakdowns in public health systems

Think about each of these concerns separately: To what extent are these issues the results of policy decisions that pertain to globalization? How many are due to increased trade and investment? Which of them have been driven by technology? Which of these can be thought of as results of globalization?

For example, the items we have arrayed at the top of this list, such as increased international travel, the transit of goods, and food-borne illnesses, are clearly items that are directly related to globalization. But as you move down this list, you can see that the correlation between these issues and the increasing economic linkages that we refer to as globalization grows weaker.

For example, the breakdown of the Russian public health system is more related to that country’s difficult transition from a controlled socialist economy to a democratic market one. And the increasing drug resistance of diseases is due to the global use (and abuse) of life-saving anti-microbial medicines.

To be sure, a link to globalization can be found within each of these issues. But it would be difficult to argue that a reversal of globalization would lead to an improvement of these problems. For instance, let us imagine that the world trading system suffered a serious breakdown; that trade agreements were scrapped and nations began to raise barriers to international trade and investment, even cutting cross-border communications and travel.

While the set of problems relating to the movement of people and goods would certainly be much improved, these changes would do little or nothing to counter the trend toward urbanization or microbial resistance. In many cases, changes might actually exacerbate these problems.

The Global Public Health System

Many international public health professionals believe that the response to global health concerns must be a stronger global public health system. They argue that we must build more effective networks that can respond to outbreaks of disease, disseminate knowledge, improve general living standards, and support research and treatment methods.

In particular, international public health officials have identified the need for action on several fronts to respond to global health concerns:

Surveillance: This refers to the development of systems to detect, monitor, and track the appearance of new diseases and the spread of existing ones. Proper surveillance requires spending on laboratories to help diagnose illnesses, and communications equipment and networks to ensure that information is being both distributed and analyzed.

International public health officials speak of the need to create a comprehensive global surveillance system, connecting doctors and research facilities around the world, so that they might better be able to identify outbreaks of disease. This would enable medical practitioners to begin vaccinations, or other preventative measures, to stop epidemics in the early stages.

Immunization: The cost savings of immunization programs can be remarkable. Every dollar spent preventing a disease often returns itself many times over in the savings on treatment and lost economic productivity.

The development of integrated public health systems that could efficiently provide immunization coverage to the entire world would be an investment with enormous returns. It is possible that such a system could succeed in eradicating some diseases entirely.

Research: Increased spending on ways to treat and identify diseases will be essential to meeting the international public health challenges of the future. As diseases inevitably develop resistance to medicines, new treatments must constantly be developed.


Source: PicApp

Unfortunately, diseases that are endemic to developing countries currently receive the least funding. Of the $56 billion currently spent on global health research, less than 10 percent of that funding goes to the illnesses that comprise 90 percent of the world's total disease burden (Kassalow). International public health expenditure must therefore help reverse this trend.

Improved sanitation and living conditions: Basic expenditures by developing countries on public health infrastructure — which can include improved nutrition and food safety testing, increased access to safe water, and proper sewage disposal — can yield enormous savings.

Price of drugs: As stated in the above sections, there is often a severe disparity between needs and resources on international public health issues. This dichotomy is certainly true concerning the availability of drugs used to treat infectious disease.

Part of the problem is that pharmaceutical manufacturers do not profit from investing research money on diseases that affect developing countries. Because few people in these countries can afford to pay the prices for the medications that

would allow the companies to recoup their research costs, pharmaceuticals do not have a large incentive to explore those avenues. In 2003, the World Trade Organization adopted an intellectual property agreement that allows developing countries to produce some patented drugs at cheaper prices, provided they are sold only in other developing countries, and further affirms that trade agreements should not interfere with a government's efforts to address public health challenges.

Beyond the price of the drugs, other health infrastructure requirements prevent citizens of poor countries from accessing life-saving medications. In addition to having access to drugs that are cheap, a sick person must also have access to local medical professionals and laboratories that can properly diagnose their ailment, transportation systems that can deliver the drugs to their area (some of which may require constant refrigeration—a considerable additional expense), and trained health officials who can administer and monitor the use of the drugs.

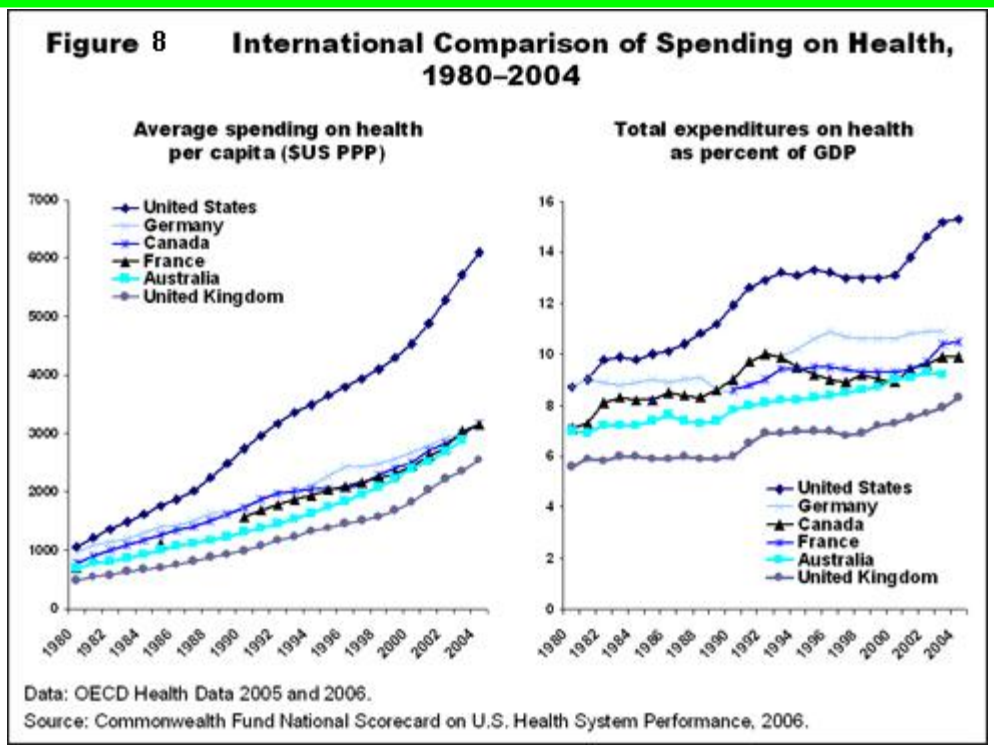
Costs and Benefits

As with many other issues, such as environmental protection and economic development, globalization presents both opportunities and challenges. Although the process of integration creates some new problems, it also offers the possibility of addressing old concerns.

