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REVIEW PAPER

Changing Nature of Health Crisis from Infectious Diseases and Responses Over Three Decades in Malaysia

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ABSTRACT

The author relates his 35 years experiences serving the public health sector in various capacities at district, state and country levels in Malaysia. He described several important outbreaks encountered such as malaria, dengue, cholera, enterovirus encephalitis, Nipah virus encephalitis, avian influenza, SARS and leptospirosis. He discussed the determinants of infectious diseases outbreak such as the pathogenicity of the organism, the environmental factors, human and animal factors. The impact of these outbreaks affected the economy, psychosocial, political and international relations. The responses to these outbreaks had improved along with the development of new technologies in diagnosis, surveillance, information technology and human resource development. The author also identified the importance of networking, appropriate risk and crisis communication and the management of the after effect of the outbreak. Apart from outbreak preparedness plan, research remains an important tool in discovering new diseases and appropriate ways of responding to the crisis.

Keywords**:** Infectious diseases, emerging infectious diseases, Sarawak, Borneo

PART I: INTRODUCTION

Over the last 35 years or so, there has been a change in the nature and effects of health crisis arising from infectious diseases, as has our capacities to respond to them. These changes are illustrated by the nine health crises that I was involved in from the time that I was a new medical officer in Lawas in the mid 1970s to the Nipah, SARS and pandemic influenza A (H1N1) more than 30 years later.

In Part I of this paper, I will first describe the nine major crises that I was involved in. This will be followed in Part II by a general discussion of health crises, and Part III will cover the lessons learnt in managing them over the past three decades.

My Experiences in Confronting Health Crisis

The early days with malaria

In 1975 I was posted as the Medical officer of Health in a lonely little town known as Lawas at northern tip of Sarawak Malaysia in the island of Borneo. It had a population of about 16,000 people then and could be reached by river to Limbang, and by air to Limbang and Miri. Being the only medical doctor in the district I was expected to look after both the medical and health problems of the community there. This was where I learned about the control of malaria. There were malaria cases in most of the villages. Besides treating the cases in hospital, I learned to look for new cases through passive case detection by screening fever cases coming to the outpatient clinics or to the few health centers and dispensaries there. However case detection alone was not good enough. We also had to carry out active case detection through our malaria investigation team which visited the remote villages affected to actively look for fever cases. Every fever case was regarded as a malaria case until proven otherwise. In some instances where the malaria outbreak had not abated for months we had to do mass blood examination and subsequently treated all the villagers with mass drugs administration regime. The blood slides carried out during the field trips were only read when the malaria team arrived back at Lawas Health Office laboratory. This process would be repeated

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again at an interval of three months until all infections were cleared. The anopheles mosquitoes were killed through spraying on the walls of dwellings. Those days DDT was the main insecticide used.

Most of the infections were caused by *Plasmodium vivax* and *Plasmodium falciparum*. There was no drug and insecticide resistance encountered. The Annual Report of the Medical and Health Department Sarawak recorded an incidence of malaria at 147.7 per 100,000 populations in 1975 (Medical & Health Department 1975). However, the investigation and control measures taken for each case took a tremendous amount of resources at the health district. Monkeys were in abundance in the forested and riverine areas. However zoonoses infection never crossed my mind.

In 1977 I was transferred to Serian as the medical officer of Health of Serian, close to home but not at all less challenging. Malaria was a problem and endemic at the border areas with Kalimantan Barat Indonesia in the Borneo Island. Thanks to the close cooperation between the two countries, a lot of the control activities were done together. There were six-monthly regular spraying of insecticide in villages within 10 kilometers along both sides of the border. Where there were difficult areas to visit the Indonesian counterpart would cross our side and then re-enter their own communities for the spraying activities. During this period, insecticide-treated mosquito nets were not available as a malaria preventive strategy. Now, insecticide-treated mosquito nets are regarded as the main preventive action for malaria. Sarawak has now discovered more and more monkey malaria *(P. knowlesi)* as polymerase chain reaction method (PCR) is used in the detection and differentiating it from the human *P. malaria* (Cox-Singh *et al.* 2008). It is to be noted that Sarawak is trying to eliminate human malaria. However with the monkey malaria thrown across the path of elimination it may not be possible to eliminate all human plus zoonotic malaria in the near future (Cox-Singh *et al.* 2008)

