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# Combating Emerging Infectious Diseases in the South-East Asia Region



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## FOREWORD

The pandemics of SARS and avian influenza during the past two years have underscored the importance of emerging diseases and their impact on health and economic development. Asia is, unfortunately, at the epicentre of such epidemics. Moreover, many new micro-organisms have emerged and several existing communicable diseases are spreading to newer areas. Several of the 30 new micro-organisms detected in last three decades, have profoundly affected many countries in the South-East Asia Region.

Dengue fever, Japanese encephalitis, leptospirosis and drug-resistant malaria are some of the diseases which have slowly but steadily entrenched themselves in large geographical areas in the Region. The losses due to the outbreaks of SARS and avian influenza alone in resource-starved Asian countries are estimated at billions of dollars. These emerging diseases will continue to challenge public health systems for years to come. Though several socio-economic, demographic and environmental factors facilitate the emergence and spread of these diseases, their impact could be minimized through a well-prepared and strong public health system. To effectively respond to these diseases a well-developed strategy and programme must be implemented through a coordinated and pragmatic plan of action.

This document on emerging diseases has been prepared in consultation with leading experts in various disciplines of public health in the Region. It highlights the impact of emerging diseases and provides an insight into the factors that facilitate their emergence and spread. It also suggests broad strategies and key activities that can strengthen the public health system to respond effectively and efficiently to the challenge.

I sincerely hope that this document will provide a framework to Member States to formulate their plans for preparedness and public health response to emerging infections. WHO will continue to support all Member States in strengthening their capacity to combat these diseases in the years ahead.



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Regional Director



## EXECUTIVE SUMMARY

Despite considerable success in controlling communicable diseases, recent epidemics of SARS and avian influenza have clearly demonstrated the vulnerability of Asian countries to rapidly evolving micro-organisms. The frequent occurrence of these pandemics has also highlighted the fact that, given the existing environmental, socioeconomic and demographic situation, Asia will be the most likely epicentre of any future pandemic due to a known, genetically modified or unknown microbe. Though the major, and initial impact of these pandemics will be borne by developing countries with weak health systems, inadequate resources and poor state of preparedness, the entire world would be ultimately at equal risk.

Microbes, especially viruses are unstable and evolve rapidly. During the past 30 years more than 30 new organisms have been identified world-wide. Infections such as HIV/AIDS, viral hepatitis C and E, Ebola, and highly pathogenic modified strains of influenza virus have altered the entire perception of public health. There is an urgent need to strengthen efforts to meet the challenge of these emerging infectious diseases.

Prevention and control of such diseases requires strong political commitment and sustained financial support along with the application of various epidemiological, molecular biological, behavioural as well as statistical approaches and technologies. A thorough review of the public health infrastructure is warranted to create a comprehensive national plan to develop and apply established standards for public health infrastructure (laboratory, epidemiological, communications and research) within and across the public and private sectors. This should be complemented by a spirit of partnership with and across all relevant sectors, notably veterinary sciences, academia, environmental institutes and NGOs and by enhanced communication of public health information to obtain active cooperation of the communities. Research is a crucial part of the response to new and emerging diseases. A sustained, forward-thinking applied research programme would enable scientists to identify the weak links in the armour of emerging microbes, create novel ways to fight microbial foes, and evaluate the preventive power of new approaches. To combat emerging infectious diseases, public health,

therefore, requires the renewal and expansion of research on the epidemiology and biology of microbes, vectors and intermediate hosts, and awareness of the possibility that new epidemics can and will emerge in unexpected places.

Recent experiences in the South-East Asia Region with the outbreaks of SARS, Avian Influenza, Nipah virus, Chandipura and dengue fever have stimulated the preparation of this vision document on Emerging Infectious Diseases. There is a wealth of capacity in the Member States for surveillance and response, in the laboratory, epidemiology, public health and pharmaceutical sectors. These capacities can be better utilized through intercountry collaboration and cross-border co-operation supported by regional formations like SAARC and ASEAN, with technical support from WHO. The existing public health and laboratory capacities need to be further strengthened through the networks established among centres of excellence as well as through the WHO Collaborating Centres. Links need to be developed between public health, veterinary and clinical laboratories. This is important to ensure the timeliness and quality of surveillance, research and response.

Effective risk communication and management have critical roles in ensuring that emerging infectious diseases are recognized early, are promptly reported and appropriately managed. The mass media, both electronic and print, have important roles which necessitate sustained partnerships between health authorities and the media. The rapidly expanding information technology in this Region can be effectively utilized in risk communication and management activities.