The challenge of addressing international public health issues is in many ways similar to the concern about global warming: although improvements in global public health benefit everyone, the costs are often borne by individual countries, so there is less incentive by lesser-affected countries to make big investments. Compounding this problem is that the countries with the most significant public health problems typically have the fewest resources to respond to them.

The world's low-income nations spend an average of $81 per person on total health expenditures per year. By way of comparison, in 2008 the United States spent an estimated $2.3 trillion on health care, an equivalent of $7,681 per person per year.[13] The figure below provides a historical glimpse of per capita spending on health care, from 1980 to 2004.

[13] http://www.kaiseredu.org/topics_im.asp?imID=1&parentID=61&id=358



However, even though expenditures are expected to continue to rise swiftly, there are still millions of individuals living in the United States without proper health care. *New York Times (July 17, 2008)* writes, "*Access to care in the United States has worsened since the [Commonwealth Fund, a nonprofit research group]'s first report card in 2006 as more people — some 75 million — are believed to lack adequate health insurance or are uninsured altogether. And within the nation, the report found, the cost and quality of care vary drastically*."

Economist Robert Fogel performed an economic analysis of the effects of improvements in health and nutrition over Britain's history. He found that these health benefits were responsible for at least 20 percent of Britain's growth in national income over the period between 1780 and 1979.

The Obama administration has tried to rectify this situation through the passage of H.R. 3200 America's Affordable Health Choices Act of 2009. Despite passing Congress in May 2010, various U.S. states are contesting this controversial health care bill and trying to weaken its influence on the state-level. Because of this disparity between needs and resources, many people argue that the proper response to public health concerns requires that the wealthier countries of the world increase their spending on an improved international public health system, concentrating on developing countries.

Professor Jeffrey Sachs of the Columbia University's Earth Institute has become one of the most prominent advocates of increased international public health spending. A Commission on Macroeconomics and Health that he leads has recommended that rich countries must commit to spend an extra one-tenth of one percent of their economies on the health of poor countries.

Cooperation by all the wealthy countries would add an additional $38 billion per year to international public health spending. However, these academics calculate that this level of investment would eventually realize $360 billion a year in economic gains to poor countries, saving eight million lives a year and lifting millions more out of poverty.

The estimates of the costs of disease to developing countries are staggering:

- Economists have estimated that malaria alone may be responsible for sapping between 6 and 50 percent of economic productivity of various African nations.
- As HIV/AIDS ravages South Africa, economists predict that the epidemic will reduce economic growth by 17 percent over the next 10 years.

Leading public health institutions, including the Centers for Disease Control and Prevention (CDC) and the WHO, have identified the need to establish and implement global health initiatives. Because infectious diseases know no borders, public health infrastructures need to expand beyond the national level to encompass international objectives.

Major international health initiatives underway include the polio eradication campaign, the Global Alliance for Vaccines and Immunization, and the newly established United Nations Global Fund to fight HIV/AIDS, Tuberculosis, and Malaria. Global health initiatives combine the skills of numerous organizations in combating morbidity and mortality around the globe. These initiatives have the capacity to make enormous strides in improved global public health.

Globalization plays a role in the dissemination of proven public health tools from the developed world to the developing world. The uses of modern technologies allow public health practitioners to provide state of the art interventions in regions where a few years ago interventions such as these would have been impossible.

New tools include vaccines, drugs, disease surveillance strategies, and behavioral or medical interventions that prevent, or eliminate, disease transmission. The use of these tools in international settings could have a dramatic effect in improving scientific, financial, and cultural barriers. Improved communication networks, computer technology, and innovations in medical technology have all played a valuable role in reducing morbidity and mortality rates around the globe.

As with so many other aspects of globalization, the new world we are entering presents opportunities as well as challenges. The increasing pace of international travel and trade unquestionably presents new concerns about global public health. Of course, this development is not new, but is in fact part of a centuries-long trend of increasing human interaction. However, if properly harnessed, globalization holds the possibility of offering new ways to address not only the new threats but also some very old problems.

Questions for Discussion:

Do you agree with the argument that any effective response to the spread of global diseases must be global? Who would coordinate this effort? How would you prioritize your efforts if you were in charge (would you spend more money on prevention, treatment, or research? Would you allocate more money to particular countries than others)?

What do the current trends in trade, migration, and development tell us about the future of infectious disease spread?

Conclusion

The challenges facing the international public's health concern improving networks and methods of identifying, tracking, and responding to the emergence of new diseases. Building an effective, integrated web of global public health services to serve these needs is, of course, itself a kind of globalization.

Technology also drives much of the globalization phenomena. Technological developments, from increased travel to better communication abilities and the development of new crops that can improve nutrition are also partially responsible

for driving changes in global health indicators. These forces not only present new risks for the transmission of disease, but also contain the possibility for improving millions of lives.

The question for the future will be whether these challenges are met, raising all the world's people to the health standards of those in wealthy countries—or whether infectious disease will prove too much for these systems, and lead to increasingly severe pandemics that may affect rich and poor countries alike.

Genetically Modified Organisms
A final issue that is very important to global public health is the debate over genetically modified organisms (GMO's). Scientists, working with farmers, have found ways to unlock the genetic codes of many plants and animals for the sake of improving these organisms. These changes may involve making them more resistant to parasites, making them grow faster, or yield higher quantities of protein. However, this practice has also generated fierce controversy, raising concerns about the ethics of tampering with life as well as health concerns. To learn more about this debate, please continue reading our section on GMO's.