Cholera

Despite the remoteness of many of the villagers along the border with Kalimantan Indonesia, other infectious diseases were not unnoticed. In 1997 there were several cases of cholera in a village in the interior. For the control activities, the quickest approach was by helicopter. It affected a very poor village where the river was the only source of water supply and the vessels for storing water were made of large bamboo. The water in both the river and the storage vessel were positive for cholera. A team of rural health supervisors and health inspectors were sent to dig trenches for waste disposal and wells were dug for water supplies. After mass antibiotic treatment and prophylaxis, along with the environmental control, the outbreak was brought under control. The area affected was away from river estuaries by the sea and there were hardly mass movement of people there. One wonders how the cholera organisms were brought to those remote areas. During those years in the late seventies there were large outbreaks of cholera in the Sixth Division of Sarawak covering Sarikei, Matu, Daro and at smaller scale in other districts. These were largely low lying areas of brackish water, lacking in fresh water supplies during the dry seasons. At such times there were intrusions of salt water into the major rivers. The rivers were easily polluted by the cholera bacteria and boats carrying patients purging with cholera disseminated the infections further. Those were difficult times and called for interagency collaboration to control the outbreak, supplying treated water to distant villages and so on. In 1985 when I was the Deputy State Director of Health in Sarawak there were big outbreaks of cholera along the Samarahan River of the Muara Tuang district. The river was polluted with cholera and practically all the villagers living along the river were affected. One village was severely affected and most of the inhabitants were positive. The only quick approach to cut the continuous cycle of infections was to remove the villagers from the kampong while the environmental control was being done. A fishing vessel was hired to transport the villagers down to Muara Tuang road and from where they were transported by lorries to be quarantined at the Rajah Charles Brooke Memorial Hospital. They were discharged after all stool specimens were negative. When I was the State Director of Health in Kelantan I took the same actions to an Orang Asli village in Jeli District in 1993. Similarly here the river which was the main source of drinking water

was found positive with cholera. Again, to break the cycle of infection all the villagers were transported to a handicraft hall in Jeli town while environmental control was done at the affected village. Water sample could be negative for the growth of cholera using the conventional laboratory method. Nowadays, PCR technique is a more sensitive method used to detect the organism. This has been made possible due to the rapid development in laboratory technology. This was illustrated by the experience with cholera outbreaks in Bintulu and Daro districts in 1998 (Norazah *et al*. 2001).

Dengue and Dengue Hemorrhagic Fevers

Dengue and Dengue hemorrhagic fever are endemic in Malaysia with major outbreaks happening now and again. In 1984 there was a major outbreak in Kuching. The usual action was case investigation, followed by aedes search and destroy operation and fogging in the evening or early morning. However the outbreak failed to abate and since the outbreak affected the whole of Kuching town, a decision was made to do mass fogging of the whole of Kuching from Kampong Tabuan till the Satok Suspension Bridge. The same process was done in Sibu and Serian (Medical and Health Department 1984). That was the only massive fogging operation that I could recall during my service. It proved to be useful. Vaccine against dengue is still not available for community use but research on this is still going on in many countries.

Enterovirus outbreak, a re-emerging disease

In 1997 to March 1999 I was the State Director of the Sarawak Health Department. April to June 1997 was the peak of an outbreak of Hand Foot and Mouth disease (HFMD) in the community in Sibu, Kuching, and several other districts in Sarawak. Twenty nine previously healthy infants and young children died after a short history of fever (Chan *et al.* 2000). That a hitherto usually mild infection could cause many deaths was a new phenomena. The management and control measures were based on the hypothesis that the outbreak was caused by the enteroviruses infection. Prior to the detection of the causative agent, an enhanced surveillance mechanism, field investigations, case-control study, toxicological investigation, micronutrient survey, and serological studies were done. Isolation wards were set up, mandatory postmortem done, personal-protection for staff advocated, health education carried out and notification system set (Kiyu *et al.* 2000). As that was a new experience in Malaysia, a lot of interests were generated globally; the media made extensive coverage and consultant field epidemiologists were flown in from CDC Atlanta to assist with the investigation and control. Enterovirus 71 (EV71) and possibly adenovirus and other enteroviruses were likely responsible for the fatal cases. This was classified as a re-emerging disease. Since this outbreak over the years, there were several outbreaks in the rest of Malaysia and in the Asia Pacific region Subsequently, laboratory and sentinel surveillance system was set up by Sarawak State Department together with the Institute of Health and Community Medicine, UNIMAS (Podin *et al.* 2006). Through seven years since the surveillance was set up in 1998, this surveillance showed that human enterovirus 71 occurred in a cyclical pattern once in three years. This information has helped in the prediction of outbreak years and preparation for it could be done early. Vaccine against this infection is being developed by a number of centers.

