National Institute of Social Sciences
Harvard Club, New York June 17, 2015

New Threats for the 21st Century
Ebola, measles, Chikungunya, and More

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It is a pleasure for me to have the opportunity to participate in this annual luncheon and my thanks to Chauncey Ollinger and the National Institute of Social Sciences for the invitation. I commend particularly those who looked twice at the title, noted one or two diseases of which they had never heard and were not sure they wanted to hear more – but came any way. In fact, this is an especially propitious moment as I will relate. There are new diseases and problems of which you will hear more during the coming months. The fact is that we are now in the midst of several unexpected and serious infectious disease challenges. Two have recently warranted lead coverage in the NYTimes – a distinction in itself given the ongoing competition provided by turmoil in the Middle East and the United States Congress. However, in deference to you and to the chef, I promised Chauncey not to display colorful pictures of patients or pathological specimens.

The world of the microbes is now making itself known. There are valid concerns. It is quite different than in the 1960s when I was just embarking on a career in infectious diseases. An Australian Nobel Laureate, Sir Macfarlane Burnett, took note of the array of new vaccines and antibiotics being discovered. He argued that the time had come to shift our research agendas from infectious diseases to the chronic illnesses. As he saw it, the infectious diseases would soon be fully under control. For an aspiring infectious disease specialist, this was not good news. But, indeed, during the 1970s and 1980s, hospital positions for medical residents in infectious disease decreased sharply. Interest in tropical medicine waned. There was a general confidence within our own country that with our plentiful supplies of clean water, nutritious food, and healthy living, microbes would soon enough be a problem largely restricted to the developing countries. And besides they were far distant and international travel was not all that common.

Indeed, as health and living conditions in the industrialized world steadily improved, development in the developing countries lagged further behind. Differences in the disease problems of the two worlds increased. However, international travel by air permitted microbes to move across continents with greater facility; large densely, populated cities grew in size and number; and exploration and habitation of tropical areas became more frequent. With these changes has come the discovery and spread of microbes hitherto unknown to us—most dramatically the human immunodeficiency virus with its disease called AIDS. Its source was simian but, since 1982, it has spread throughout human populations across the globe. It is not yet contained despite billions of dollars invested in control and treatment measures.

Other new viruses have emerged. In 2002 a virus, called a coronavirus, appeared in China. It affected Asian civet cats in particular. These were sold in animal markets and they carried a virus that caused a severe pneumonia called SARS. Infection moved rapidly across Asia and Europe and finally it came to North America. One of the most seriously affected cities was Toronto, Canada. The disease could be spread rapidly; certain patients transmitted the virus to so many persons and so widely that the term "super-spreaders" began to be used. I recall well

the alarm we all felt as the hospital chief of infectious diseases in a Toronto hospital told us of one explosive episode --- some 20 cases that traced back to an apparently healthy woman sitting in a waiting room while her husband was being admitted for pneumonia. She later developed symptoms but the transmission occurred before she became ill. Fortunately, there were few such episodes but it was apparent that more was needed than simple ordinary respiratory precautions for those who were ill. In Toronto, heroic measures were taken including the quarantine of some 25,000 people. However, some 400 persons were infected over a 2 month period; Toronto's tourist industry all but collapsed. Eventually, this virus mysteriously disappeared.

Meanwhile, we have begun to cope with the emergence of wave after wave of new influenza viruses. With each new wave, efforts have intensified to discover methods by which effective vaccines can be developed, produced and delivered. The continuing fear is that we may once again have a strain as virulent for man and as capable of spreading as did influenza in 1918. Then, in 2005, a strain called H5N1 emerged that was unusually virulent. It was feared that it might gain the capability to spread rapidly. Fortunately it didn't but we needed national, indeed international, programs that would permit us to produce and distribute a new vaccine rapidly.

Today three viruses are of heightened interest –indeed, during the weeks since accepting this invitation, there have been surprising developments with respect to each. I will briefly touch upon these.