Youtube video: http://www.youtube.com/watch?v=B8p7M0WF_7A&feature=related.

Global Diseases
Throughout this issue brief, a number of diseases have been mentioned several times. HIV/AIDS, TB, cholera and malaria are among the most serious diseases that the world faces, causing millions illnesses and deaths each year. To learn more about these individual diseases, please continue reading the following sections:

- HIV/AIDS
- TB
- Malaria
- Cholera

Genetically Modified Organisms

A final issue that is very important to global public health is the debate over genetically modified organisms (GMO's). Scientists, working with farmers, have now found ways to unlock the genetic codes of many plants and animals for the sake of improving these organisms. These changes may involve making them:

- more resistant to parasites,
- grow faster, or
- yield higher quantities of protein.

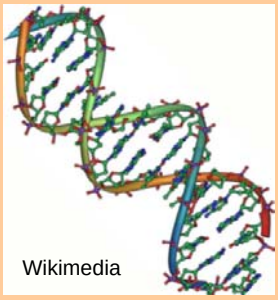
However, this practice also has generated fierce controversy, raising concerns about the ethics of tampering with life as well as health concerns.

A GMO is an organism (either a virus, a bacterium, or a more complex life-form) whose genetic makeup has been altered by humans for a specific purpose. One of the more common motivations for genetic modification is to increase the nutritional content, yield, or pest resistance of crops.

Organisms are modified by
1) identifying the portions of Deoxyribonucleic acid (DNA) that govern the trait that is to be replicated;
2) extracting the DNA from the organism;
3) introducing the DNA into a different organism; and,
4) reproducing the new organism, with the new trait.

Is this process anything new? Through selective breeding, farmers and ranchers have introduced valued traits into crops and livestock for centuries. It was selective breeding, for example, that produced two main species in the grass family, wheat and rye. Some farmers focused on breeding a grass that was rugged (resulting in rye), and other farmers focused on breeding grass with a high yield (wheat). By identifying and "crossing" grasses that exhibited the desired traits, farmers were able to breed these two distinct species.

Genetics Basics


Wikimedia

What is a gene? Genes are the units of inheritance that are made up of DNA arranged in long strings on a cell's chromosomes. Humans have as many as 50,000 genes (about twice as many as a flowering plant). Every cell has two copies of each gene.

What is DNA? Deoxyribonucleic acid, any of various nucleic acids that are usually the molecular basis of heredity, are located in the nuclei of cells, and are constructed of a double helix held together by hydrogen bonds. If placed end-to-end, DNA strands would stretch more than five feet but would be only 50-trillionths of an inch wide.

What is a genetic mutation? A genetic mutation is a subtle irregularity in a cell's DNA sequence. These mutations are responsible for many inherited diseases such as cystic fibrosis and sickle cell anemia. They also may predispose an individual to cancer, major psychiatric illnesses, and other complex diseases.

To experience the difficulty of DNA coding, visit http://dna2z.com/DNA-o-gram/index.html and send each other "coded" messages.

The difference between GMOs and their selectively bred predecessors is that with selective breeding, all the traits of the desirable animal or plant are passed on to the new offspring. With genetic engineering, it is possible to isolate and introduce into another organism only those traits that one wants to pass on to that organism's offspring.

To extend the wheat example, when farmers crossed different kinds of grass to produce grasses that grew quickly and prolifically, they had to accept that these grasses also grew very tall, and their stalks often broke before they were cultivated. With selective breeding, farmers have to accept undesirable traits along with desirable ones.

In addition, selective breeding only works with different organisms of the same or similar species, limiting the sorts of combinations that can be produced. The same limitation does not apply with GMOs. In one example, human DNA sequences were introduced into mouse DNA, creating mice that produced components for human blood that are needed in medicine. This sort of interaction is impossible with normal selective breeding.

GMOS: Different Schools of Thought

Highly Beneficial: Increased Yield and Hardiness

Supporters of GMOs argue that the genetic modification of foods allows for increased food production and more resilient and nutritious crops. They believe GMOs offer a valuable tool for responding to the serious problem of malnutrition facing many people around the world.

Anemia, for example, affects 56 percent of pregnant women worldwide (and 76 percent of pregnant women in South and Southeast Asia). Anemic women face higher infant mortality rates, and their babies have lower birth rates and are more likely to be born prematurely. According to a World Bank report, deficiencies of just vitamin A, iodine, and iron can result in total economic losses as high as 5 percent of gross domestic product (GDP).

Food can now be fortified with iron through genetic modification, which may help contain a global health crisis. Scientists have also figured out ways to introduce vitamin A into rice, creating a new strain of "golden rice" that could help prevent blindness in millions of poor children.

Youtube video on Golden Rice: http://www.youtube.com/watch?v=sbxA4WlkUP8.

Advocates of genetically modified (GM) foods also argue that, contrary to popular belief, GM foods cause less environmental damage than their unmodified counterparts. This is because foods can be engineered to be pest-resistant, decreasing the amounts of toxic chemical pesticides that need to be applied to plants and crops. In addition, GM advocates say, the components of a genetically modified plant that drive insects away are not harmful to human consumers.

Finally, while advocates acknowledge that GM foods have not been in production for a long time, they stress that no adverse health risks have yet been traced to GM foods. According to industry experts, GM foods are as healthy, if not healthier, than their unmodified counterparts.

Furthermore, while GMO proponents also recognize that unintended, harmful mutations are possible when cultivating GM foods, they argue that there is no logical reason to assume in advance that any mutation would cause sufficient harm to outweigh the benefits of pursuing the production of GM foods. Regulation of the development and production of GM foods is sufficient precaution against unintended harm.

GMOS: Different Schools of Thought

Highly Dangerous: Tinkering with Nature

Opponents of GMOs make three main arguments against their production. First, they argue that GM foods might be unhealthy. While they have not been linked with harmful effects yet, GM foods are relatively new and should not be available for human consumption they say, until additional research proves, beyond a doubt, that they are harmless.