Nipah virus encephalitis, a newly emerging disease

I became the Director of the Disease Control Division of the Ministry of Health in March 1999. At that time there was an outbreak of viral encephalitis which was initially thought to be due to Japanese Encephalitis virus, among pig farmers in Perak and Negeri Sembilan. On the fifth day of my tenure, the control action committee chaired by the Director General of Health received a call from a virology professor of University Malaya stating that a new virus was cultured from the specimen taken from a patient residing in a village called Nipah in Negeri Sembilan. Subsequently after several other patients confirmed to have the same virus infliction, the control measure was revised and the disease was called Nipah virus encephalitis. The history dated back several months earlier in Perak. Thus from 29 September 1998 to 31 May 1999, 265 cases of viral encephalitis were

reported to the Ministry of Health. The clusters started in Kinta District of Perak in September 1998. The cases then spread southward to Sikamat and Bukit Pelandok with the sale and movement of infected pigs. There were 105 fatalities and a case fatality rate of 39 percent. The outbreak involved pig farmers and people in direct contact with live pigs. The public health actions taken were to restrict movement of pigs out of the affected areas including stopping the export to Singapore where a similar outbreak occurred (Ling 1999). Eventually one million pigs were culled at the infected farms (Taha 1999, 2000). Several lessons were learnt from this outbreak and they included the importance of effective crisis management and risk communication, collaboration with other government and non government agencies, looking out for the possibility of a newly emerging disease, and a well designed and controlled pig farming system. In this outbreak assistance from WHO and CDC Atlanta, Australia Animal Health and other international agencies were of great help in the investigation and control as well as in the research activities (WHO 2001). The research conducted included determining the risk factors for Nipah virus transmission, using a hospital-based case-control study (Amal *et al.* 2000), Nipah virus infection among military personnel involved in pig culling (Roslinah *et al.* 2001), a cohort study of health care workers to assess nosocomial transmissibility of Nipah virus (Mounts *et al.* 2001), case-control study of risk factors for human infection from Nipah virus (Parashar *et al.* 2000), Nipah virus infection among abattoir workers (Sahani *et al.* 2001) animal studies and others. Studies of the infection on pigs, goats, dogs, horses, bats and other animals were conducted by veterinary epidemiologists (Johara *et al*. 2001; Mohd. Nordin 1999). The Nipah virus encephalitis outbreak was classified as a newly emerging zoonosis. No other incident of this disease has happened in Malaysia since this outbreak. However in later years (2001-2004) outbreaks in Bangladesh and India were reported (Hsu *et al.* 2004). There were also evidences of human to human transmission in the Bangladesh outbreak (Hossain *et al.* 2008).

SARS, the First Newly Emerging Disease of This Century

I was the Director General of Health when severe acute respiratory syndrome (SARS) emerged. In February 2003 the health authority in Guangdong China reported to the World Health Organization (WHO) 305 persons with a typical pneumonia (WHO 2003). Out of this, 30 percent were among health care workers and included five deaths. On 12 of March 2003, WHO subsequently issued a global alert of this incident (WHO 2006). By 14 March, Hanoi, Hong Kong, Canada and Singapore reported similar cases. On 15 March, 2003, WHO issued a second Global Alert and announced the disease as Severe Acute Respiratory Syndrome (SARS), gave it a definition and issued emergency travel advice (WHO 2006). Civet cat was suspected as the animal host in early part of this infection. Transmission was through droplet-infection and via oral fecal route. According to the World Health Report 2003, Shaping the Future, from November 2002 to August 2003, 8422 cases and 916 deaths were recorded (WHO 2003). Malaysia had five imported probable cases and did not have any secondary spread of the disease. Malaysia responded by instituting prompt preventive measures at the hospital and public health facilities and played a significant supportive role in controlling the disease at the regional and at international level. The ASEAN Ministers of Health meeting on SARS took place in Kuala Lumpur on 25 April 2003 and came up with a Joint Statement which was taken up to the Head of State Special meeting in Bangkok on 29 April 2003 just four days later. WHO put SARS into an agenda item in the 56th World Health Assembly in May that year. Through Resolutions WHA 56.29, the fifty six World Health Assembly came up with several actions for Member States and the Director General of WHO (WHO 2003). Among many things the Resolution calls for actions on prompt control, surveillance, Global Alert and Response Network, multisectoral collaboration, public information, financial and human resources mobilization, research and others. Malaysia also hosted the biggest Global forum on SARS in June 2003 in Kuala Lumpur.

