

GUEST EDITORIAL

PUBLIC HEALTH MANAGEMENT OF INFECTIOUS DISEASES: RISK ASSESSMENT AND EVENT MANAGEMENT

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THE THREATS OF INFECTIOUS DISEASES

The major threats related to infectious diseases (IDs) have not changed substantially over the years¹. These include antimicrobial resistance, healthcare-associated infections, vaccine-preventable diseases, respiratory tract infections and HIV infection².

The main threats of IDs however, come from diseases prone or capable of causing outbreaks that may affect general population, especially those with high mortality³. Previous outbreaks of plague, SARS, and other bacterial origins such as cholera, anthrax and leptospirosis, viral origins such as measles, dengue hepatitis or chikungunya or parasitic origins such as malaria and kala-azar had caused great misery to the affected nations and stretched the health services. Along the way, it created awareness, forced the responsible agencies to implement policies and upgrade laboratory services. The following highlights extracted from WHO statistics are examples of updates on IDs of public health concern.

Pandemic H1N1 in 2009 is the latest infectious disease (ID) celebrity, if we may say so. As of 4 July 2010, more than 214 countries, territories and communities worldwide have reported laboratory confirmed cases of pandemic influenza H1N1 2009, with over 18311 deaths. Although the overall pandemic influenza activity remains low worldwide, active circulation of pandemic influenza virus persists in areas of the tropics, particularly in South and Southeast Asia, the Caribbean and West Africa. Overall, pandemic influenza activity remains low to sporadic, except in parts of India, Malaysia, and Singapore.

The number of death is still considered an underestimate because many deaths were never tested or recognized as influenza related. Some places might not have the facilities or ability to do so. Nevertheless, the reported mortality as shown by the statistics from WHO (Table 1) is definitely more than alarming to render serious and urgent interventions by the respective authorities.

Table 1. Deaths due to H1N1 by WHO Regional Offices

WHO Regional Office	No of Deaths
Africa (AFRO)	168
The Americas (AMRO)	At least 8516
The Eastern Mediterranean (EMRO)	1019
Europe (EURO)	At least 4879
South-East Asia (SEARO)	1883
The Western Pacific (WPRO)	1846
Total	At least 18311

Source: WHO Pandemic (H1N1) 2009 - update 108

In Indonesia, the Ministry of Health has announced a new death of human infection of H5N1 avian influenza, a 34-year-old female from South Jakarta District, who died 8 days after she developed the symptoms. Of the 166 cases

confirmed to date in Indonesia, 137 have been fatal.

In the Republic of Congo, blood samples taken from one of the suspected cases of Acute Haemorrhagic Fever (2 July 2010) tested

negative for several viral haemorrhagic fevers - Ebola, Marburg, CCHF and Arenavirus. Additional laboratory investigations are ongoing. The negative laboratory tests, however, do not exclude that an acute haemorrhagic fever outbreak has occurred, or is still ongoing. More than 40 people who have had direct contact with the suspected cases will continue to be monitored for a period of 21 days from the last date of their exposure, 19 June 2010.

Though seldom discussed openly, bioterrorism is an emerging public health and infection threat⁴. Potential biological agents include smallpox, anthrax, plague, botulinum toxin, brucellosis, Q fever and haemorrhagic fever, just to mention a few.

Framework for Global Outbreak Alert and Response (GAR), established by WHO to detect, verify and respond to outbreaks of international importance efficiently and effectively, should be activated at national and state levels as well⁵. The underlying principles that govern the effectiveness of this network are strong partnership of existing technical institutions and networks, effective coordination of partners for alert and response, rapid communication of information, rapid and efficient mobilization of technical support to contain outbreaks and assist the affected state(s) and follow-up activities in affected state(s) to improve preparedness. Translating GAR into local needs must not be limited to developing standardized approaches for readiness and response to major epidemic-prone diseases (e.g. meningitis, yellow fever, plague), but also strengthening biosafety and biosecurity and readiness for outbreaks of dangerous and emerging pathogens outbreaks (e.g. SARS, viral haemorrhagic fevers), as well as reducing biorisks.

