EMERGING AND RESURGENT PATHOGENS IN NEW YORK CITY

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Few public health issues are as timely and as important as the topic of this symposium. Few have such massive implications on both the local and global levels.

The outbreak of Ebola virus in Zaire showed once again that emerging or resurgent infectious disease agents are neither relics of the past nor hypothetical threats. They are real, imminent dangers in this era when antibiotics and vaccines have lulled us into illusory complacency, especially in places of world-class medical capacity such as New York City. We do not need to look across the globe to recognize that we are talking about problems that are more than just theoretical risk. June 5, 1995, marks the 14th anniversary of the publication of the *Morbidity and Mortality Weekly Report* that detailed five of the earliest cases of pneumocystis pneumonia in previously healthy homosexual men.

In New York City, AIDS represents the leading cause of death for men and women between 25 to 44 years old and is the third leading cause of death overall. The city had recorded approximately 76,000 AIDS cases at the time of the conference, and each week approximately 130 individuals are lost to this devastating disease. Such a setting makes it difficult to ignore the potential for previously unrecognized organisms or unexpected diseases to take hold and to insinuate themselves into so many aspects of our society.

UNIQUE VULNERABILITY OF NEW YORK CITY TO EMERGING PATHOGENS

We must recognize that, while New York City boasts perhaps the greatest concentration of sophisticated medical research and clinical institutions found anywhere, many of New York's characteristics combine to make it particularly

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vulnerable to the emergence of diseases of infectious origin. The primary requirement for a new epidemic is not the occurrence of a new microorganism, but the occurrence of conditions that allow the rapid dissemination of disease.

New York City has an extremely high population density, one of the necessary conditions. That fact is compounded by conditions of truly appalling poverty in many of the city's communities. Unlike many municipalities, New York City has an unfiltered surface water supply. In addition, New York is a major port of entry into the country for international travel and commerce; it has a large and growing immigrant and refugee population; it is host to a large number of transients, ranging from tourists, visiting students, scholars, businessmen, and domestic and blue-collar workers, who come from across the nation and the world. All of these factors make New York City susceptible to emerging infections, homegrown and imported.

Changing agricultural practices in the US and overseas have the potential to expose New Yorkers to animal-borne diseases. The concept of domestic, as opposed to international, health is outdated in an era in which travel, commerce, ecological change, and populations are intertwined globally. The microbe that felled one child on a distant continent yesterday can reach a child in New York today and can seed a global pandemic tomorrow.

Those words became starkly real to me in autumn 1994, when New York City was called upon to respond to a suspected imported emerging pathogen, the outbreak of plague reported in India in August and September of that year. The Department of Health joined with the federal Centers for Disease Control and Prevention (CDC) to put in place a program to protect New Yorkers from potential importation of this deadly disease. Incoming flights were monitored. Using its established channels of communication, the New York City Department of Health alerted the medical community and designated hospitals with respiratory isolation rooms for triaging cases from John F. Kennedy Airport. The department arranged for a central supply of streptomycin should the rapid need for it arise. Our experience with plague also pointed up serious limitations in our ability to respond to imported disease. We noted the difficulty of recognizing possible cases prior to passenger disembarkation, and we were faced with our limited abilities to track all potential contacts if cases of imported plague had been confirmed. None were confirmed, but these weaknesses were important to appreciate.

At the time of the conference, the department was similarly mobilized to respond to the potential importation of the Ebola virus. While the possibility always seemed remote and grows smaller daily as the epidemic appears to wane,

in this era of jet travel the concern was more than just theoretical, and it was essential that the Department think through the contingency and develop a response plan. Although neither Ebola virus nor plague had appeared in New York City by June 1995, there was, and is, no doubt that immigration and international travel have helped to fuel the appearance of many diseases in New York City; these diseases range from locally acquired neurocysticercosis to periodic outbreaks of cholera and cases of malaria.

Unfortunately, imported diseases are far from the only kinds of emerging pathogens faced in New York City. In the relatively few years that I served as commissioner of health, the department had to cope with a range of emergent or resurgent infectious diseases. In fact, it was often ironic to me that so much of my time was spent addressing diseases that either did not exist when I began medical school, such as AIDS, or that we learned about briefly as diseases of historical interest only, such as tuberculosis (TB) or rabies.

