

Global Alert and Response Against Emerging and Reemerging Infectious Diseases –an Overview–

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Abstract

Emerging and re-emerging infectious diseases, in addition to accidental or deliberate release of biological agents, are a major threat to human health. In response to the Severe Acute Respiratory Syndrome (SARS) epidemic in 2003 in particular, international and bilateral (country-to-country) systems against those threats were strengthened rapidly. The implementation of the International Health Regulations (IHR) is one of the central concepts in mankind's fight against those threats. Under the IHR, national core capacities including surveillance, response and issuance on port of entry are described as the major targets for the countries to assess and develop in order to fulfill the goals of the IHR in a certain period of time. The Global Outbreak Alert and Response Network (GOARN) is a coordinated mechanism for rapid assessment and response to the occurrence of outbreaks of international concern. The Field Epidemiology Training Program (FETP) is a newer program for many countries for building up their competency to investigate and contain outbreaks. In some countries, the program is also a part of GOARN. Harmonized rapid development of those systems within each country and internationally is becoming more important and necessary for the world's citizens in the 21st century.

Key words: FETP, GOARN, international concern, outbreak, the IHR

1. Introduction

Infectious diseases have been a significant threat to human beings for ages. Throughout history, the human population has experienced major outbreaks of infectious diseases, often accompanied by large numbers of deaths, panic, disruption of trade and political instability. When disease spreads rapidly in newly affected populations, higher morbidity and mortality are marked. Modern scientists have successfully identified pieces of genomes from bacteria and viruses in the human genome. It probably reflects an unseen history in which mankind has been fighting against them to survive in severe circumstances on Earth with abundant biological diversity.

After World War II, through the development and use of antibiotics including anti-viral drugs, it was once believed that humans could overcome the threat of infectious disease. However, the fact is that, in recent years, we see the appearance of diseases caused by newly emerging or even known infectious pathogens once believed to be controlled. The WHO (World Health Organization) (2007a) defines emerging and re-emerging infectious diseases as:

– diseases that have newly appeared in a population;

– diseases that have existed in the past, but are rapidly increasing in incidence or geographical range.

Pathogens discovered after the middle of the 1970s are historically called emerging infectious diseases (EID) or re-emerging infectious diseases (REID). Following the outbreaks of hemorrhagic fever in Africa in the middle of the 1990s, and especially with the appearance of Severe Acute Respiratory Syndrome (SARS) between 2002 and 2004, international society has been strengthening its response against EID and REID. Recently strong efforts have been made toward response and preparedness to avian influenza A (H5N1) as a threat of an influenza pandemic. At the present time, the world also faces the risk of outbreaks by accidental or deliberate release of biological agents into human and or animal populations, so-called bio-terrorism. EID, REID and bio-terrorism are three events which exhibit similar features and require a special system for detection and intervention.

2. International Action to Contain Outbreaks

As the tools of transportation and communication are developed, it becomes clearer that helping other countries deal with outbreaks reduces the threat of outbreaks