Highly Pathogenic Avian Influenza (HPAI)

In August 2004, the first HPAI virus in

Malaysia was isolated in a district in Kelantan close to the Malaysia-Thailand border. The management measures included the culling of infected birds, exposed or in-contact poultry, active surveillance of poultry within 20 km radius of the focus of infection. Fortunately no human case was reported. The outbreak ended in July 2005.

Leptospirosis

When I was a medical student more than 35 years ago I used to come across cases of leptospirosis where the patients usually gave a history of working or hunting in the jungle and forest fringes. Over many subsequent years, leptospirosis was not common in Malaysia. However in recent years, we heard of isolated reports of clusters of this disease reemerging in certain areas in Peninsular Malaysia, Thailand, Sabah and in Sarawak. Thus this infection was made notifiable in Malaysia with effect from 9 December 2010. In 2011, 198 cases and 15 deaths were notified to the Sarawak Health Department. Our research group has been granted a science research fund to look at leptospirosis in Sarawak. Preliminary laboratory finding from the study indicated that about 30 percent of the rural population along the Rejang basin had evidence of past infection. Even though our study targeted only rats as the animal host, we cannot exclude the roles of other animals in the transmission of the disease. Thus more studies need to be carried out.

Influenza A (H1N1) pdm09

The outbreak started in Mexico and soon spread across all continents resulting in the WHO classifying it as a Pandemic. Malaysia was not spared. There was panic and nations prepared for the worst. The control measures put in place for SARS outbreak was handy in the face of these equally devastating respiratory ailments. The scramble for vaccine development and its purchase were met with mixed reactions across the world.

PART II: HEALTH CRISIS

Definition of Health Crisis

The few outbreaks described earlier illustrated or exemplified health crisis. The Oxford Advanced Learner's Dictionary (2010) defined crisis as a time of great danger, difficulty or confusion when problems must be solved or important decision must be made. Thus a health crisis is an occurrence or threat of exposure to an extremely dangerous condition or highly infectious or toxic agent that poses a health threat of substantial harm to the population. A crisis can develop at a local level or a global level and produce tangible and intangible effects.

Why do health crises occur?

There are three main factors which contribute to the occurrence of health crises arising from infections. These are pathogenic nature of the organisms, environmental conditions and human factors.

1. Pathogenic factors

Microorganisms constantly undergo changes that enable them to cope with an increasingly hostile environment. In fact, the development of mechanisms that permit survival of the most adaptable microorganisms is more rapid than the development of defense mechanisms that allow their hosts to combat microbial invaders. This adaptive process involves finding and exploiting weaknesses in the defenses of the host and can happen by means of several mechanisms: alteration in antigenic identity, emergence of drug-resistant strains and dual infection. These pathogenic factors cause health crisis by resulting in emerging or re-emerging infections. **Emerging infections** are infections, which have newly appeared in a population. It may be due to a new pathogen, or an old pathogen, which is newly recognized or an old pathogen that has recently acquired resistance to antimicrobial agents (WHO 1996). **Re-emerging infections** are due to the reappearance of, and an increase in, the number of infections from a known disease, but which had formerly caused so few infections that it had no longer been considered a public health problem.

