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Pandemic Influenza and the Globalization of Public Health

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Pandemic Influenza and the Globalization of Public Health

By Zhang Qiong, Karen Eggleston, and Michele Barry

Globalization means a threat to any of the world's peoples is a threat to all the world's peoples. As American journalist Laurie Garrett says in her famous book *The Coming Plague: Newly Emerging Diseases in a World out of Balance*, none of us can escape from a pandemic in our increasingly globalized world. Most of us are active members in prosperous communities, whose daily lives involve interactions with dozens of people of varied backgrounds; even if we were Robinson Crusoes safely living a life of autarky on an isolated island, a fly or bird could bring an avian or swine flu virus to puncture our well-protected balance.

Usually when we talk about globalization, we are referring to economic processes or the development of global institutions; but here we want to say more about the "global village of public health systems" which describes interconnections between individual health risk and the global safety net. We were reminded by SARS how much infectious diseases can influence the global economy. When one can circle the globe in less than the time of incubation of most infectious pathogens, it is clear every single country relies to some extent on the health systems of other countries to prevent and protect their citizens from global health threats. Therefore, creating and maintaining a good health system in one country requires attention to interregional and international cooperation. Domestic and international spheres of public health policies are becoming more intertwined and inseparable.

As one of us (Barry) emphasized in a 2003 address to the American Society of Tropical medicine and Hygiene, the benefits of globalization are potentially enormous and include increased sharing of ideas, cultures, life-saving technologies, infrastructures, and resources to breach disparities and lessen the threat. Yet the unprecedented interconnection and interdependency among human populations also introduces newly shared risks of communicable diseases and accelerates global spread of antibiotic resistance and emerging environmental health hazards. The potential for transportation of infected individuals, pathogens, and antibiotic resistance is staggering; borders are crossed with impunity. Unfortunately, due to national interests or constituency priorities, often research, teaching, surveillance, public health infrastructure, and institutions are not as globally efficient at crossing these borders.

To better understand the relationship between globalization of public health systems, it is instructive to consider the current influenza epidemic and the role of public health systems in effective and responsible responses.

Since early 2009, a novel swine-origin influenza A (H1N1) virus (S-OIV) began to cause illness in humans and spread to multiple parts of the globe. Cases of this influenza were first detected in Mexico; within two months, confirmed and suspected cases of S-OIV appeared in several other countries, especially in North America. As of 06:00 GMT, May 17 2009, 39 countries have officially reported 8480 cases of laboratory-confirmed human cases of influenza A(H1N1) infection, which respectively include 2895 (including 66 deaths) in Mexico; 4714 (including four deaths) in the United States; 496 (including one death) in Canada; and nine (including one death) in Costa Rica. More than 30 other countries have reported laboratory-confirmed cases with no deaths: Argentina (1),

Australia (1), Austria (1), Belgium (4), Brazil (8), China (5), Colombia (11), Cuba (3), Denmark (1), Ecuador (1), El Salvador (4), Finland (2), France (14), Germany (14), Guatemala (3), India (1), Ireland (1), Israel (7), Italy (9), Japan (7), Malaysia (2), Netherlands (3), New Zealand (9), Norway (2), Panama (54), Peru (1), Poland (1), Portugal (1), Republic of Korea (3), Spain (103), Sweden (3), Switzerland (1), Thailand (2), Turkey (1), and the United Kingdom (82).[1] Many countries quickly tightened their visa requirements and took other actions designed to control the epidemic.

S-OIV continues to spread, with recent school closures in Kobe, Japan to help prevent further transmission in that nation. An interactive map showing the location of confirmed and suspected cases of H1N1 influenza from HealthMap is available at http://healthmap.org/nejm. World-wide pandemic response plans have been activated, providing a valuable "test run" of the global health response for future waves of this or other pandemics (such as a possible H5N1 pandemic). Active real-time viral surveillance on a global scale remains imperative.