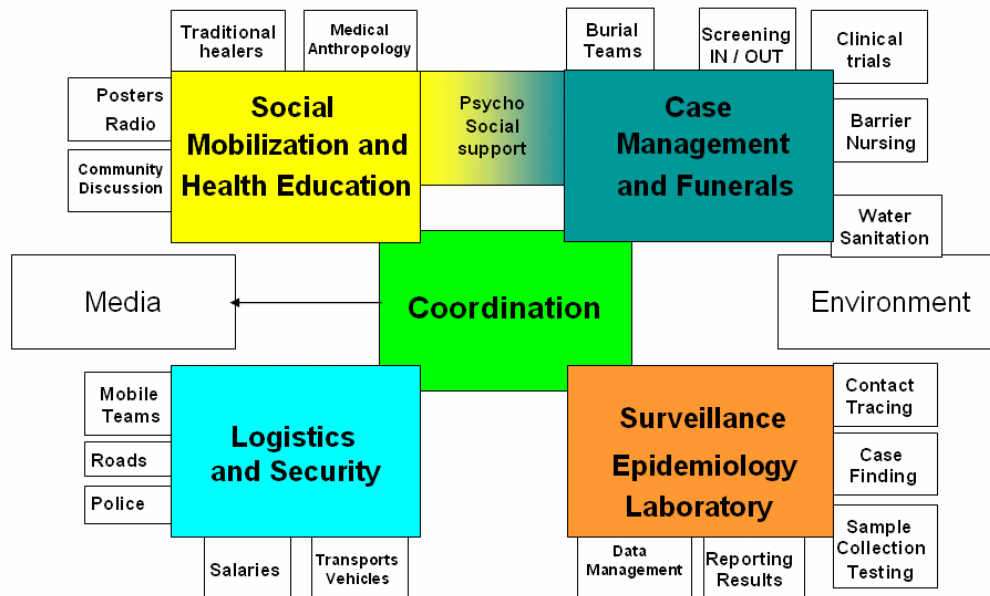


Fig. 1 Field operations and functions in outbreaks. (Source: WHO)

spreading internationally (WHO, 2000). Many countries offer bilateral assistance to countries affected by outbreaks. It is sometimes very effective when the support is comprehensive and continuous to the affected country. Sometimes in countries facing problems of conflicts or natural disasters including disease outbreaks, non-governmental organizations (NGOs) work on the frontlines to assist countries through medical care, vaccination, provision of water sanitation and social mobilization. The support by NGOs is mostly a humanitarian approach capable of covering part of the intervention. International bodies have also been involved in fighting against outbreaks for a long time. The function of outbreak response is getting complicated and fragmented. A number of international networks for specific disease threats have been established. The role of international organizations such as the WHO is now more focused on coordination to help diverse partners collaborate effectively, rather than in direct intervention (Fig. 1). The IHR is a concept for timely sharing of information and rapidly responding to threats internationally. GOARN is a coordinated mechanism for providing professional tools and human resources to contain outbreaks.

2.1 IHR2005

The International Health Regulations (IHR) (Fig. 2) entered into force on 15 June 2007. According to the WHO, the IHR are an international “legal” instrument (Baker & Fidler, 2006) that is binding in 194 countries (as of end of March 2008) across the globe, including all the Member States of the WHO. Their aim is to help international society prevent and respond to acute public health risks that have the potential to go across national borders and threaten people around the world. In fact, outbreak threats are chiefly seen as coming from outside,



Fig. 2 The cover of “International Health Regulations (2005)” book. (Source: WHO)

beyond city or national borders. The IHR target not only infectious diseases but also chemical events (*e.g.*, chemical leakage), nuclear melt-downs or whatever is recognizable as a Public Health Emergency of International Concern (PHEIC). In Annex 2 of the IHR, a decision instrument on infectious diseases is described primarily for the assessment and notification of events that may constitute a PHEIC. The summary is shown in Fig.3. There are four criteria to consider in deciding whether or not the event might constitute a PHEIC; 1) Is the public health impact of the event serious? 2) Is the event unusual or unexpected? 3) Is there a significant risk for international spread? 4) Is there a significant risk for restriction of international travel or trade? Based on the assessment on their own, countries are required to

report certain disease outbreaks and public health events to the WHO under the IHR. The WHO indicates that the IHR defines the rights and obligations of countries to report public health events.

Another aspect of the IHR is related to national core capacity building, especially regarding surveillance and outbreak response. Minimum core capacity at points of entry is included, too. Countries have to assess their national systems and resources and to develop plans of action to ensure that core capacities are present and functioning. However, the level of existing capacity and the need for further actions vary from country to country. Prioritization of core capacity-building and the WHO's support/advice are mandatory. In Japan, some research is ongoing regarding IHR implementation and preparedness.