2. Environmental factors

Environmental factors play important roles in the outbreaks I have described. The clearing of jungles, replanting of forests, opening plantations favor human insect interphase, thus favoring the transmission of malaria, exposure to disease bearing animals causing leptospirosis. Camping in jungles and washing and bathing in pools of semi stagnant water

also expose human to urine of infected rats and other animals. Climate changes can cause alterations in the prevalence of vector-borne infections, zoonotic infections and food and waterborne infections. Deforestation and building of dams and mini-hydro also contribute to increasing exposure of humans to disease-bearing insects and vectors. Urbanization and rapid development, heavy amount of solid waste, unhealthy and indiscriminate refuse disposal also contributed to an increase in breeding grounds of the *Aedes* mosquitoes. Massive construction in cities also contributes to the breeding of mosquitoes. Certain level of alkalinity and temperature of brackish water in river estuaries favors the release of vibrios cholera from copepods and thus expose humans to the infection especially where clean and treated water is scarce (Drasar & Forrest 1996). Air pollution from open burning, exhaust fumes and industrial emission also contribute to ill health.

3. Human Factors

Changes in human behavior can lead to health impacts. One of the challenges of the Health Care Delivery system in Malaysia is the rural urban migration as well as increasing migration and travel of foreign workers. When city development could not keep up with the increasing demand of good health facilities, treated water supplies, and better sanitation, urban decay can develop. People become more vulnerable to diseases outbreak and the importation of new diseases into the country. Behavioral factors have been blamed for the increase of chronic diseases in the country.

4. Animal factors

Zoonoses are diseases and infections (the agent of) which are naturally transmitted between (other) vertebrates animal and men (Park 2011). Examples are avian influenza, swine influenza, brucellosis, malaria (*P. knowlesi*), Hendra, Nipah, SARS, melioidosis, leptospirosis, Ebola, rabies, filariasis and others.

Apart from wild animals, birds and bats, domesticated animals also can cause outbreak to occur among animals and in some cases transmit the diseases to humans. Examples are the outbreak of Hendra in Australia, Nipah virus encephalitis in Malaysia, Singapore and Bangladesh, avian influenza in China. Modern animal husbandry and close surveillance of animal diseases help to alert and control outbreak. Close animal-human interphase can also create major outbreak such as in leptospirosis, melioidosis, monkey malaria and others.

IMPACT OF HEALTH CRISIS

The impact of health crisis thirty years ago was very different from that felt today. Health crisis caused by cholera, filariasis and leptospirosis were contained locally. Recently because of rapid travel and migration, health crisis can cause far reaching impact. There is always the direct health burden on morbidity and mortality due to the disease. However health crisis can affect psychosocial, economics and the political arena.

Psychosocial

One detrimental effect of a health crisis is the psychosocial component. The media and improved communication technologies have lead to rapid transmission of information. A lack of sufficient and timely medical information regarding the crisis can cause unnecessary fear and further aggravates the situation.

During the outbreak of the Nipah encephalitis and SARS outbreak there were undue stress and anxiety among the public. During the Nipah outbreak, people voluntarily left their homes and lost their source of income. During the SARS outbreak people were overcome by fear to the extremes of being hypochondriac, anxiety, depressed, resentment and avoided public places, including health facilities.

In Taiwan, it was reported that some of the affected people even attempted suicide as an emotional reaction to the losses incurred.

The SARS outbreak alerted health managers on the psychosocial issues faced by health care workers and other personnel involved in the management of the patients. Health care workers showed a wide range of emotional responses from being heroic to fear, anxiety and to the avoidance of their duties. Due to the long hours of duty, in both the SARS and Nipah encephalitis outbreak, health care

workers experienced fatigue and sleeping disorders.

Economy

Health crisis can affect the economy of a family, the community and the nation's economy as well. During the SARS outbreak, economy was affected through the effect on demand arising from people perception and fear of the disease. Movement of people were reduced, tourism was restricted therefore affecting airline, hotel, entertainment, retail and restaurant industries. The Asian Development Bank cut its growth forecast for the Asia Pacific economies to 5.3 percent from the 5.7 percent it had expected in December 2002. If the impact of SARS had extended till the third quarter of 2003, the estimated income loses could range from USD 12 billion to USD 27.7 billion for East and South East Asia. (United Nations Economic & Social Council 2003).

Similarly, during the Nipah virus outbreak in 1999, the country's pig farming industry incurred tremendous losses. The tourism sector in Port Dickson also suffered irretrievable loss because it was in close proximity to the pig farms located in Bukit Pelanduk. According to the Food Agriculture Organization, the loss in export trade in 1999 from the pig industry was estimated at about USD 120 million, whilst the loss of tax revenue directly from the pig industry was about USD 105 million. Furthermore, an estimated cost of USD136 million was spent in the control programme to contain the outbreak (FAO, APHCA 2002).