INFECTIOUS DISEASES: BEYOND THE THRESHOLD

Outbreaks of IDs are sometimes inevitable, and often unpredictable⁶. The impact and uncertainty on how devastating can outbreaks of IDs be always causes panic, confusion and sense of urgency among the public⁷. Appropriate management strategies that include laboratory analyses, epidemiological evidences and outbreak communication are then required to enhance public resilience and participation in the containment of an outbreak which may limit morbidity and mortality⁸.

Communication, generally through the media, is an important feature of the outbreak management⁸. Unfortunately, examples abound

of communication failures which have delayed outbreak control, undermined public trust and compliance, and unnecessarily prolonged economic, social and political turmoil.

MANAGING INFECTIOUS DISEASES: EVENT MANAGEMENT AND SUSTAINABILITY

Managing, controlling and preventing the occurrence, importation and spread of IDs are the oldest organised public health activities recorded⁹. The role of public health physicians (PHP) in managing IDs of national scale is well recognized but seldom appreciated. Although this situation is being reversed in most developed countries, it still hold true in many developing and less developed nations. Under routine services, two professionals feature permanently in managing IDs, the attending clinicians and microbiologists / virologists¹⁰. Public health physicians (including epidemiologists) will be added to the picture only when there are outbreaks of IDs, mainly to carry out activities in support of the decisions made by clinicians and microbiologists or virologists during the process of disease containment.

Management of IDs involves prompt empirical treatment and definite diagnosis that allow focused therapy. To deal with outbreaks, an outbreak management system (OMS) supported by public health information network is needed. Perhaps it is not too late for the PHP to start play a more prominent role in the management of IDs especially those with high risk of causing outbreaks. As a matter of fact, the role of PHP, directly or indirectly had been detailed out in The International Health Regulations (2005) or "IHR (2005)" which have been in force since 15 June 2007. The IHR (2005) provides a framework for WHO epidemic alert and rapid response activities already being implemented in collaboration with countries to control international outbreaks and to strengthen international public health security. It introduces new operational concepts that include specific procedures for disease surveillance, notification and reporting of public health events, verification of public health events, rapid collaborative risk assessment and comprehensive event management for international outbreak alert and response.

The event management system (EMS) generates a dynamic picture of alert and response operations and provides information for action in a systematic way. The EMS features comprehensive databases on epidemic intelligence, verification status, laboratory investigation and operational

information that allow tracking and recording of outbreak history and other key documents. The event management process adheres to the principles of consistency, timeliness, technical excellence, transparency and accountability. All the above are done through systematic event detection, event verification, real time alert, coordinated rapid outbreak response and outbreak logistics response.

RISK ASSESSMENT IN MANAGEMENT OF INFECTIOUS DISEASES

Management of IDs in public health ideally should begin with “disease prevention” and end with “disease prevented”. The small window period between the presentation of the disease and the beginning of outbreaks stress the importance of having surveillance and risk assessment continuously irrespective of the threats.

Risk assessment is the process of evaluating the probability and consequences of injury or illness arising from exposure to identified hazards. It is an iterative process that continues from the time the event is first detected to the time the event is “closed”. Once the aetiology of the event is known, further refinement of the risk assessment specific to the hazard or disease may be required.

The outcome of Risk Assessment supports one or more of the following actions at any point in time:

- Discard - No risk, close the event, document the assessment in EMS.
- Monitor - The event is currently of no public health importance but requires continuous assessment.
- Assist - Provision of technical assistance is required, or likely to be required.
- Disseminate - event information to the community to prepare for or prevent similar events in future.
- Escalate - reporting to senior management for action and intervention.

The process of ID risk assessment may begin with analyses of existing data to gauge both the likelihood and the impact of communicable diseases. Assessing risk is critical to identify priority interventions, to inform health planning, and to contribute to the reduction of morbidity and mortality in the affected populations.