The dominant subject of international concern for nearly a year has been the Ebola virus, now epidemic in West Africa. It was first discovered in Central Africa some 25 years ago. African bats are its permanent reservoir. But when humans or other mammals are infected, the virus can spread by contact from individual to individual. It causes a severe, often lethal illness with fever, diarrhea, and hemorrhage. The death rate approaches 50%. There is no vaccine or drug. Understandably, it is greatly feared by residents and health care workers. At one clinic which dealt with one of the earliest recognized outbreaks, 11 of the 17 medical care staff died. The only mechanism for stopping the spread is by isolation of cases and close contacts. Until a year ago, the Ebola outbreaks occurred in tropical rain forest areas of Central Africa but the outbreaks were generally small and could be contained within a matter of weeks.

But, over the past year, the disease abruptly spread across 3 West African countries –Liberia, Guinea, and Sierra Leone, all located in a tropical rain forest area which is roughly equivalent in size to the state of California. For the first time, the Ebola virus invaded densely populated cities. The challenges in these three countries were multiplied as the result of a 10 year brutal civil war which had largely destroyed what there was of the infrastructure. The mud roads and tracks were all but impassable.

Countries around the world have been alarmed and have been screening visitors coming from this area. Especially of concern is the fear that the disease might spread to densely populated cities especially in Africa and Asia where facilities for isolation and care are especially limited. And, as you know, all countries, including the United States have undertaken elaborate

screening procedures to detect possible cases among those coming from the area. Even those crossing borders on foot have been screened to determine if they have a temperature. A traveler told me that at one site, the guard had only one thermometer and after taking a temperature, he simply popped the thermometer into the mouth of the next in line.

In our own country, special isolation rooms in hospitals have been especially rebuilt and equipped to receive possible patients. Fear and even panic are understandable given that the disease is spread by simple contact; that there is no treatment; and the death rate is so high.

This epidemic began in December, 2013. when a small child in the forest area of Guinea was infected by a bat. Thereafter, the disease gradually spread from individual to individual, household to household, skipping over large areas as individuals, still in the incubation period of disease, travelled to visit friends and family. Within 3 months international authorities were informed of a growing epidemic but failed to appreciate the implications of its existence.

As the epidemic grew in size, efforts to isolate patients and to identify contacts were overwhelmed. Quarantines of entire areas in some cities were invoked but these rapidly collapsed and rioting occurred. Treatment centers attempted to provide fluids and simple medical measures but these were rapidly overrun. The commercial airlines largely suspended service and many ships refused to dock. Finally, in August, the epidemic was declared an international public health emergency and significant resources began to flow in.

An especially difficult problem was to assure that the disease did not spread to health workers and others in contact with patients. Gowns, masks, goggles, and shoe coverings were necessary to prevent transmission of infection. Before such equipment arrived in sufficient quantity, many health staff, including physicians and nurses, became infected and died. There were more than 500 victims among the health care staff alone. But even with protective equipment, there were problems in wearing the gear in the tropical climate and in rooms that were not air-cooled – almost none were. Because of this, health staff were limited to 45 minutes of time before taking a rest and changing the protective clothing.

All out efforts have been made by national, commercial, and university laboratories to develop vaccines and anti-viral drugs for treatment. The open collaboration and of all concerned is unprecedented. .Studies of several vaccine studies have progressed to the point of early experimental use in the epidemic area. At best, however, it will be many months before even limited quantities could be available.

The numbers of cases declined steadily and through much of April the weekly numbers of cases fell to between 5 and 15. In all some 27,000 cases had occurred with more than 11,000 deaths. It was hoped that the last cases might be contained by the end of June but within the past few weeks cases in both countries have begun to increase. The rainy season has begun. Can transmission be stopped despite this? As of last Friday, it was by no means certain.

This epidemic was a potent reminder to all of us and especially to health officials and politicians that we do not live in a sealed compartment. Microbes are constantly multiplying and mutating; growing populations are continually being exposed to changes in all parts of the world and rapidly increasing numbers of international travelers inadvertently carry microbes from one part of the world to another unnoticed and within hours. Our concerns and plans must be global.