The H1N1 flu is a clear case of the importance of how globalization has impacted health. Even though the current outbreak seems unlikely to lead to widespread, severe morbidity and mortality, further waves of the outbreak are largely unpredictable. Previous pandemics (such as those in 1918 and 1968) started with a mild wave, followed by more severe waves in succeeding winters. Illness may recur in the Southern Hemisphere during the coming winter or again in the Northern Hemisphere when the traditional influenza season returns.

As Stanford University expert Doug Owens notes, two factors are important in determining the impact of a flu pandemic: the mortality rate in those who are infected, and how easily the virus is transmitted from person to person. In studies that model the impact of flu, the ease of transmission is captured by a parameter known as the reproductive number. The reproductive number represents the number of new infections that occur from each infected person in a completely susceptible population. A reproductive number of two indicates that each person with flu will infect two more people on average, if all the person's contacts are susceptible. In the 1918 flu epidemic, one of the worst on record, the mortality rate among people who were infected was about 2%, and the reproductive number was 1.8 to 2.0. Both the mortality rate and ease of transmission are still uncertain for the 2009 swine flu.

The current S-OIV outbreak and many previous epidemics such as cholera, measles, and SARS test the resilience of our best-laid plans for national public health preparedness and international cooperation. An economy's vitality relies not only on the scale of industry and services, prudent use of resources, and ability to provide security such as through military power, but also on its alacrity of response to natural and man-made disasters. Pandemics pose austere challenges to national and global public health systems; effective responses depend upon global thinking and collaboration. A global health challenge of this sort rests heavily on the work of our scientific and medical community. An investment in global health research should be perceived not just as a matter of national defense but as a global health imperative.

There are several crucial jobs. First, the whole society must have a clear perspective about the disease. International scientific collaboration has already gone a long way towards filling in the blank gaps in knowledge about the virus, its transmission,

[1] http://www.who.int/csr/don/2009_05_17/en/index.html

symptoms, and appropriate clinical care for infected patients. This knowledge should be made available promptly and the recommended actions publicized to the public and to health service providers. Appropriate medical treatment of confirmed patients as well as close inspection of suspected cases are vital. If a vaccine is produced, it needs to be effectively delivered. Hence an effective public health response also relies to a great extent on health care financing and delivery systems in the affected countries and regions.

Over a longer time horizon, we need to foster more international collaboration and basic research at the interface between animals and humans. Indeed, close animal-human interactions have been linked to virtually all outbreaks of emerging viral diseases in the past 20 years, including West Nile, SARS, avian and swine flu, and even Ebola. We need to get the animal husbandry people talking to the medical epidemiologists and scientists. There is a movement now called the "One Health Initiative" focused on having physicians talk to veterinarians (http://www.onehealthinitiative.com/) which has been endorsed by many leading professional organizations.

Four "signature features" of the past three previous influenza pandemics — A/H1N1 from 1918 through 1919, A/H2N2 from 1957 through 1963, and A/H3N2 from 1968 through 1970 — should inform our current response, according to a recent article in the New England Journal of medicine by Mark A. Miller and colleagues. These four features are a shift in the virus subtype, shifts of the highest death rates to younger populations, successive pandemic waves, higher transmissibility than that of seasonal influenza, and differences in impact in different geographic regions.

Pandemic threats can pose difficult ethical questions at the local, national, and global scale. If a vaccine becomes available but, as is likely, with limited supply, whom should we target first? Mark A. Miller and colleagues argue that "the role of preexisting antibodies in the elderly, their reduced immune response…, and greater transmission among children should prompt the targeting of younger age groups as the soundest policy in a 1918-like scenario. However, these attributes do not necessarily apply to other pandemics to the same extent."