Political impact

A health crisis also has political implications. In pressing cases, important decisions need to be made within a short period of time. The Ministry of Health and the government has to prove its commitment to control the crisis. These may involve decisions concerning travel restrictions as in the case of SARS outbreaks, which have economic impact. Trans-boundary relationships can also be affected. Collaboration and understanding between Malaysia and Singapore during the SARS outbreak was handled sensibly as several thousands of workers moved in and out through the Johor Causeway on a daily basis, even during the crisis. It become a political decision too when it involves the accessibility to scarce resources such as the giving of influenza A (H1N1) vaccine to frontline health workers during the recent outbreak.

Failure to address health crisis can result in politicians and top officials losing their posts (WHO 2006). Thus, efficient health crisis management is important, as it reflects the effectiveness of the health sector and the country's commitment in ensuring the health and safety of the nation.

Lessons Learned and Responses

The response to health crises has led to a number of positive lessons and challenges for future preparedness planning.

1. Surveillance

The problem with newly emerging diseases as related by the experiences with the enterovirus and nipah virus outbreak, is that it is often not identified until it has reached major proportions. In order to develop an early warning system for infectious disease we need to improve and strengthen our surveillance and monitoring mechanism. Although we have a surveillance system in place for known infectious diseases, there is none for newly emerging diseases. It should be emphasized that a functional surveillance system is very essential for public health decision-making.

The Infectious Diseases Prevention and Control Act Malaysia 1988 has made it mandatory to notify health officers of the occurrences and suspicions of certain infectious diseases as listed in the schedule of the Act. (Percetakan Nasional Malaysia 2006) The list has included more and more diseases for notification. To date there are 27 types of infectious diseases included in the list. Thus this procedure made it possible to do surveillance on morbidity and mortality of important diseases.

To further enhance the surveillance system in Malaysia, laboratory-based surveillance and syndrome surveillance system has been introduced by the Ministry of Health. To overcome the delay in identifying unknown etiologic agents in outbreaks, syndromic notification provides an avenue for early identification of emerging disease. The

syndromic surveillance approach is based on the revised International Health Regulations 2005, for example, for acute haemorrhagic fever syndrome, acute respiratory syndrome, acute diarrhoeal syndromes, and others (WHO 2008).

2. Outbreak Preparedness Plan

Following the SARS outbreak, the Ministry of Health has drawn up an alert mechanism for SARS during the post-outbreak period (Ministry of Health Malaysia 2003) and subsequently drew up a national outbreak preparedness plan for influenza. The plan enables the Ministry to tackle any health crisis of the future including the threat of bio-terrorism. The plan requires the setting up of rapid response teams at national, state and district levels.

Thus the Public Health Department has formulated the Public Health Emergency Management Plan which aims to provide emergency public health care during a health crisis, collaborate with partner agencies and to seek technical assistance and co-operation from local and foreign agencies. It also outlines the strategies to attain the objectives at the pre-crisis, crisis and post-crisis phases. This general plan would have to be modified according to the specific health crisis.

The Ministry also has in place a Crisis Response Plan for medical cases to deal with crisis emanating in the hospital setting. These plans at both the public health and hospital level were put to use during the last Influenza A (H1N1) pandemic affecting Malaysia.

3. Laboratory services

In the past, medical laboratories played a critical role in recognizing and establishing diagnosis of known infection through blood slides, blood culture, serology and others. It was not until lately that laboratory plays a greater role in recognizing emerging and re-emerging infectious diseases by establishing a specific etiology for disease syndromes seen by clinicians, and by reporting new or unusual pathogens that such laboratories might encounter. Where necessary, specimens are also sent to more sophisticated laboratories to confirm diagnosis and to work on dangerous organism. The cross references within the country is good and assistances from another country is sought only if necessary. Some of the organisms involved in an outbreak are highly pathogenic and would require special high containment facilities for their processing. The Infectious Disease Research Centre (IDRC) has been set up at the Institute for Medical Research following the outbreak of Nipah encephalitis. It was modeled after the Communicable Disease Centre at the Centers for Disease Control in Atlanta, USA and served primarily to promote and conduct quality research and as a training center on all aspects of infectious diseases in Malaysia.