**********MERS

In May, German Chancellor Angela Merkel addressed the opening meeting of the World Health Assembly. She, as other world leaders was deeply troubled by the Ebola epidemic and the failure of the world community to deal with it more expeditiously. "We need some kind of global disaster response plan. And the World Health Organization must play a key part in this." It was the first time that a political leader had presented the Assembly's opening remarks. Extensive meetings followed in an attempt to lay out definitive plans.

Even as they were deliberating, another infectious disease crisis was emerging. On May 20, as the World Health Assembly was in progress, the Republic of Korea reported one case of MERS (Middle East Respiratory Syndrome). This disease is a severe pneumonia not unlike that of the SARS pneumonia in 2003.

The discovery of the very first case of MERS was in 2012, only 3 years ago. Like the SARS virus, it is what is called a coronavirus—a related virus but distinctly different. A number of cases occurred as a result of infection acquired in a hospital, sometimes from another patient. Increasing efforts were made to prevent hospital transmission but the efforts were only partially successful.

Since 2012, the MERS virus has been isolated from 1227 patients in some 25 different countries (including the U.S.); 449 patients (one-third) died. Not infrequently, the source of infection could be traced to a prior patient but no reservoir for the virus has been determined. The fact that the virus could regularly be isolated from young, healthy camels is intriguing but how camels could be a reservoir is not apparent.

This first case in Korea had acquired Infection from a Saudi patient with severe pneumonia. Thus, the one case in Korea was itself not surprising. This time, however, MERS became epidemic. Within three weeks, the government had recorded 145 cases with 14 deaths occurring in 7 different hospitals. More cases are being reported daily. What is remarkable, however , is that all cases have been traced to direct exposure to patients either while in crowded hospital waiting rooms or as visitors to hospitalized patients. Korea's first patient sat in the waiting rooms of two different hospitals and one clinic during the course of seeking admission. He was the source of infection for as many as 20 or more patients. At least 3800 people have now been isolated. Infectious disease isolation procedures as well as the role of waiting rooms for hospital admissions are under review.

**********INFLUENZA

And now we are struggling with yet another surprise but in this country -- a new strain of influenza. As yet, it has shown no ability to infect humans but, as we speak, a newly modified strain called H5N1 is spreading rapidly among chickens and turkeys – In states of the West and

Midwest. It can kill 90% of a flock within 48 hours. Control of the epidemic is achieved by early destruction of infected flocks and those at special risk. By early June, Iowa which produces 20% of our nation's eggs had destroyed more than 40% of its egg-laying hens. Flocks in 15 other states have now been infected and more than 50 million chickens and turkeys destroyed. China, Japan and Mexico have now barred poultry imports from the United States. Egg prices have almost doubled. There is no end in sight. Special arrangements are now being made to gain approval for more eggs to be imported from Europe.

**********CHIKUNGUNYA

Finally, a new word for your vocabulary and a hope that it remains no more than that. In December 2013, just 18 months ago, a new virus came to the Americas, called Chikungunya. It took up residence in St. Martin's in the Caribbean and cases soon were being reported from across the Caribbean and even south Florida. It is a mosquito-borne virus disease with a 3 to 7 day incubation period and then fever, aching pains, malaise and often joint pains and stiffness which may last for weeks to months. The word may seem to suggest a relationship to poultry, it is not. The word is Bantu meaning "that which is bent up" and was intended to describe the joint pains and stiffness of the disease. Last year, about one million cases were reported from Caribbean Islands; the forecast is for far more cases this year.

Each of these events dramatizes the fact that whatever our breadth of scientific capabilities, there are and will be new and unexpected challenges with which we must cope. The viruses, in particular, are special problems ---continually adapting, innovating, and spreading. We have had some remarkable successes in coping with some of the more serious ones – SMALLPOX FOR one. But we must do more to deal with the diseases where ever they might arise. A new epidemic in Central Africa today could well be throwing off sparks sufficient to infect New Yorkers tomorrow. In brief, we are more a part of One World than we sometimes imagine.