We know that an optimal community response to a flu pandemic varies according to the severity of the pandemic, and often involves a mixture of strategies. Several countries, including Mexico at the height of the recent outbreak there, called for extreme changes in daily routine – closures of schools, cancellations of events and other "social distancing", widespread use of masks, and so on – to prevent further spread. To what extent these measures are appropriate depends of course on the circumstances of the outbreak. For example, a recent Stanford study finds that "multilayered mitigation strategies that include adult and child social distancing, use of antivirals and school closure are effective and, for a severe pandemic, cost effective. Choice of mitigation strategy should be driven by the severity of the pandemic, as defined by the case fatality rate and infectivity" (http://healthpolicy.stanford.edu/events/costeffectiveness_of_social_distancing_and_antivirals_for_the_mitigation_of_pandemic_influenza_in_a_us_community/). Deciding on the optimal strategy is far from straightforward, given the complexity and unpredictability of many aspects of a pandemic. In the US in 1976, for example, an H1 influenza virus of swine origin infected soldiers at Fort Dix, New Jersey, and one soldier died. The subsequent efforts to develop a vaccine and vaccinate over 40 million people

proved controversial when it was later shown that the vaccine was associated with increased incidence of Guillain–Barré syndrome.

Who will make the hard decisions about when and how to respond to a pandemic? This is where a robust public health system reveals its value. Unfortunately, population health services are often vulnerable in times of economic crisis; public health functions frequently become victims of budget cutting, leaving the population less protected when an emergency situation does develop.

Let us use the US public health systems as an illustration of how the organization and funding of public health plays such a vital role in global responses to disease outbreaks. But first, what is a public health system? The U.S. Institute of Medicine defines public health as "the efforts, science, art, and approaches used by all sectors of society to assure, maintain, protect, promote, and improve the health of the people." Specific domains include epidemiology, health promotion and education, public health administration, international health, maternal and child health, biostatistics, environmental health, and nutrition. Public health is a web of relationships which serves to assure conditions that result in a healthy public, rather than a single product or service. As Public Health Commissioner Lloyd Novick emphasizes, "the operative components of this definition are that public health efforts are organized and directed to communities rather than to individuals." Furthermore, public health has taken an emphasis on prevention and health promotion, not treatment and cure, and these measures save *statistical* lives and reduce *rates of disease* within populations.

Similar to other public goods, because of their externalities or their scale effects, public health services are mainly financed by taxation, supplied and organized by governments, and are designed to be equally accessible to all residents, regardless of social status.

Public health systems often involve a complex web of national, regional, and local organizations in both the public and private sectors which coordinate with each other and with counterpart organizations in other parts of the world. As Karen Shore notes in "Understanding the United States Public Health System," federal government agencies whose functions pertain directly to population health include not only the Federal Department of Health and Human Services, the U.S. Surgeon General (the head of the U.S. Public Health Service), and the Centers for Disease Control and Prevention (CDC), but multiple other agencies (the Health Resources and Services Administration, National Institutes of Health, Food and Drug Administration, Agency for Healthcare Research and Quality, the Department of Agriculture, the Environmental Protection Agency, the Occupational Safety and Health Administration, the Department of Defense, the Department of Veterans Affairs, and the Department of Homeland Security). Even more important, however, are the approximate 3000 county and city health departments that coordinate public health at the local level.

A public health system needs to raise sufficient funds for citizen health, pool money to spread the financial risks of illness, and ensure that the funds are used effectively, efficiently, and equitably. Even before the financial crisis and this latest epidemic, funding for public health was quite modest as a share of total health spending in the US. For example in 2005 it is estimated that the US spent about $162 per person for population health measures, totaling about $54 billion – a hefty sum of money, but only about 3% of national health spending. These funds came not only from the government

(federal, state, and local), but also from foundations, insurance payments, and patient and regulatory fees.