Besides international travel and immigration, the several emerging infectious disease problems facing New York City fall into a number of categories. For example, some, such as the rabies epizootic, are associated with animals. Prior to 1992, apart from rabies in bats and in animals brought in from other endemic areas, no cases of rabies had been reported in New York City for decades. In March 1992, however, the mid-Atlantic raccoon rabies epizootic reached New York City when rabies was observed in a raccoon that was found staggering on a street corner. Soon thereafter, all five boroughs became endemic. Thankfully, more than 90% of cases were found to be in raccoons, not dogs or cats, and there were no human cases. In response to the reappearance of rabies or in anticipation of what appeared to be an inevitable trend, the Department of Health launched an educational campaign directed to emergency room physicians and changed guidelines on prophylaxis. Previously, the city had recommended rabies vaccine only for wild animal or bat exposures.

Responding to this disease threat reminded the Department of Health of some of the restraints on capacity and resources faced by New York City. The Department of Health is no longer able to dispense free vaccine, which costs about \$1,000 per series, nor can it directly monitor all patients to ensure that prophylactic treatment is completed. Both the department's animal-control program and laboratory facilities are limited with respect to the challenges posed by a raccoon epizootic.

The department has also been challenged in its efforts to monitor, track, and respond to infectious disease stemming from pathogens that change in pattern or increase in virulence. A highly visible experience, thanks to New York City's

tabloid press, is that concerning invasive group A streptococcal infections. Group A strep represents a common cause of mild sore throat and skin infections, but, when it becomes invasive, the infection can progress rapidly and cause fatal disease. The Department of Health believes that the rate of invasive group A strep disease, including toxic shock, may be increasing. In response, the department made invasive group A strep infection a reportable disease on April 14, 1995; it undertook an educational outreach to the local medical community and public. The department was optimistic that these new efforts would provide a better handle on this disease syndrome, yet, once again, important resource constraints were observed on some tried and true public health approaches. Limitations of staff resources have made it difficult to perform effective surveillance, so the department depends to a great degree on the passive reports of medical providers and laboratories. The Department of Health's laboratory similarly is without resources to type group A strep. Although it could collaborate with colleagues at the CDC and with others, the department's own resource constraints led to greater delays and cessation of certain important activities.

An enormous concern is the growing problem of antibiotic resistance being seen in New York City and across the nation. The phenomenon of resistance is not new, but it is one that we cannot afford to be complacent about; its impact has become increasingly pronounced with respect to a number of important pathogens and antibiotics. A compelling example is pneumococcal disease. Pneumococcal infections are a leading cause of disease among young children and the elderly. Until recently, these infections were routinely treatable with penicillin. As a consequence of widespread use (often misuse), drug resistance has emerged as a major concern in community and institutional settings. Treatment of resistant strains often requires expensive antibiotics and hospitalization.

In 1993, in response to the increasing threat of drug-resistant pneumococcus in New York City, the Department of Health surveyed laboratories citywide to assess prevalence. Up to 10% of pneumococcal isolates were found to be resistant. Other surveys showed dramatic increases over the previous few years. Pneumococcus became a reportable disease entity in November 1994; the Department of Health launched an educational campaign to encourage appropriate laboratory testing and judicious use of antibiotics. Nonetheless, the inadequacy of resources hampers the department's ability to respond fully to this problem in the manner it would like—for example, to determine the true prevalence of resistance in the community, the risk factors for acquiring resistant strains, and the appropriate use of pneumococcal vaccine.

Of course, resistant pneumococcus is only one of the concerns of the Depart-

ment of Health. New York City's hospitals and clinics are faced with problems of penicillin-resistant gonorrhea, methicillin-resistant staphylococci, and, of course, multidrug-resistant TB.

Tuberculosis represents one of the most pressing resurgent disease problems today. The recent history of TB is a powerful reminder of the importance of applying basic public health principles and the need to guard against complacency.

Early in the century, rates of TB began to decline, first with improvements in housing, hygiene, and sanitation and then with the introduction of antibiotics. However, despite overall declines, high rates of TB persisted in some of our most underserved communities. Nonetheless, because overall TB was diminishing, resources were diverted, and programs known to be effective fell victim to overconfidence, shortsighted public policy making, and fiscal neglect. These factors, combined with worsening poverty, increasing homelessness, crowding, incarceration, immigration from areas where TB is common, and the HIV epidemic, all resulted in steady increases in TB cases in New York City between 1979 and 1992.