A handbook prepared by the Consumer's Choice Council (CCC), a non-governmental consumer advocacy group, asserts that, "as a result of altered regulatory functions, GMOs may exhibit increased allergenic tendencies, toxicity, or altered nutritional value… These risks are compounded when a GMO product is released into an uncontrolled environment. The interaction of GMOs with other complex biological systems, such as the human body or natural ecosystems, cannot, in many cases, be anticipated or fully tested before commercial release."

The second major objection to GMOs is that they can endanger biodiversity. Genetic mutations are a natural part of life. Some people worry that creating certain species in order to emphasize particular traits undermines the natural, mutation-driven evolutionary process.

If the majority of wheat produced in the United States were a specific GM strain, for example, that wheat could potentially be more vulnerable than if multiple strains were cultivated. If an insect or a plant disease that the GM wheat could not repel were introduced into the United States, the entire wheat crop could be threatened. But if multiple natural strains are cultivated, GMO opponents argue, the likelihood that at least one of them would not be affected by the infestation grows, preserving some of the United States wheat crop.

GMO critics are also concerned that genes introduced into GM crops may transfer through natural cross-breeding into unmodified neighboring crops. Weeds could become pest resistant, and the introduction of unusually hardy GM crops could upset the ecological balance of the area in which they are produced. This could lead to the crowding out of other plants and animals.

Finally, some opponents of GMOs question whether human tinkering with the building blocks of living organisms is ethically acceptable. Just because we have the ability to make specially designed crops and other organisms does not mean we should do so. Some who hold this view argue that GMOs should not be produced because their very existence is an unethical extension of human dominance, and jeopardizes the livelihood of other species. Before developing GMOs further, they say, the scientific community should investigate their potentially adverse health and environmental consequences.

The U.S. and The EU: Different Approaches

Disputes over genetically modified crops represent a significant economic and political issue because differences in regulations between the EU and the United States, concerning which GMOs are acceptable for human consumption, have made U.S. exports of agricultural products to Europe more costly and time-consuming.

What regulations exist on GM foods in the United States? The U.S. Department of Agriculture (USDA) regulates the transport, growth, and propagation of plants. Companies that wish to grow GM plants must apply for permits to conduct

field tests of new GM crops or of new varieties of existing GM crops. One factor USDA considers, before issuing a permit, is whether unmodified versions of the proposed GM crops exist in the area, raising the possibility of an unintended transfer of GM material to unmodified plants.

The U.S. Environmental Protection Agency (EPA) examines GM crops that are engineered to be pest-resistant. The U.S. Food and Drug Administration (FDA) requires companies to inform it at least 120 days in advance if they intend to market a human or animal food that involves GM material. The FDA reviews information and analysis submitted by the company to make a judgment concerning whether the GM food is as safe as its non-GM counterpart. [Look at www.fda.gov for company information and the FDA decisions on these cases.] These FDA regulatory requirements are a substitute for labeling.

The Debate over Labeling

The European Commission, the body that makes health- and environment-related regulations for the countries of the EU, is considering regulations that could make it even harder for U.S. exporters to sell foods and agricultural products in the EU. Currently, foods need to be labeled as containing GM material if genetically modified proteins or DNA can be detected in the product. GMOs are defined by the European Commission as any "organism in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination." Under the Commission's proposed new regulations, labels would be required for any human or animal food that is derived in any way from a GM crop, even if the GM content is so minimal, or so far removed from the final product, that it is no longer detectable.

The American Medical Association (AMA) has adopted a different position. In recommendations issued in December 2000, the AMA argues that "there is no scientific justification for special labeling of GM foods, as a class, and…voluntary labeling is without value unless it is accompanied by focused consumer education." Furthermore, according to the AMA, "federal oversight of agricultural biotechnology should continue to be science-based and guided by the characteristics of the plant, its intended use, and the environment into which it is introduced, not the method used to produce it."

Questions for Discussion:

One of the biggest battlegrounds over GMOs is in Africa. While U.S. companies have supported the introduction of GM crops to increase crop yield and the nutritional content of food, European companies and governments have opposed these measures. How would you weigh the trade-off between the possibility for increased food production and the potential these crops might harm the environment and health?

If that dilemma isn't tricky enough, agro-businesses such as Monsanto and Aventis have patents on the GM crops they have developed and sell their seeds to farmers for a profit. What are the possible implications of this practice? Does it matter whether the farmer lives in Guinea-Bissau or Georgia? Is it any different from businesses selling their non-GM seeds to farmers in developing countries?

Global Diseases

Throughout this issue brief, a number of diseases have been mentioned. HIV/AIDS, TB, cholera, and malaria are among the most serious diseases that the world faces, causing millions of illnesses and deaths each year. To learn more about these individual diseases, please continue reading the following sections.

