Global Surveillance of Communicable Diseases

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Globalization and Health: The Need for Global Surveillance

A recent report of A/Sydney/05/97-like (H3N2) influenza on a cruise ship from New York to Montreal demonstrates the ease with which communicable diseases can be transferred across international borders (1). In this outbreak 2.7% of passengers and 0.5% of crew had acute febrile respiratory illness during or after the cruise and introduced this antigenic variant of influenza A into both Canada and the United States.

Other viral infections and parasitic diseases are also associated with population movements. During 1996, fatal yellow fever infections were imported into the United States and Switzerland by tourists who traveled to yellow fever–endemic areas without yellow fever vaccination (2,3). During the same year approximately 10,000 cases of malaria were imported into the European Community, one fourth of them from the United Kingdom (4). Had mosquito vectors been present, these diseases could have set up endemic cycles. Misdiagnosed by an unsuspecting health worker, they could have been fatal.

Bacterial infections such as meningococcal meningitis and cholera are also spread with ease by international travelers. Among the pilgrims for the Haj in 1987, 7.7 per 100,000 returned to their countries of origin with meningitis (5). Cholera, often associated with religious pilgrimage and movement of refugees, resulted in 70,000 cases and a 22% fatality rate in 1995 among recently arrived Rwandese refugees in Goma, Democratic Republic of the Congo (formerly Zaire) (6). Rickettsial diseases such as louse-borne typhus have also recently caused illness and death among refugee and prison populations of Burundi and Rwanda (7,8).

Population movement is only part of the globalization fallout. Expansion in international travel and commerce in food and medicinal biologic products provides another potential source of communicable diseases such as hepatitis and other bloodborne infections. Social and environmental changes linked to urbanization, mobility, and deforestation have created new opportunities for infection, while rapid adaptation of microorganisms has facilitated the return of old communicable diseases and the emergence of new ones. With the rapid evolution of antimicrobial resistance, treatments for a wide range of parasitic, bacterial, and viral infections have become less effective. Today, a communicable disease in one country is a global concern.

In industrialized countries, where deaths due to communicable diseases have greatly decreased over the past century, the concern is to prevent diseases from entering and causing an outbreak or reemergence. In developing countries, the concern is to detect communicable disease outbreaks early and to stop their mortality, spread, and potential harm to trade and tourism. When cholera entered Peru in 1991, it spread through the existing sanitation and water systems, causing more than 3,000 deaths (9). Seafood export embargoes and decreased tourism cost an estimated loss of US$770 million to the Peruvian economy in 1 year. Negative economic impact can also occur in the more robust industrialized economies, the most recent example being bovine spongiform encephalopathy and the new variant of Creutzfeldt-Jakob disease in the United Kingdom.

Concerns about communicable diseases in both industrialized and developing countries can best be addressed through strong surveillance systems, renewed commitment to public health, and strong international partnerships to strengthen national and international cooperation in communicable disease prevention and control. In view of the disparity among national surveillance systems, partnerships in global surveillance are a logical starting point in this area of common commitment.

Global Surveillance: An Essential Public Health Instrument

With globalization, strengthened communicable disease surveillance at the global level has become an essential public health instrument. In addition to providing necessary information for monitoring communicable diseases and evaluating control measures, global surveillance serves as an early warning system for epidemics and provides the rationale for public health intervention. Early detection of communicable diseases and immediate public health intervention can curtail the numbers of communicable illnesses and deaths and negative effects on international travel and trade. At the close of the 20th century, which has seen the affairs of all countries become ever more intertwined, global communicable disease surveillance and response is a decisive element in controlling communicable disease.

Global surveillance provides health advice for international travelers and guidance to those involved in international transport and trade, including the food, plant, animal, and animal products industries. At the same time, it supplies crucial data to support the Biological Weapons Convention and to prevent or anticipate bioterrorism. To be effective, global surveillance must be free of, and be perceived as free of, political bias. Global surveillance requires a neutral reporting and response environment, and the World Health Organization (WHO) is strengthening the framework within which it can be fostered.

Global Networking

Formal Sources of Information

Government and university centers such as the U.S. Centers for Disease Control and Prevention, the U.K. Public Health Laboratory Service, the French Instituts Pasteur, the global network of schools of public health, and the Training in Epidemiology and Public Health Intervention Network (TEPHINET) provide confirmed reports of communicable diseases. Most of these sites are or will become part of the WHO Collaborating Centre network. This network, as well as the WHO Regional Offices, WHO country representatives, and other WHO and UNAIDS reporting sites, contributes to global surveillance along with reporting networks of other United Nations agencies such as the United Nations High Commissioner for Refugees and the United Nations Children's Fund. International military networks such as the U.S. Department of Defense Global Emerging Infections System, private clinics, individual scientists, and public health practitioners complete the network of formal information sources.

Geographic gaps and deficiencies in expertise in these networks must be rectified. These networks must develop means of including the private sector as well as other sources of valid information such as military and research laboratories. They must represent both human and animal infections and provide information on antimicrobial resistance and the environment, including water, insect vectors, and animal reservoirs.

Informal Sources of Information

Telecommunications, media and Internet access, and rapid information exchange across the globe permit public health professionals around the world to communicate more effectively. Many groups, including health professionals, nongovernmental organizations, and the general public, have access to reports on disease outbreaks, challenging national disease surveillance authorities, which were once the sole source of such information. Public Internet sites are dedicated to disease news and include sites for medicine and biology as well as major news agencies and wire services.