2.2 Epidemic Alerts and Verification

The process of global disease surveillance, which was initiated in 1997 by the WHO, involves the systematic collection and collation of information, including

both official information and rumors, from many different sources, such as countries' ministries of health, other United Nations organizations, mass media and personal communications (WHO, 2006). As a source of information, outbreak verification relies on a broad range of information sources including the Global Public Health Information Network (GPHIN) which is a web-based electronic system developed by Health Canada in collaboration with the WHO which scans the web in varieties of languages to identify suspected outbreaks. The four above criteria nominated as decision instruments in Annex 2 of the IHR, have been established to identify events that may constitute an international public health risk. If the event is assessed as being a potential public health risk of international concern, then verification and further information are sought from the affected country. Verified events undergo continuous risk assessment and monitoring to assess the need for further information and response. The aim of this process, "epidemic alert and verification," is to improve epidemic disease control by actively collecting and

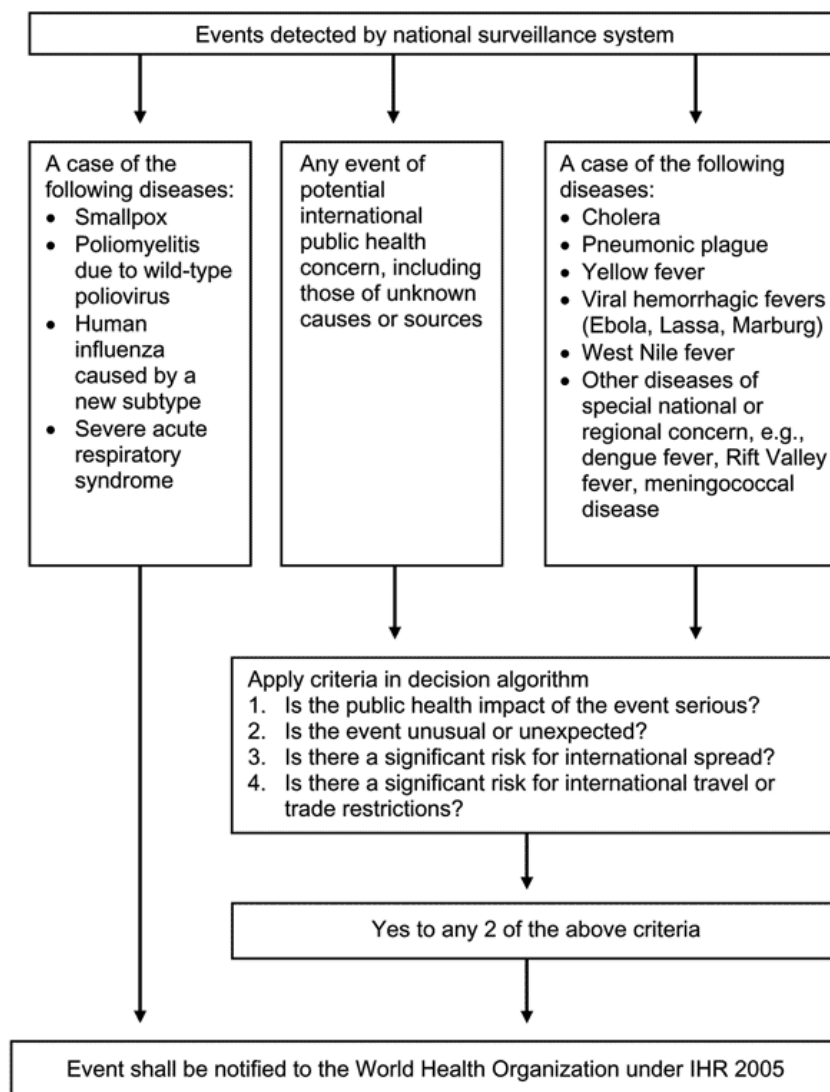


Fig. 3 Decision instrument. (simplified from Annex 2 of the International Health Regulations (2005)) (Baker & Fidler, 2006)

verifying information on reported outbreaks and informing key public health professionals in the world about outbreaks (WHO, 2006). Since the implementation of the IHR in June 2007, the WHO has shared all information regarding the current public health risks of international concern with its Member States through their National Focal Points (NFPs) designated by the IHR.