In retrospect, it is hard to understand what happened. Throughout the 1980s, the numbers of TB cases were mounting, but no significant efforts at TB control were put in place until the early 1990s. Despite the fact that the incidence of TB cases was rising and it was known that resistance could pose a potential problem, efforts to track drug-resistant TB had ceased altogether until a member the New York City Department of Health did a study in 1991 that demonstrated how serious the multiple-drug-resistant TB problem had become.

I am extremely proud of how the Department of Health and the city responded to the TB epidemic. The ambitious TB treatment and prevention program put in place by the Bureau of Tuberculosis Control and the leadership it provided across the city provided cause for guarded optimism. In early spring 1995, we were able to announce that in 1994 the number of new TB cases in New York City had dropped for the second year in a row, bringing about an almost 22% drop in the city's TB caseload between 1992 and 1994. Moreover, the rate of resistant TB fell almost 25% from 1994 to 1995. Given the many obstacles the Department of Health faced, I believe that this was a truly remarkable accomplishment. Now the challenge is to sustain and extend these important gains.

Unfortunately, the list of other emergent or resurgent infectious diseases in New York City goes on. The Department of Health has been working to address issues of the safety of New York's water supply. One focus has been to ensure that New Yorkers do not become infected with cryptosporidiosis, a disease

thought to be only of relevance to veterinary medicine, but one that resulted in over 400,000 people becoming ill in Milwaukee, with several thousand hospitalizations and over 100 deaths. Reporting of cryptosporidiosis became mandated in New York City in January 1994. In November, 1994, the Department of Health added a surveillance component to its active laboratory-based program for giardiasis. It also is pursuing several important research studies actively.

Other infectious diseases are constantly emerging to conquer new territory and gain access to new host populations both inside and outside of the immediate borders of New York City. Outbreaks of environmental illness, such as the much-publicized episode of Legionnaires' disease on a cruise ship docked in New York Harbor, or the threat of foodborne illnesses, such as from *Escherichia coli* O157, pose constant threats. The Department of Health also has to cope with new manifestations of disease, such as Hantavirus pulmonary syndrome. The list goes on.

RESPONSE MECHANISMS OF THE NEW YORK CITY DEPARTMENT OF HEALTH

The primary weapons of the New York City Department of Health in the ongoing and escalating war against emerging infectious diseases are those that have formed the backbone of our responses. The core functions of public health include health status monitoring and disease surveillance; investigation and control of disease; protection from environmental hazards; health, education, and disease prevention programs; targeted outreach; public and professional mobilization for health-related issues; and, when appropriate, direct clinical services for disease control or for indigent and underserved populations.

Almost 130 years ago, the Department of Health was established in response to a cholera epidemic. Today, much has changed about New York City, its Department of Health, and the health problems that must be addressed, but the mission to protect New Yorkers from infectious diseases remains among the highest priorities of the department.

The Department of Health's commitment to support and improve the epidemiology and surveillance of infectious diseases has been steadily growing stronger. Disease surveillance in New York City is a particularly important function as a sentinel to alert the Department of Health to new or re-emergent threats and as a research tool to enable department investigators to intervene to stem the tide of disease. Success also depends critically on the partnerships the department is able to forge between its work and the work of the medical provider community throughout New York City. For example, health care providers have the responsi-

bility to alert the Department of Health to the problems they may see in their offices and emergency departments. Some of the health department's expanded requirements for disease reporting or for the appropriate completion of all information required on birth and death certificates may seem onerous, but the department relies on such information to monitor disease and to identify and respond to emerging trends. The department, in turn, communicates with providers to inform them when there may be an outbreak of disease and what to expect.

The Department of Health also depends on partnerships forged with infectious disease colleagues in New York City and across the nation. Toward this end, the department has established an expert advisory committee to advise on many aspects of the emerging infectious disease agenda. The Department of Health also works with many other groups and organizations, and, importantly, its efforts depend on collaborations with our federal colleagues as well.