Such electronic discussion sites, accessible through free and unrestricted subscription, are valuable sources of information. Their scope may be worldwide (ProMed, TravelMed), regional (PACNET in the Pacific region), or national (Sentiweb in France). They exemplify unprecedented potential for increasing public awareness on public health issues.

The Global Public Health Information Network is a second generation electronic surveillance system developed and maintained by Health Canada. Its powerful search engines actively crawl the World-Wide Web looking for reports of communicable diseases and communicable disease syndromes in electronic discussion groups, news wires, and elsewhere. Searches are in English and French and will eventually expand to all official languages of the WHO, to which it has created close links for verification.

Other network sources for communicable disease reporting include nongovernmental organizations such as the Red Cross and Crescent societies, Médecins sans Frontières, and Medical Emergency Relief International (Merlin), and Christian religious organizations such as the Catholic and Protestant mission networks.

Legally Mandated Sources of Information

The International Health Regulations (IHR) are a legal instrument that requires WHO member states to report diseases of international importance: currently plague, cholera, and yellow fever. Countries have not uniformly complied, often fearing unwarranted reactions that affect travel and trade. In addition, the official international reporting mechanism has not evolved with the new communications environment and does not include many communicable diseases of importance to international public health. A revision of IHR is therefore being directed toward a stronger role in global communicable disease surveillance and control. Currently being evaluated in a pilot study in 21 countries, the revised IHR emphasizes immediate notification of all disease outbreaks of urgent international importance. Electronic reporting of specific clinical syndromes of importance to public health will help countries report immediately, facilitating rapid alert and appropriate international response while awaiting laboratory verification. Once the diagnosis is confirmed, it will also be fed into the system, permitting any necessary adjustments to the international response. When the revision is complete, IHR will constitute an important public health tool as a source of information linked to an appropriate international response.

Pulling the Networks Together: Exchange and Verification of Global Surveillance Information

A neutral environment, internationally accepted surveillance standards and norms, and wider use of modern communication tools is required to bring all these networks into a global surveillance system—a true "network of networks." The network has been developed together with the 191 WHO member states and other partners, including the European Union-U.S. Task Force on Emerging Communicable Diseases and the U.S.-Japan Common Agenda and has been cited as an area of collaboration by the G-7/G-8 member countries at both the Lyon (1996) and the Denver (1997) Summit Meetings. Requirements for monitoring the intentional use of pathogenic microbes have also been addressed in the network, specifically in the revision of the IHR, in collaboration with the ad hoc Group of States Parties to the Biological Weapons Convention.

Nonverified information about communicable diseases coming from within the networks, including that from IHR, requires rapid verification from multiple sources other than the originator. Such "disease intelligence" requires information management skills, knowledge of field conditions, and commonly used, standardized medical language compatible with modern communication technology. WHO has therefore created an electronic verification system based on its internationally accepted norms and standards. This user-friendly system consists of an electronic repository for ready information access, regular electronic communication with network members, and a tracking and follow-up mechanism to verify each piece of information.

The power of the verification system is its network of contributors, which includes official government channels and all participating networks. Electronic mail provides immediate follow-up with easy-to-archive responses at low cost. Communications keep the focus on diseases with international implications to avoid information overload. The criteria used to determine international implication include suddenness of onset, illness and death, potential for international spread, and likely effects on international travel and trade. Timely sharing of relevant information strengthens networking and contributes to common awareness of current events, thus increasing international preparedness.

Epidemic Preparedness and Response

Once a communicable disease outbreak has been confirmed, pertinent information is placed on the World Wide Web, available to the general public. At the same time, an international response including technical and humanitarian partners is mounted if required. A WHO team arrives on site within 24 hours of outbreak confirmation to make an initial assessment and begin immediate control measures and prepare the ground for the larger international response if needed. By linking the international response to systematic global surveillance, a worldwide "network of networks" is available from which to solicit support, thus ensuring that no one country, technical, or humanitarian partner must bear the entire burden.

How It Works in Practice: Global Influenza Surveillance

Influenza surveillance, one of the most developed global surveillance and monitoring systems of WHO, started in 1948 and developed over the years into a highly successful global partnership. The network now involves 110 collaborating laboratories in 82 countries, constantly monitoring locally isolated influenza viruses and providing information on true emergence and spread of different strains.

National case detection systems and laboratories have been strengthened using internationally accepted norms; virus isolates from national laboratories are analyzed in more detail in one of the four WHO Collaborating Centers for Influenza. The data are then used by experts associated with the surveillance system to make recommendations on the three virus strains to be included in the next season's influenza vaccine. Thus, information generated from global surveillance results in an important and unified public health response each year. The annual design of the vaccine also represents outstandingly successful collaboration between the public and private sectors.

In parallel to the surveillance program, national and global plans are being developed to systematically address the next influenza pandemic. Both the surveillance system and the elements of the global pandemic plan were tested during the outbreak of the avian influenza A(H5N1) virus in humans in Hong Kong in late 1997. The rapid identification of the virus strain in one of the collaborating laboratories in the Netherlands, mobilization and coordination of an investigating team from WHO Collaborating Centers in the United States, extensive epidemiologic and laboratory studies, prompt dissemination of public information, development of diagnostic test kits for international distribution, and identification of a virus line suitable for vaccine development, all contributed to a timely, ordered, and effective response to the outbreak.

WHO will celebrate the 50th anniversary of global influenza surveillance with a meeting bringing together participants from the national influenza laboratories and WHO Collaborating Centers and other experts. Participants will look back over past successes and lessons learned and ahead to needs for improved surveillance and control of influenza in the 21st century, including research priorities. The success of the global influenza program can serve as a model for the continued development and strengthening of international collaboration in the surveillance and control of other communicable diseases.

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