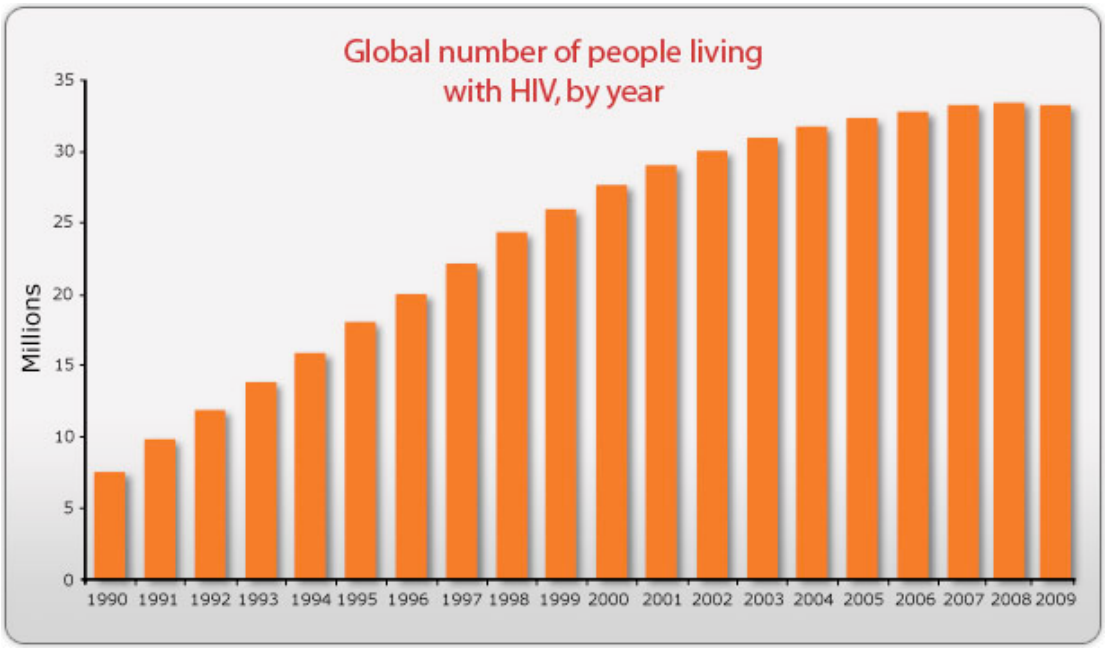
HIV/AIDS

AIDS (Acquired Immune Deficiency Syndrome) is an incurable disease that destroys the patient's immune system. AIDS is caused by infection with HIV (Human Immunodeficiency Virus). HIV is transmitted through the exchange of bodily fluids. People can become infected by HIV through sexual contact, by using needles that are contaminated with the virus, or by coming into contact with infected blood.

The immune system of a person infected by HIV becomes weaker over time, and the person is less able to fight off infections; this process can take months or years. The final stage of HIV is the development of AIDS. As their immune systems collapse, people with AIDS become increasingly vulnerable to infection by a variety of life-threatening diseases.

HIV/AIDS is truly a global disease. While infection rates are highest in poor countries that lack developed public health services, roughly 56,000 Americans are infected every year.[14] According to statistics, by the end of 2009, more than one million Americans were living with HIV/AIDS. Additionally, 33.3 million people worldwide (with 2.6 million newly infected), 22.5 million people in Sub Saharan Africa, 4.1 million in South and South East Asia, 1.4 million in Eastern Europe and Central Asia are HIV-positive or have AIDS.[15]

[14] http://www.cnn.com/2010/HEALTH/07/13/hiv.strategy/index.html
[15] http://www.avert.org/worldstats.htm



Source: http://www.avert.org/worldstats.htm

[More statistics on AIDS worldwide]

[Map outlining HIV/AIDS cases worldwide.]

By taking a mixture of what are known as anti-retroviral drugs, AIDS patients can prolong their lives for many years. Many of these patients might be able to survive until an AIDS cure is developed. But AIDS medicines are very expensive, even for patients in the world's rich countries; most people in developing countries cannot possibly afford them on their own. In addition, many developing countries lack adequate public health systems and trained health care personnel. As a consequence, they have limited capacities to educate people about how to avoid HIV infection, to distribute AIDS medicines, and to treat people with AIDS.

Brazil's Successful Response to an Epidemic

Brazil was out on the forefront among nations facing the AIDS crisis. A 1996 law proposed by President Jose Sarney guaranteed every AIDS patient state-of-the-art treatment. To do this, Brazil began producing generic copies of eight of the 12 antiretrovirals used to treat AIDS. Also, Brazil launched a World Bank-financed prevention program. Since Brazil began producing its own drugs in 1998:

- price has fallen by an average of 79 percent
- the epidemic has stabilized
- Brazil has had the same number of new cases in the last three years
- the death rate has been cut in half

The international community is responding to this global health threat in a number of ways. Through UNAIDS, the United Nations has launched an international effort to bring relief to countries that cannot afford medicines or implement prevention or treatment programs. The World Health Organization also runs a major program on AIDS. It is partnering with UNAIDS and private companies to help countries bring their epidemics under control through prevention, treatment, and vaccine research.

http://zunal.com/myaccount/uploads/drugs(5).jpg

Some countries, such as Brazil and India, have begun producing generic copies of name-brand medicines and distribute them to AIDS patients at a fraction of the cost of the original drugs. Developing countries in Africa and elsewhere have expressed an interest in buying these lower-priced versions of name-brand drugs.

The replication of name-brand AIDS drugs is controversial. The companies that produced the original drugs believe that the companies that copy their drugs are cheating them out of earnings. Developing country governments and some health experts say it would be immoral for people to be denied life-saving drugs simply because they cannot pay for them.

In response to the competition from manufacturers of lower-priced generic drugs, many of the U.S. and European countries that invented AIDS drugs decided to sharply discount the prices of their medicines in the world's poorest countries.

HIV/AIDS FACTS (from the "UNAIDS Report on the Global AIDS epidemic 2010")

- In 2009, an estimated 2.6 million people were newly infected with HIV/AIDS. This was 19 percent fewer than the previous year (est. 2009).
- There are about 33.3 million people living with HIV/AIDS today (est. 2009).
- 97 percent of those living with HIV/AIDs live in low or middle income countries
- In low and middle income countries, 36 percent of the 15 million people in need were receiving antiretroviral therapy (est. 2009).
- After the primary HIV infection, there are four clinical states of HIV/AIDS.
- 17.7 million women and 2.5 million children under the age of 15 were living with HIV/AIDs at the end of 2009.
- Only one in ten persons infected with HIV knows his/her HIV status and has been tested.

Tuberculosis

Tuberculosis (TB) is another disease that infects people across the globe. Tuberculosis spreads through the air when people who are infected with it cough, sneeze, or speak. People infected by TB often have no symptoms of the disease. It is only when a person's immune system is compromised that he or she develops symptomatic TB. Symptoms include a lingering cough, fever, weight loss, night sweats, loss of appetite, and fatigue.