Advocacy for sustained political commitment at national, regional and global levels has to be stepped up to mobilize additional resources for supporting and enhancing epidemic preparedness plans in all Member States.

Intense human-animal interaction in Asia increases the vulnerability of the populations to the emergence of zoonotic infectious diseases. In view of the health and economic interactions, partnerships are required with veterinary, agriculture, forestry and the health sectors at national, regional and global levels.



Monitoring and evaluation is an integral component of surveillance, early warning and response to emerging infectious diseases. Selected critical indicators should be incorporated into integrated disease surveillance. Periodic internal and external assessments of the performance of the system are essential.

This document visualizes strategies for confronting the challenge of emerging infectious diseases. It outlines regional partnerships and measures for improving capacity for surveillance and outbreak response through the application of appropriate public health tools to the control of emerging infectious diseases. It also calls for strengthening regional initiatives, conducting applied research on emerging infectious diseases and building public health training and capacity.



## 1. INTRODUCTION

The spectrum of health, environment and development hazards has changed considerably over the millennia of human existence. People are living longer, literacy has increased, education has improved and incomes and opportunities have amplified. With the discovery of vaccines that helped to eradicate smallpox, launch a global campaign to eradicate poliomyelitis, and support control of measles, diphtheria and other killer diseases, and the discovery of potent antimicrobial agents, the last 50 years of the 20<sup>th</sup> century heralded strong hope for conquering many infectious diseases in the near future. Yet, despite these advances, infectious diseases remain the leading cause of death in developing countries, and the South-East Asia Region (SEAR) is no exception. In addition, these countries, mainly those with low resources, are grappling with a variety of new, emerging and re-emerging infectious diseases.

Emerging infectious diseases are diseases of infectious origin whose incidence in humans has increased within the recent past or threatens to increase in the near future. These also include those infections that appear in new geographic areas or increase abruptly. The new infectious diseases and those which are re-emerging after a period of quiescence are also grouped under emerging infectious diseases.

The recent emergence of a new strain of H5N1 of influenza A virus and the outbreak of SARS underlines the importance of Asia as an epicentre not only for influenza A viruses, but also for other microbial agents. It is likely that epidemics will continue to occur in the future as they have in the past. Changes in human behaviour and customs will continue to provide opportunities for microbes to produce unexpected epidemics. Science cannot stop the emergence of new microbes. These emerge from the evolutionary stream as a consequence of genetic events and selective pressure that favours them. It is nature's way. It is strongly believed that new infections shall continue to emerge and pandemics commence in all likelihood from the developing countries, mainly in Asia. What is needed is to enhance the

capacity to detect them early and respond most effectively and efficiently with available resources, skills and knowledge.

Emerging infectious diseases threaten to disrupt the health care system. Conversely, a strong health system is a prerequisite for effectively combating emerging infectious diseases. Left unchecked, today's emerging diseases can assume pandemic proportions causing social and economic disruption and ultimately becoming endemic. This is what happened with HIV/AIDS, which spread from a remote part of Africa to all other continents and is now entrenched all over the world. In less than 25 years from its first isolation it has become the fourth leading cause of death worldwide.

The successful detection and treatment of emerging infectious diseases is becoming a formidable challenge. The periodic occurrence of epidemics of infectious diseases serves to underscore the importance of the public health system. To combat emerging infectious diseases, public health, therefore, needs to strengthen and expand research on the epidemiology and biology of microbes, vectors and intermediate hosts, and create awareness on the possibility that new epidemics can, and will emerge in unexpected places. A sustained forward-thinking applied research programme is crucial to effectively respond to new and emerging infectious diseases.

The health and economic impact of recent outbreaks occurring in many countries of the Region underscore the need to further strengthen national disease surveillance and response systems, including early warning systems and epidemic preparedness as well as laboratory and entomological investigation facilities. They have also driven home the critical role of collaboration within and between the countries. Inter-regional cooperation can facilitate an effective and prompt response through activation of various technical networks available all over the world.

This is a wake up call for all those who are concerned with the health of the people. This includes mainly policy makers, health administrators, public health professionals, national finance managers, international agencies and NGOs. The importance of emerging infections must be recognized and suitable remedial measures instituted to combat emerging infections.

More than 30 years ago, the then US Surgeon General stated that “the time has come to close the book on infectious diseases”. Hindsight is a great teacher and the last three decades have taught us that there will be no closing of books on infectious diseases, now or ever. In fact, emerging infectious diseases seem to be closing, or have the potential to close windows of opportunity for infectious disease eradication or elimination.