As Doug Owens has written in the Mercury News, local U.S. public health departments' lack of funding, people, equipment and laboratory capacity pose a threat to our ability to respond adequately to an epidemic. "Our local public health departments decide whether to close schools, whether to stop public events and whether to quarantine individuals. In public health emergencies, such as an influenza epidemic, they would also play a lead role in releasing drugs for treatment and prophylaxis, like Tamiflu, from local and national stockpiles. Unfortunately, the economic downturn and previous inadequate funding have eroded the already poor public health infrastructure.…." Fortunately, the CDC has a well thought out plan for a flu pandemic which will extend guidance to local public health authorities (http://www.cdc.gov/h1n1flu/guidance/).

Nations that invest in public health systems despite economic downturns will find that they are far better equipped to prevent or at least mitigate the health and economic toll of a severe pandemic. Indeed, robust public health systems and basic scientific research are the most important advantages we have over previous generations when confronting historical pandemics, themselves linked to earlier stages of globalization. In "Health in an Age of Globalization," Angus Deaton of Princeton University notes that disease has long been an unwelcome companion of trade and migration. Examples include the Plague of Athens in 430 B.C. that killed perhaps as much as one-third of the population; the infamous bubonic and pneumonic plague in Europe in the 1300s; and the decimation and even eradication of the peoples of Central America and Oceania by European germs. Economists Acemoglu, Johnson, and Robinson have shown how disease shaped colonial institutions and later prosperity: in places where it was unhealthy for colonists to settle, the imperial powers set up extractive (plantation and mining) regimes that led to a "reversal of fortune" and long-run adverse consequences for development. Quarantine measures at times have become methods of discrimination and exclusion, even in the absence of threats to public health.

What have we learned? As Roy Porter notes in his 1997 book on the medical history of humanity, the 1918 influenza pandemic "was the single greatest demographic shock mankind has ever experienced, the most deadly pestilence since the Black Death. Nothing since has struck on such a scale. Is that luck? Or a mark of the effectiveness of the better nutrition, public health measures, vaccines, chemotherapy and antibiotics since developed? It is hard to be sure" (p.484). But one thing is for sure: in this age of globalization, the health of people around the globe is shaped by the public health investments made by each country. China's investments in improved population health service coverage (as announced in the recent health reform plan, http://www.gov.cn/jrzg/2009-04/06/content_1278735.htm) will benefit the Chinese people and others around the globe, and help to prepare for coping with future pandemics.

In sum, the current S-OIV pandemic reminds us of four important facts. First, we are all interdependent. Just as for the financial crisis and global warming, actions on one part of the globe have ripple effects that can become tsunamis affecting all. We must do our best to understand what a pandemic is and how we as individuals, communities, and nations should respond. For even if S-OIV does not prove to have multiple deadly waves, the probability of pandemic influenza occurring is virtually 100%, according to Michael

T. Osterholm of University of Minnesota, an expert on pandemics; the question is only when it will happen and how effectively the global public health system will respond.

Second, these events remind us that health policies in other parts of the world – investments in diseases prevention, surveillance, immunization and other public health services, risk pooling (insurance) and service delivery, and so on -- impact our own health and well-being. Supporting effective health systems in developing countries, and in the poor and vulnerable sections of our own middle- and higher-income countries, is not just ethically appropriate but in our own long-run self interest.

Third, even in this age of high tech solutions, simple steps can go a long way: frequent hand washing; adequate sleep, nutrition, and exercise; coughing into a sleeve or tissue, not into hands or toward others; if sick, staying home or seeking care rather than going to work or school. These measures are state-of-the-art for responsible community response as well as old-fashioned common sense.

Finally, the high-level attention and media coverage reminds those of us who work in health policy how many "silent killers" -- from seasonal influenza to dirty water, lack of sanitation, TB, malaria, tobacco use, and others -- lead to large daily tolls of death around the globe that fail to inspire headlines anymore (if they ever did). But the populations ravaged by under-nutrition and compromised immune systems are often precisely those most vulnerable to pandemics. Let us not forget the death and suffering from these other causes, even as we remain alert in the global effort to respond appropriately to an influenza pandemic.

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