Tuberculosis is most prevalent in areas with high population density. As economies become more industrial and less rural, urban populations grow and the conditions improve for the spread of TB. The disease is most common in poor areas, where multiple families share housing and work in buildings with poor ventilation; in refugee camps, where people are forced to live together (it is estimated that as many as 50 percent of the world's refugees are infected with TB); and among homeless populations.

Tuberculosis is not only found in poor and distant countries; it is a public health concern in the United States as well. According to the CDC, "In total, 11,545 TB cases (a rate of 3.8 cases per 100,000 persons) were reported in the United States in 2009." This represents a drop of 10.5% since 2008.[16]

TB is not only a problem in areas with high concentrations of people, like cities; it is also a problem in schools, where children spend a lot of time close together in classrooms, and among people with compromised immune systems. Individuals with HIV/AIDS are particularly vulnerable to catching fatal cases of TB. In fact, 24 percent of TB deaths [are] HIV associated.[17]

Estimated TB incidence, prevalence and mortality, 2008

	Incidence[1]	Prevalence[2]	Mortality

[16] http://www.cdc.gov/tb/statistics/default.htm
[17] http://www.who.int/hiv/topics/tb/en/index.html

	Incidence[1]			Prevalence[2]		Mortality	
WHO region	No. in thousands	% of global total	Rate per 100 000 pop[3]	No. in thousands	Rate per 100 000 pop	No. in thousands	Rate per 100 000 pop
Africa	2800	30%	340	3900	450	430	50
The Americas	270	2.9%	29	350	37	20	2.1
Eastern Mediterranean	660	7.1%	110	1000	180	99	18
Europe	420	4.5%	47	560	63	62	7
South-East Asia	3300	35%	180	4900	280	480	27
Western Pacific	1900	21%	110	2900	160	240	13
Global total	9400	100%	140	14000	164	1300	19

[1]Incidence is the number of new cases arising during a defined period.
[2]Prevalence is the number of cases (new and previously occuring) that exists at a given point in time.
[3]Pop indicates population.
http://www.who.int/mediacentre/factsheets/fs104/en/

On the whole:

TB can be cured, but treatment typically involves taking at least four different medicines over a 6-12 month period. Many TB patients are not able to follow this treatment routine, and health care systems in developing countries, in particular, often lack the staff and resources necessary to monitor TB patients effectively.

From a public health perspective, poor or incomplete treatment of diseases like TB can be more damaging than no treatment at all. Poor treatment can encourage the development of new strains of a treatable disease that are resistant to available medicines. As with malaria, a strain of TB has become drug-resistant. This strain has been labeled "MDR-TB" (multiple drug-resistant tuberculosis). This form of TB is much more difficult and costly to treat. While the typical six-month treatment for regular TB can cost $10, treatment for MDR-TB can cost $20,000 and take several years.

The strategy for treating TB recommended by the WHO is called DOTS. DOTS combines political commitment, detection, drug supplies, and monitoring services to treat and prevent the disease. According to the WHO, DOTS can produce a 95 percent cure rate, even in poor countries. In July 2001, the WHO, a non-governmental organization called Doctors without Borders, and Harvard University Medical School launched an effort to provide poor countries with affordable drugs that are effective in treating MDR-TB. The plan calls for some countries to receive medicines at prices reduced by as much as 94 percent.

In 2007, this combined effort led to its first huge success. The first Doctors without Borders patient, N.L. from Armenia, completed treatment of MDR-TB. According to Doctors without Borders Field News (November 6, 2007), “Up until two years ago, there was no medical treatment for such strains of TB in Armenia due to the complexity of the treatment, which takes at least two years, including several months of hospitalization.” Doctors without Borders are expecting many more

such positive results. Says Robert Parker, MSF head of mission in Armenia: "We are now able to respond honestly to the recurrent question from our patients: 'Does this treatment work?' 'Has anyone ever been cured with this treatment?'"

TUBERCULOSIS FACTS

- One-third of the global population is infected with TB
- An estimated 1.7 million people died from TB in 2009. It is estimated that between 2000 and 2020, 1 billion people will become infected, 200 million will become sick, and 35 million will die from TB.
- More than 9 million new cases of TB develop worldwide every year
- One person is infected with TB every second.
- TB is contagious and spreads through the air (e.g. sneezing, coughing, etc.)
- Left untreated, each person with active TB will infect 10-15 more people each year.
- 1 in 10 people infected with TB will become sick with active TB.
- People with HIV are at much greater risk to become sick, once infected with TB.
- Over 1.5 million TB cases occur every year in Sub-Saharan Africa.

Malaria


Source: Wikimedia

Malaria is a disease that is spread by mosquitoes. Mosquitoes pick up malaria parasites from the blood of infected humans. While there is only one type of mosquito that can carry malaria parasites, there are four different types of malaria parasite, so there are four different types of malaria people can catch. Symptoms include fever, shivering, pain in the joints, headache, vomiting, convulsions, and – ultimately - coma. If an infected person is not treated, he or she can die.

The mosquitoes that carry malaria breed in warm, damp climates. As forests are bulldozed to build roads and housing in developing countries, conditions improve for mosquito breeding. War has also been identified as a factor that can increase malaria outbreaks. Refugees who spend long periods of time exposed to the elements and who travel across borders fleeing violence are more likely to come in contact with malaria-carrying mosquitoes.

But even ordinary travelers are at risk. Malaria-carrying mosquitoes can stow away on international flights and bring the disease far from infected areas. Geneva, Brussels, and Oslo have had outbreaks of "airport malaria" in the past few years. In fact, up to 30,000 cases of malaria were reported among Europeans traveling abroad in 2008 – and numbers are increasing.

The health threat posed by malaria is worsening because the disease is becoming resistant to the most common drug prescribed to prevent it, chloroquine. In some parts of Asia, the four main drugs used to fight malaria have become ineffective. Moreover, the mosquitoes that carry malaria are becoming resistant to pesticides. Unless new medicines and pesticides are developed soon, the numbers of people catching malaria and dying from it will rise.