For too long and too often, the approach of Member States in SEAR towards public health has been crises driven. This approach has been a costly one because it blocks the ability to institute cost-saving preventive strategies. History has shown that it is far less costly, in both human suffering and economic terms, to anticipate and prevent infectious diseases than to react with expensive treatment or containment measures to public health crises.

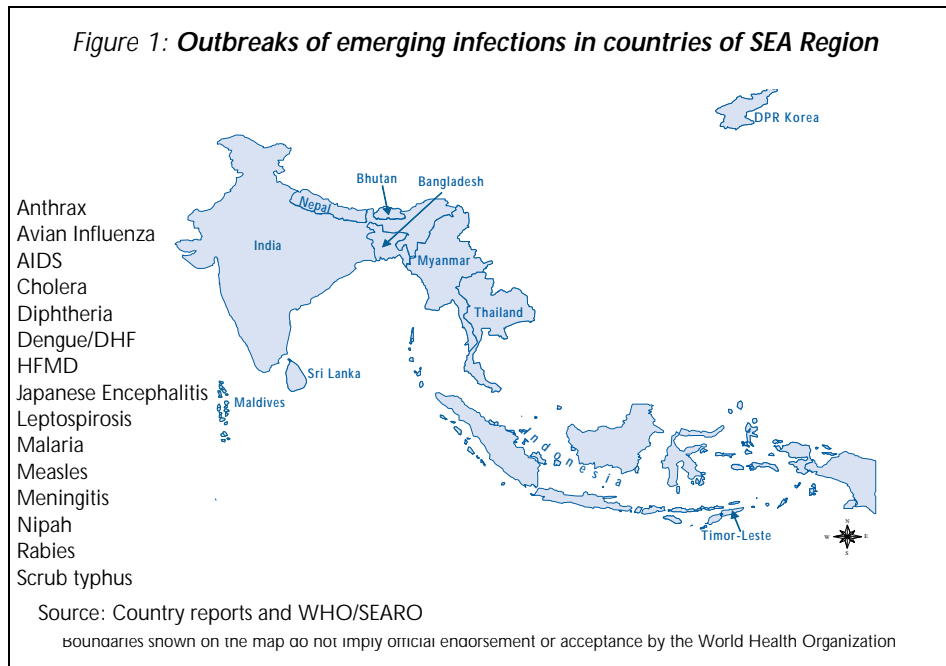
## **2. SITUATION ANALYSIS OF EMERGING INFECTIOUS DISEASES**

### **2.1 Distribution and Trends**

Infectious diseases continue to be a major challenge in the South-East Asia Region (SEAR). They are estimated to be responsible for about 40% of the 14 million deaths annually in the Region and account for 28% of the global burden of infectious diseases. Of 350 million DALYs that are lost due to communicable diseases globally, South-East Asia Region accounts for 89 million. The brunt is mainly borne by children, women and marginalized sections of society. Children show greater vulnerability. Infectious diseases represent 7 out of 10 top causes of child deaths in developing countries, and account for nearly 60% of all such deaths. Acute respiratory infections cause 18% of all deaths and diarrhoeal diseases kill 15% children in developing countries. More than 80% of the population in SEAR continues to live in malaria-prone areas of which 178.8 million are at high risk. On an average, 2 to 2.5 million cases of malaria are reported annually with an estimated 27,000 deaths and an annual economic loss of US\$ 2 billion.

Tuberculosis continues to be the biggest killer of young adults. Notwithstanding the success of DOTS, the TB situation is likely to be complicated with the rapid spread of HIV and the emergence of drug-resistant strains in the Region. Multidrug resistant-TB is at least 100 times more expensive to cure. There is a new threat to TB control in the form of a parallel HIV/AIDS epidemic with around 2.5 million people estimated to be co-infected with HIV and TB in countries of the Region. HIV/AIDS is one of the most rapidly growing epidemics globally. HIV has already spread to more than 6 million people in SEAR.

The Region has witnessed several outbreaks of new and emerging infections (Figure 1) as new micro-organisms continue to appear and some of the existing ones alter their characteristics to promote their survival at the expense of human health. Japanese encephalitis, Chandipora virus, Nipah virus and leptospirosis are examples of emerging infectious diseases that appeared a few years back and have now established endemicity. These infections are gradually and steadily progressing to conquer newer areas and populations.



Microbes are never idle. They possess remarkable genetic versatility that enables them, under favourable circumstances, to develop new pathogenic vigour, to escape population immunity by acquiring new antigens and to develop antimicrobial resistance.