The results of a recent Epidemic Alert and Verification situation, which occurred in around 2006, are summarized by the WHO (WHO, 2007b). In 2006, WHO identified 279 events primarily associated with epidemic-prone diseases. Investigations were successfully completed in 246 (88%) of these events; 71% (197 events) of them were verified as being a potential risk to international health security and 18% were determined to be of no international concern. Twelve percent remained unverified. Of the 197 verified events, 37 (19%) were attributed to cholera or acute watery diarrhoeal syndrome, 30 (15%) to influenza (non-H5N1) or acute respiratory syndrome, 23 (12%) to Meningococcal diseases and 7 (4%) to influenza A (H5N1). Other common syndromes or diseases include acute diarrhoeal syndrome, measles, acute haemorrhagic fever syndrome, malaria, poliomyelitis, chikungunya, dengue fever and yellow fever.

Some countries are also conducting Epidemic Alert and Verification activity (personal communication). Applications using other languages to scan web-based information including those in Asia are now being developed.

2.3 GOARN

GOARN, the Global Outbreak Alert and Response Network, is a coordinated mechanism for rapid identification, confirmation and response to outbreaks of international concern through technical collaboration among existing institutions and networks. According to GOARN's website (WHO, 2008), its objectives are described as:

- combating the international spread of outbreaks,
- ensuring that appropriate technical assistance reaches affected states rapidly and
- contributing to long-term epidemic preparedness and capacity building.

It started officially in 2000 through a coordination of the WHO in an outbreak response. One of the earliest examples of dispatch by GOARN to the field was during an outbreak of Ebola hemorrhagic fever in Uganda in 2000 (WHO, 2001). The outbreak was contained by getting technical support from 104 specialists (23 partner institutes) and financial support from many countries and organizations. GOARN's partners include scientific institutions in Member States, medical and surveillance initiatives, regional technical networks, networks of laboratories, United Nations organizations (e.g., UNICEF, UNHCR), the Red Cross and international humanitarian NGOs (e.g., Médecins sans Frontières, International Rescue Committee, Merlin and Epicentre). In Japan, the National Institute of Infectious

Diseases (NIID) is one of the partners of GOARN. GOARN has been discussing and bringing agreed standards to international epidemic response through the development of the Guiding Principles for International Outbreak Alert and Response and operational protocols. They will include laboratory, clinical management, research, communications, logistic support, security, evacuation and communications systems. In an article published by the WHO in 2000, an outline of the function of these networks was briefly illustrated (Fig. 4).

When SARS outbreaks occurred in Asia in 2003, GOARN requested partner institutions to dispatch field epidemiologists to the fields. For example in Hong Kong, epidemiologists were gathered from multiple countries such as the United States, Australia and Japan. Two were sent from Field Epidemiology Training Program (FETP) in Japan. One of the important activities for them was to summarize a descriptive epidemiology at an early stage of the outbreak. The investigation included interviews with patients, analysis of epidemiological information and observational studies where outbreaks occurred (Fig. 5).

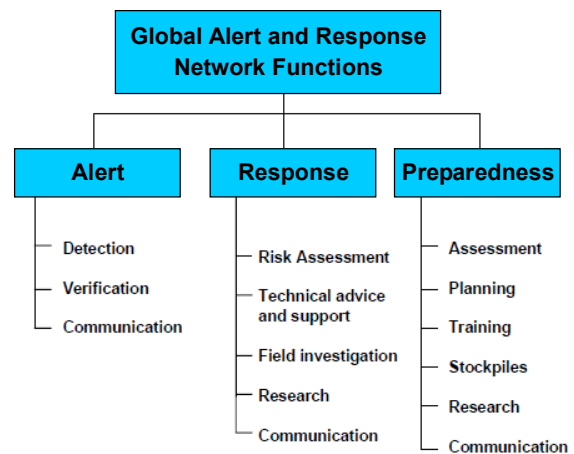


Fig. 4 Possible functions of Global Outbreak Alert and Response Network. (WHO, 2000)



Fig. 5 A view from the corridor of "Apartment A" on the 16th floor, where many SARS cases were reported in Hong Kong. (April 2003, photo by T. Sunagawa)



Fig. 6 TEPHINET member programs of the world. (TEPHINET, 2008)