MALARIA FACTS (WHO – Malaria: http://www.who.int/mediacentre/factsheets/fs094/en/index.html)

- In 2008, there were 247 million cases of malaria.
- Ten people contract malaria every second.
- In Africa, a child dies of malaria every 45 seconds.
- Malaria killed almost one million people in 2008, mostly children in Africa.
- 700,000 children under the age of five die from malaria each year. Malaria is the cause of 25 percent of all childhood deaths in Africa.
- 90 percent of all malaria cases occur in Sub-Saharan Africa.
- According to a Harvard University study, Africa's GDP would be as much as 32 percent higher today if malaria had been eliminated 35 years ago.
- According to the World Bank, the direct and indirect costs of malaria in Sub Saharan Africa were nearly 12 billion in 2008.
- Malaria can decrease gross domestic product by as much as 1.3 percent in countries with high disease rates.

Cholera

Cholera is a disease caused by a bacterial infection of the intestine. It makes people sick, and sometimes kills them, by causing persistent diarrhea. Cholera infections are often mild, but approximately one in 20 of those infected develop severe symptoms. Once the disease has progressed to this state, death can occur within a few hours.

When the fluids lost through diarrhea are promptly replaced, cholera patients rarely die. When cholera occurs in an unprepared area, as many as 50 percent of newly infected individuals may ultimately die. People catch cholera by drinking water or eating food that has been contaminated with the cholera bacterium. It spreads most rapidly in areas where public sanitation is poor and drinking water is untreated. Unlike HIV/AIDS and tuberculosis, person-to-person infection is not likely.

Cholera has had an adverse impact on economic development in many countries. Families face hardships paying for hospital stays and medicine used to treat cholera. Countries face economic losses from the lost productivity of the caregivers. Productivity losses can be high, especially in sub-Saharan Africa where people do not retire, due to the lack of a social security system. Cholera can also negatively impact the tourism sector and subsequent loss of livelihoods. . The economic damage caused by cholera can be compounded by the international reaction. When Peru experienced a cholera outbreak in 1991, the country lost $770 million due to sharp drops in food exports and tourism.

By 2005, cholera had been reported in almost 120 countries: "*As the disparity between industrialized and less-developed countries grew, cholera, which previously had been a global disease, seemed to have become yet another burden to be borne by impoverished nations of the Third World*." (Britannica Encyclopedia).

To prevent cholera outbreaks, countries must provide adequate public sanitation, clean drinking water, and instruction on good food hygiene. Providing these services requires a long-term commitment of significant resources, often with the assistance of international bodies such as the WHO and the UN.

CHOLERA FACTS

- In 2008, The World Health Organization reported 190,130 cases of cholera, including 5,143 deaths, in 56 countries. The real number is estimated to be 3-5 million cases and 100-200 thousand deaths per year.
- Cholera is transmitted by eating foods or drinking water that is contaminated with the cholera bacterium.
- Approximately 75 percent of people infected with cholera do not develop any symptoms.
- Nearly 2 billion people currently lack access to safe water, and about 2.5 billion people have no access to adequate sanitation.
- Once a cholera infection reaches a severe state, a patient can die within two hours.
- In 2007, there was an outbreak of hog cholera (classical swine fever) in Central Luzon, the Philippines, affecting nearly 3,000 hogs.
- According to the World Health Organization, "As of 30 May 2009, 98,424 suspected cases, including 4 276 deaths (Case Fatality Rate of 4.3%) have been reported by the Ministry of Health and Child Welfare (MoHCW) of Zimbabwe since August 2008. Fifty-five out of 62 districts in all 10 provinces have been affected."[18]
- In the aftermath of the 1994 war in Rwanda, more than 58,000 cases of cholera were reported, with 23,800 deaths, within one month.

Swine Flu

In 2009, Swine Flu, or H1N1, took the world by storm. News quickly spread of Swine Flu spreading throughout both Europe and the Americas. International travel decreased as people became concerned with the international outbreak. According to the CDC, Novel H1N1 is "a new influenza virus causing illness in people. This new virus was first detected in people in the United States in April 2009. Other countries, including Mexico and Canada, have reported people sick with this new virus. This virus is spreading from person-to-person, probably in much the same way that regular seasonal influenza viruses spread."[19]

The WHO argued that because H1N1 was a new virus, which the general populace seemed to have little immunity to, the virus could cause "more infections than are seen with seasonal flu."[20] On June 23, 2010, the U.S. Public Health Emergency for the disease expired and the WHO declared the global pandemic to be over. Nonetheless, the virus will probably continue to spread and return during times prone to seasonal influenzas.[21]

CDC video about the Swine Flu: http://www.youtube.com/watch?v=0wK1127fHQ4.

For more information on H1N1 see the following websites:

http://www.who.int/csr/disease/swineflu/frequently_asked_questions/about_disease/en/index.html

http://www.cdc.gov/h1n1flu/

[18] http://www.who.int/csr/don/2009_06_09/en/index.html
[19] http://www.cdc.gov/h1n1flu/
[20] http://www.who.int/csr/disease/swineflu/frequently_asked_questions/about_disease/en/index.html
[21] http://www.cdc.gov/h1n1flu/

What is a "Global Disease?"

What is a "global disease?" Are cholera, HIV/AIDS, malaria, and TB global diseases?

Jean Lanjouw, an economist from Yale University, has argued that we should distinguish between global diseases and other diseases that target poorer countries. Dr. Lanjouw defines a global disease as a disease that exists both in developed and developing countries. Diseases that mainly afflict poor countries are not truly global in scope. According to WHO, over 99 percent of worldwide cases of malaria, measles, and diarrheal diseases are found in low- and middle-income countries.

The distinction between global and other diseases becomes important when we consider ethical and practical questions relating to how we respond to public health crises. The drugs that treat cholera, HIV/AIDS, malaria, tuberculosis and other diseases often cost a lot of money to produce and distribute, and, in many cases, the drug companies that produce them have sole ownership rights to their production and sale. This means that agreements need to be struck with drug companies if people want to make sure that treatments are available at prices poorer countries can afford.