New pathogens, particularly viruses, remain unpredictable and continue to emerge and spread across countries, without respecting national boundaries. During the past 30 years, more than 30 new pathogens have been detected worldwide (Table 1) many of which have caused serious outbreaks. They continue to challenge our ability to respond to the epidemic quickly. Deliberate use of the micro-organisms adds another grim dimension to the burgeoning problem of microbial diseases.

The recent epidemics of SARS and avian influenza caused grave concern and made an enormous health and economic impact throughout the world. There is no way, as yet, to say whether SARS has finally been brought under control and whether avian influenza will make a comeback. Since the SARS epidemic was contained in July 2003, there have been four further outbreaks in Asia during 2004. Three of these were from laboratory accidents, emphasizing the need to strengthen bio-safety. Human cases due to avian influenza have also reappeared in Vietnam after a period of four months.

**Table 1:** Newly discovered organisms of public health importance

Year	Microbe
1973	Rotavirus
1975	Parvovirus B-19
1976	<i>Cryptosporidium parvum</i>
1977	Ebola virus
1977	<i>Legionella pneumophila</i>
1977	Hantaan virus
1977	<i>Campylobacter jejuni</i>
1980	Human T-lymphotropic virus I (HTLV-I)
1981	Toxin producing strains of <i>Staphylococcus aureus</i>
1982	<i>Escherichia coli</i> O157:H7
1982	HTLV-II
1982	<i>Borrelia burgdorferi</i>
1983	Human immunodeficiency virus
1983	<i>Helicobacter pylori</i>
1985	<i>Enterocytozoon bieneusi</i>
1986	<i>Cyclospora cayatanensis</i>
1988	Hepatitis E virus
1989	<i>Ehrlichia chafeensis</i>
1989	Hepatitis C
1991	Guanarito virus
1991	<i>Encephalitozoon hellem</i>
1991	New species of <i>Babesia</i>
1992	<i>Vibrio cholerae</i> O139
1992	<i>Bartonella henselae</i>
1993	Sin nombre virus
1993	<i>Encephalitozoon cuniculi</i>
1994	Sabia virus
1995	HHV-8
1999	Nipah virus
2002	SARS virus



A new type of influenza virus can be bred from a novel recombination of the segmented genome of two parents. This is one of the best examples of a new virus that can cause an epidemic with amazing pathogenicity and infectivity. The virus may not be destroyed by the conventional antiviral drugs and the available vaccine may not be able to confer immunity against it. Detection of a new virus shall also depend upon the effectiveness of global surveillance systems and capabilities of the hitherto neglected public health laboratories.

The challenge of emerging diseases is here and will remain in the foreseeable future. Dengue fever is one of the most important emerging arbovirus infections in South-East Asia with 1.3 billion people at risk. Infection is spreading to newer areas as evident by the first-time occurrence of this disease in Bhutan in 2004. Currently, nine of the 11 Member States report cases and outbreaks of dengue. The rise of dengue fever in tropical and subtropical areas of the world is explained by factors such as rapid population growth, expanding urbanization, inadequate municipal water supplies and inadequate refuse disposal facilities.

A number of viruses have been associated with fruit bats (flying foxes), particularly members of the genus *Pteropus*, over the past 10 years. These viruses include Hendra and Nipah. Subsequent to a major outbreak in Malaysia, Nipah virus has caused outbreaks in Bangladesh and India. Some of the recent outbreaks in India with high case fatality ratios have been attributed to Chandipora virus. Though viruses have been in the forefront of the emerging diseases scenario, the response to various bacterial diseases has also become complex because of the resistance acquired by the bacteria against commonly used antimicrobial agents.

The magnitude of the antimicrobial resistance crisis is unknown because of the absence of systematic monitoring in developing countries. However, data available from selected institutes in SEAR indicate the enormity of the spectrum and extent of resistance. Gonorrhoea used to respond dramatically to penicillin; now it resists treatment with penicillin and many other antimicrobial agents including ciprofloxacin; chloramphenicol is no longer the drug of choice against typhoid fever; most of the hospital-associated infections are due to multi-resistant strains of commonly encountered bacteria and, in some instances, even the ultimate weapon against bacteria does not work.

Vancomycin resistance in *Staphylococcus aureus* and enterococci is a reality in hospitals. Increasing resistance of the malarial parasite to the commonly used antimalarial drugs has become an important challenge. It is estimated that 400 million people are at risk of contracting drug-resistant malaria. Drug resistance first appeared on the Thai-Cambodia border in 1962 and now affects all countries of the Region with *P. falciparum* transmission.