2.4 Field Epidemiology Training Program

The Field Epidemiology Training Programs in each country formulate a global network which is called the Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET, 2008). It was incorporated in 1999 as a non-profit organization with the aim of strengthening international public health capacity through the support and networking of field-based training programs. This network comprises 32 countries as of end of March 2008 and is expanding year by year (Fig. 6). In particular under the IHR, every country needs at least a minimum core capacity in epidemiology for evaluating their health promotion and disease control programs and monitoring progress towards achieving program goals, which will contribute to global alerts and responses to emerging and reemerging infectious diseases. Many programs are located among the institutions of the GOARN partners. The primary goal of these training programs is to foster the development of field-trained epidemiologists who are competent in the practical application of epidemiological methods to a wide range of public health problems in their respective areas. There are various models of field-based training programs in the world. All of them are programs based on training through service and are adapted to meet the health needs of the country or area in which they function.

3. Conclusion and Discussion

Response to infectious diseases is often like that to disasters. Preparation is most important. Many countries have started preparing for effective implementation of the IHR. A few countries have developed and implemented work plans for strengthening their core capacity for EID and REID. For many countries, it seems that awareness of the importance of the IHR is still important and needed. Multisectoral workshops for advocacy and administrative arrangements have to be planned and conducted. In order to achieve effective implementation of the IHR, assessment of national core (minimum) capacity is an essential first step and should now be ongoing in countries. The level of existing capacity and the need for future actions vary by country. Even for

industrialized countries including Japan, the capacity for response to EID and REID is not always sufficient and participation in global networks is crucial. GOARN is an international coordinated mechanism for response to EID and REID. Standardized competency of the partner institutions in each field will be important. FETP is a possible mechanism for most of the countries to collaborate easily with other programs with a similar level of capacity because of its standardized training world over. For some countries such as Japan where there already exists a strong laboratory capacity, there is also a need to strengthen field epidemiology programs. In order to respond effectively and efficiently against EID and REID at a global level, international collaboration based on harmonized development of the necessary functions under the IHR in each country will be necessary.

References

- Baker, M.G. and D.P. Fidler (2006) Global Public Health Surveillance under New International Health Regulations. *Emerging Infectious Diseases*, 12(7): 1058-1065. Available at <http://www.cdc.gov/ncidod/Eid/vol12no07/05-1497.htm>
- TEPHINET (2008) Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET). Available at <http://www.tephinet.org/>
- WHO (2000) A Framework for Global Outbreak Alert and Response. Available at [WHO/CDS/CSR/ISR/2000.2](http://www.who.int/csr/2000.2)
- WHO (2001) Outbreak of Ebola Hemorrhagic fever in Uganda, August 2000-January 2001. *Weekly Epidemiological Record* 2001, 76: 41-46
- WHO (2006) Epidemic alert and verification: summary report 2005. *Weekly Epidemiological Record*, 81: 357-364. Available at <http://www.who.int/wer/2006/wer8138/en/index.html>
- WHO (2007a) International travel and health Situation as on 1 January 2007
- WHO (2007b) Epidemic alert and verification: summary report 2006. *Weekly Epidemiological Record*, 82: 105-116. Available at <http://www.who.int/wer/2007/wer8213/en/index.html>
- WHO (2008) Global Outbreak Alert & Response Network. Available at <http://www.who.int/csr/outbreaknetwork/en/>



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Tomimasa SUNAGAWA graduated from the University of the Ryukyus School of Medicine in 1991 and served at the US Naval Hospital in Okinawa. In 1993, he joined the Pediatric Department at the Osaka Graduate School of Medicine where he earned his doctorate in 1998. In September 1999, he joined the Field Epidemiologist Training Program (FETP) in National Institute of Infectious Diseases (NIID). He became a senior researcher at Infectious Disease Surveillance Center in NIID from November 2002, where he investigated Severe Acute Respiratory Syndrome (SARS) in 2003 and Avian Influenza in 2004. From August 2004, he was given a short to long-term appointment to the WHO/EPR Division, returning to NIID in June 2007. Since then, he has been working mainly for FETP program, national measles elimination plan, and pandemic influenza preparedness in Japan.