As we noted earlier, recently drug companies have agreed to offer medicines to treat HIV/AIDS at substantially reduced prices in certain poor countries. One reason the drug companies can afford to do this is because they can recover part of the cost of providing the drugs at reduced prices in poor countries by charging normal, higher prices in developed countries. Put differently, drug companies can afford to cut the cost of AIDS treatments in a country like South Africa because they can charge full-price for the same drugs in the United States. U.S. consumers, in effect, subsidize the sale of drugs to South Africa.

But there is no meaningful market in developed countries for drugs that treat cholera and malaria, because those diseases are largely found in poorer regions of the world. Without the opportunity to make sales in rich-country markets, drug companies sometimes lack the financial motivation either to develop new drugs for the treatment of diseases common to developing countries or to cut prices for existing drugs. Drug manufacturers believe they will be unable to recover the high costs of drug research and development through sales of new drugs in countries where people cannot afford to pay a lot for treatment. This means that some of the money to develop new drugs will have to come from other sources, not exclusively from private drug companies. Additional funding is also needed to help purchase and distribute drugs. Generating the necessary funds will be a major challenge for governments in the coming years.

The Link between TB and HIV

The Tuberculosis Bacterium and the HIV virus are not only concerns by themselves, but the two diseases are also acting together in a kind of deadly synergy that is propelling their spread even further. As stated earlier, roughly one-third of the world's total population is believed to be infected with TB. However, the vast majority of those cases are in the *latent* form. Latent TB normally only becomes active when a person's immune system is weakened, which can happen because of poor nutrition or other infections.

Because HIV is a disease that incapacitates a person's immune system, people with latent TB are much likelier to develop active TB if they are also infected with HIV. A person infected with both diseases is in fact estimated to have a 100-times greater risk of developing active TB. When TB is active, it is also the most contagious.

Therefore, the CDC estimates that:

- Worldwide, one-third of the deaths of people with AIDS are directly due to TB.
- One-third of the new cases of TB over the past five years have been due to the HIV epidemic.

Glossary

AIDS: Acquired Immune Deficiency Syndrome is the last stage of HIV infection. People with AIDS are increasingly more susceptible to catching life-threatening infections and diseases because the AIDS virus attacks their immune systems. The AIDS virus is transmitted through bodily fluids.

Anemia: A condition, usually caused by inadequate dietary iron, in which the blood is deficient in red blood cells, hemoglobin, or total volume.

BSE: Bovine Spongiform Encephalopathy, known as "mad cow" disease, is a disease of cattle first identified in 1986. Some people, worried about a link between BSE and the human disease Creutzfeldt-Jakob Disease (CJD), have lost confidence in beef throughout much of Europe. In March 1996 the European Union introduced a ban on the export of any UK beef and beef products. This has had a very serious impact on the entire beef sector and has resulted in financial hardship for farmers and for those engaged in related businesses.

Communicable Diseases: Diseases that spread between agents, such as human-to-human transmission (e.g., the cold or AIDS), or animal-human transmission (e.g., rabies, malaria). These differ from diseases that self-generate in the body, such as cancers.

Copyrights: The exclusive legal right to reproduce, publish, and sell the matter and form (as of a literary, musical, or artistic work (Merriam-Webster's Collegiate Dictionary).

Genetically Modified Organisms (GMOs): Genetically Modified Organisms are organisms (virus, bacterium, or more complex life-form) whose genetic makeup has been altered by humans for a specific purpose.

Genetic Engineering: Changing the genetic make-up of an organism using molecular techniques. This includes introducing one or more genes from unrelated species.

Geographical Indications: Place names.

HIV: Human Immunodeficiency Virus damages cells in the immune system that defend the body against infections and disease. Over time, a person's immune system becomes more damaged and the person is less able to fight off infections; this process can take months or years. The final stage of HIV is the development of AIDS.

Immune System: The bodily system that protects the body from foreign substances, cells, and tissues by producing the immune response and that includes especially the thymus, spleen, lymph nodes, special deposits of lymphoid tissue (as in the gastrointestinal tract and bone marrow), lymphocytes including the B cells and T cells, and antibodies (Merriam-Webster's Collegiate Dictionary).

Incidence: The number of times an event occurs in a given time, e.g. the number of new cases of malaria in a calendar year.

Industrial Designs: The aesthetic or ornamental aspects, such as shape, pattern, or color, of a useful commercial article.

Integrated Circuits: Tiny complexes of electronic components and their connections that are produced in or on a small slice of material (as silicon).

Intellectual Property: Pieces of information that have economic value in the marketplace. Types of intellectual property include copyrights, patents, trade secrets, and industrial designs.

Malaria: A human disease that is caused by sporozoan parasites in the red blood cells. Malaria is transmitted by mosquitoes, and is characterized by periodic attacks of chills and fever. Worldwide, malaria kills 3,000 people a day.

Malnutrition: Poor or insufficient nutrition. Malnutrition results when a person either eats too little food to get all of his or her needed calories, vitamins, and minerals in a day, or eats foods that do not provide these basic nutritional needs.

Patents: A legal monopoly to an inventor for a set number of years granting the inventor the exclusive right to make, use, or sell his or her invention.

Prevalence: The total number of specific conditions in existence in a defined population at a precise point in time, e.g., the number of cases of TB recorded so far in a specific country.

Selective Breeding: A practice where farmers change the genetic make-up of plants and animals by breeding plants or animals that exhibit particular, desirable traits in hopes of producing offspring that also produce these traits.

Trademarks: A device (as a word) pointing distinctly to the origin or ownership of merchandise to which it is applied and legally reserved to the exclusive use of the owner as maker or seller. (Merriam-Webster's Collegiate Dictionary).

Trade Secrets: Confidential business information.

Tuberculosis (TB): Tuberculosis (TB) is a highly contagious, airborne disease that can damage a person's lungs and cause serious illness. Every year 25,000 Americans catch TB; worldwide, 2 million people die from TB each year.

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