Since the potential for transmission of IDs is influenced by a complex interplay of host, agent and environment, to accurately defining risk requires a careful consideration of the potential interactions of all three factors within the

specific context of the area and population. Systematic review of multiple sources of data (including existing data on notified outbreaks and other events or natural disaster, e.g. earthquake, flooding, tsunami etc.), can provide real-time analysis of event, threats and risk. These will enable identification and quantification of key ID risks and interventions. All potential data sources that include the Ministry of Health, WHO communicable disease epidemiological data summaries, WHO databases such as EMS, EPI summaries, WER, or WHO global atlas database, UNAIDS, tuberculosis control annual reports, joint WHO-UNICEF reports, government agencies or even from reliable non-governmental organizations could be used for the purpose.

If the established risk assessment methods are too lengthy and complicated, especially to be used during post outbreaks or inter-outbreaks periods, the basic three-step approach comprises of event description, threat or vulnerability assessment and risk characterization could be adopted. Event description is the process of systematically assessing the type of emergency (IDs in this instance) and the characteristics of the population involved.

Threat or vulnerability assessment identifies potential interactions between the affected population (host factors), likely pathogens (agents) and exposures (environment) that determine factors facilitating IDs transmission. Half of the threats in Europe are either of environmental or zoonotic origins, 22% food and waterborne, 12 % vaccine-preventable, 5% TB and 4% Influenzae².

Population factors that include immunization coverage, malnutrition, community practices (such as use of bed nets and boiling of drinking-water), cultural practices (e.g. consumption of specific food or interaction with domestic animals) may contribute to IDs risk. A comprehensive consideration of likely agents or pathogens is critical for the threat assessment. Specifically, endemic and epidemic-prone diseases (and their seasonality), the history of recent outbreaks and the communicable disease control programmes operating in the area must be considered.

Environmental factors, such as shelter, availability of safe water and sanitation, and access to basic health care services, can strongly influence ID transmission. The ongoing population survey in Malaysia that includes streets and homeless people will enhance the in-depth quality of population data.

The third step, risk characterization, uses a risk assessment matrix to analyze the available information on hazard and exposure for each disease under consideration. Both aspects of risk - the potential magnitude of the health impact and the likelihood of the event occurring - shall be quantified and the overall risk is then characterized using the matrix. Based on the overall risk assessment and additional factors such as cost, technology, and availability and infrastructure requirements, interventions for disease control are prioritized.

The outcome is a concise, timely and population-specific profile of projected ID risk, allowing evidence-based decision-making and focusing efforts on critical immediate actions. This method of risk assessments have been performed for the Horn of Africa flooding disaster¹¹ and the Indonesia earthquake¹², to quote examples, for deciding interventions priority.

MATHEMATICAL MODELING AND MANAGEMENT OF INFECTIOUS DISEASES

Initial modeling in ID concerned mainly on the prediction of cases over years to come, basically utilizing the trend and survival rates of the infected or target population. However, with better understanding and developmental of better mathematical modeling that take into consideration all aspects of ID transmission characteristics; it can be used to measure the impact and effectiveness of management of IDs and IDs outbreaks¹³. Appropriate mathematical models may enhance or strengthen ID risk assessment.

CONCLUSION

In a football league, every team will give their best while chasing the number one team to be at the top. One team would achieve that goal and become the champion, the rest would have done brilliantly and were almost there, whilst others played brilliantly with the limited materials that they have and were effective. The same scenario applies in dealing with IDs and outbreaks. The issue is on the sustained effort of the system to respond in a similar manner in future outbreaks. Observations have shown that once the dust settled; there would be complacency all around. Continuous assessment of risk, conventional or through mathematical modeling, could be the impetus needed to maintain the rage¹⁴ of IDs management so that the threats of outbreak-potential IDs could be tracked and dealt with before it turned into epidemic monsters and

caught everybody off guard. There is definitely the need to “maintain the rage”.

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