The establishment of IDRC enables laboratory strengthening through the setting of a Biosafety Level 3 (BSL) facility at the Institute for Medical Research. BSL level 2+ was set at the microbiology laboratory in University of Malaya as well as at the Institute of Veterinary Research in Ipoh. Another similar but larger facility was set up for the National Public Health Laboratory in Sungai Buloh. The BSL3 facilities aimed to enable diagnostic and research work on hazardous pathogens to be conducted in a manner that will protect the safety of the laboratory worker as well as the environment. The ability to work on dangerous pathogens is important in view of the emergence of new and exotic pathogens which can cause significant morbidity and mortality and for which no treatment or vaccine is currently available.

4. Risk and Crisis Communications

The enterovirus, Nipah virus and SARS outbreak were trying times for health managers and the politicians. The public were faced with a lot of uncertainties and demanded for transparencies in times when information about the new diseases was limited. Risk communication and crisis communication are essential parts of dealing with a crisis (Sandman & Lanard 2003). Risk communication deals with what is being expected out of a situation, while crisis communication deals with explaining what has happened and how to deal with the community responses. Whenever there is a crisis, the public can exhibit fear and panic. Proper risk communication and crisis communication will enable health care professionals to provide information that allows the public to make the best possible decisions about their well-being

and to communicate those decisions. The information given should be in a manner that it does not frighten the public and at the same time they still pay attention to the message and learn what needs to be done (Sandman 2004).

5. Research

Research is an important tool in the discovery of a new entity and its effect upon the environment and human life. Good research contributes to new knowledge which can be shared among professionals across the globe. Whenever a health crisis occurred researchers from the public sectors and universities should collaborate for the discovery of new knowledge. Currently there is no shortage of researchers for public fund to conduct research, however the competition is great. For highly important research, the government still allocates funds for researchers to perform research on a top down basis. Without evidence-based information, current practices can easily become inappropriate, inefficient, intrusive, and sometimes even disruptive. The overall research goal is to contribute to the identification of evidence-based information which in turn allows for effective and appropriate options for action at community and health system level.

6. Training

Based on past experiences in handling outbreaks of infectious diseases, outbreak investigations must be handled by competent public health officials with field experience and trained in the principles of epidemiology. To strengthen this capacity and capability in detection and response to outbreaks, the Ministry of Health has established the Epidemic Intelligence Program (EIP) to train public health specialists. More medical officers are offered postgraduate degree in masters of Public Health which runs for four years or officers can now opt for the one year MPH and three years DrPH program conducted at four local public universities in Malaysia.

7. Networking

In managing any outbreak, networking locally and internationally is essential. Networking enables collaboration with governments and other agencies in the prevention and control of emerging and re-emerging diseases through establishing and strengthening disease surveillance, responding to emergency outbreaks in a timely and efficient manner, and facilitating information exchange on communicable diseases. Networking and global communication during the Enterovirus, Nipah virus, SARS and Influenza A crisis became a reality whereby health staff were communicating in real time situation with local and foreign experts. This was made possible with our advanced communication technology. For the enterovirus and Nipah virus encephalitis outbreaks epidemiologists, toxicologists, medical specialists and veterinarian were flown in to collaborate in the control. The WHO played an important role in facilitating for networking, providing expert advice, travel advice and other assistances. This should continue.

Most of the above factors will facilitate health workers and the health agencies in responding appropriately to a newly emerging disease outbreak (Taha 2000).

SUMMARY

In order to confront any health crisis, it is essential to have strong professional leadership at the highest level to mobilize entire societies, to ensure speedy action, and to improve coordination between national, state and district levels. Increase investment in public health for surveillance, infrastructure strengthening, capacity and capability building, research, as well as updating our legislation. The public's concern need to be addressed by appropriate risk and crisis communication. Networking and international collaboration by developing smart partnerships through open sharing of experiences and findings, and rapid communication of information should be maximized and maintained. Although health care professionals may not be able to prevent the initial cases of illnesses resulting from a health crisis, but they can play a critical role in minimizing the impact of such an event through intelligent rapid response prompt diagnosis and effective management.

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