For the New York City Department of Health, newly recognized pathogens, whether Hantavirus, Ebola virus, or HIV/AIDS, have been sobering reminders of the need to be prepared for new challenges. It is extraordinary that, despite the steady pace of medical progress and the elaborate technologies and formularies available to health care providers, the barriers that protect all of us from assault by a new or changing infectious organism are fragile and fallible indeed. Nevertheless, there are some straightforward measures that, if implemented, would greatly enhance our prospects for success. For example, limited resources hinder the Department of Health from doing all that it believes needs to be done. These are serious and ongoing difficulties. Not enough staff are available to investigate all disease reports, so routine surveillance data may be delayed or incomplete. Staff shortages may mean that case investigations have to be given priorities, sometimes forcing difficult choices or the need to pull staff from other areas.

The need to respond to outbreaks of infectious disease also stresses the capacity of the Department of Health for maintaining routine activities. Further, emerging infectious diseases place a tremendous burden on ancillary support services such as vector surveillancing, rodent and animal control, and environmental health functions responsible for food and water safety. Improving these systems, so that they may detect, monitor, investigate, and respond to emerging pathogens, is an extremely high priority for the Department of Health, as well as for the federal CDC. The CDC plan emphasizes the importance of surveillance and response, applied research, prevention and control, and strengthening local, state, and national public health infrastructures.

Clearly, considerable reinvestment in the public health infrastructure is required to bolster surveillance, outbreak investigation, and disease control pro-

grams. Yet, despite the clear importance of these critical public health functions, our national commitment to them has faltered.

During the past 15 years, economic pressures from the national, state, and local levels have brought about cuts in public health programs that were once deemed essential. The proven value of public health programs in protecting the health and safety of our nation notwithstanding, it is probable that less than 1% of the total national health expenditures goes to public health. The proportional expenditures for public health have decreased over the last decade and a half. Weighed against the risks posed by emerging and resurgent infectious diseases, the cost in human suffering and the failure to reinvest in the public health structure should make this one of the highest priorities.

Additional funding must be spent well. The Institute of Medicine and CDC both have provided thoughtful recommendations for programs to allow the nation to recognize and respond better to emerging infectious diseases. The price tag is not all that high. In New York City, funding requirements are clear. The Department of Health needs increased staffing for its surveillance unit in epidemiology activities so that it may conduct routine data collection and perform special studies in outbreak investigations. The department needs to improve the diagnostic capability of its laboratories and increase educational outreach to the medical community and public. It also needs to improve collaborative partnerships across local and federal lines in terms of research, training programs, surveillance, and control. Even if the Department of Health could maintain effective surveillance and implement control and prevention strategies on the local level, it still would need to turn to CDC and the National Institutes of Health at the federal level to maintain disease-specific expertise for national reference laboratories, to conduct and support basic and applied research, and to set national guidelines.

It is extremely unfortunate that, at a time when the need for strong, intact public health activities for infectious disease control has never been more clear, some of our nation's policymakers appear unable or unwilling to respond. At a time when there is a renewed awareness of the importance of basic biomedical research into the science of infectious diseases, some federal budget cutters are threatening to devastate this nation's scientific capacity.

CHALLENGES

The challenges are immense. Three key implications may be drawn from the experience with emerging infectious diseases in New York City.

First, we must do everything we can to prevent further compromises to our public health system. For the services and strategies I and others have recommended to be available on local and national levels, we desperately need a strong, adequately funded, and stable public health infrastructure. The consequences are too costly in terms of loss of life and human suffering. In the current rush to eliminate government involvement in people's lives, we must not forget that some government services are fundamental to the quality of lives we live and our safety; many of these desperately need strengthening.

Second, we must not lose sight of the importance of a global perspective in surveillance and control. This issue is not simply a matter of stemming the suffering, wasted lives and premature deaths caused by infectious disease, if this alone were not motivation enough. As numerous observers from the scientific and government sectors have pointed out repeatedly, our abilities to meet the challenges posed by a global panoply of emerging diseases are really issues of international stability and national security.

The third and final implication is one of hope and necessity. I believe that the necessary degree of social and political will can help us to reach the infectious disease control objectives that will have major impacts on the health and well-being of our citizenry. In the final analysis, we have little choice. The tactics of resourcefulness and persistence that served us well must help us to recognize and control the emerging infectious disease threats, both new and old, that imperil us.

The staggering array of infectious disease risks we will face in the foreseeable future will not go away, nor will our responsibility to the people whose lives these diseases consume.