There are plenty of examples that demonstrate that resistant organisms can rapidly move internationally as became evident with the spread of resistant pneumococcus from Spain to several countries. Antiviral drugs are now available to combat infections caused by viruses such as influenza, herpes, HIV and hepatitis B and C. The lessons learnt from extensive and overuse of these drugs will guide their future use. It is already known that HIV mutates very quickly and that resistance to antiviral agents can emerge quickly.

The vulnerability of the human race against emerging infections is paramount; the weapons with microbes unfathomable. The challenges are enormous. The options are limited. Though there have been significant achievements on several fronts, a lot more need to be done to combat emerging infectious diseases.

## **2.2 Factors Influencing Regional Vulnerability**

Infectious diseases have always been closely interwoven with the history of developing countries which are ideal sites for the emergence and propagation of infectious diseases. Poverty, over population, deforestation, urbanization, global warming, ignorance and weak health structures are characteristics of any developing country and ideal settings for the emergence of infectious diseases. The end-result is borne by the health of the people.

### ***Demographic factors***

Population pressure is an overarching determinant. A net addition of 77 million people per year occurs in the world. The 11 Member States of SEAR cover only 5% of the global land mass which houses 25% of the global population. In Bangladesh and Maldives, almost 1000 people occupy one square kilometre of land. This high population density carries increased

potential for spread of person-to-person disease, greater likelihood of global warming, large number of travelers, increased hunger and malnutrition. More people virtually guarantee extensive urbanization. By 2015, there will be 23 megacities with a population exceeding 10 million each of which seven shall be in SEAR. Most governments and civic authorities have not planned for this population explosion in the cities and are thus ill prepared to provide the necessary basic amenities like water, sanitation, electricity, garbage disposal, communication and transport etc.

In Asian countries, 10% of the population is expected to be over 65 years old by 2030. The aging process is characterized by multiple decrements in host defenses and concomitant increase in susceptibility to emerging infections.

Sharing of syringes by intravenous drug users, unsafe tattooing and skin-piercing practices spread blood-borne viruses such as hepatitis C. Globally, overuse of injections and unsafe injection practices have together caused an estimated 22.5 million hepatitis B virus infections, 2.7 million hepatitis C virus infections and 98,000 HIV infections.

### ***International travel***

International travel and trade also facilitate movement of infections. SARS has been documented to be the one of the fastest moving micro-organisms in the history of mankind. The Spanish influenza traveled around the world in less than 12 months; Hong Kong (1968-69) influenza took only six months and a future pandemic is likely to spread more rapidly because of the speed and frequency of human travel. SARS was carried through international air travel by infected people to 31 countries that reported probable cases of SARS.

### ***Socioeconomic factors***

Poverty breeds ill health and ill health, in turn, breeds poverty. Poverty remains the prime killer. Today, poverty amidst plenty is the world's greatest challenge. More than 522 million people in the South-East Asia Region live in abject poverty with an income of less than a dollar a day. Poor children are particularly affected with a greater burden borne by the female child. Not only are children more heavily and frequently exposed to threats to their health but are more vulnerable to diseases.

### **Environmental factors**

Safe water and good hygiene are prerequisites for individual as well as public health. Globally, it is estimated that over 1 billion people are without access to improved water supply and about 2.5 billion people lack access to improved sanitation. In SEAR, though 86% of the population is claimed to have access to improved water supply, the quality and safety of water is often questioned. Water-borne illnesses continue to be a major problem. Almost all the outbreaks of hepatitis E in India have been traced to the piped water that got contaminated by sewage from the pipes carrying sewer. Basic sanitation facilities are weak; more than 880 million population in SEAR lack access to improved facilities for excreta disposal.

**Animals and human health:** Human beings have lived closely with animals since time immemorial. But nowhere is this coexistence as intense, continuous and close as in SEAR countries. The close, continuous contact provides frequent exchange of micro-organisms between animals and human beings and provides an opportunity for some of the genetically altered organisms to adopt the human body and initiate a new cycle of human-to-human transmission. SARS exemplifies this phenomenon.

Zoonotic infections increase proportionately to the number of animals and the intensity of their contact with human beings. In addition, the demand for meat production has also increased exponentially. Emerging infections can arise from animals and birds (e.g. chickens and H5N1) and seed a pandemic through movements to distant countries through seasonal migrations or trade.

**Man-made ecological changes:** Haphazard degradation of the environment, especially in developing countries, is common. Ecosystems all over the world are being destroyed. Deforestation is altering flora and fauna with the resultant deterioration of the environment and providing greater contact to hitherto restricted pathogens. Clearance of forests to build an international airport in Malaysia in the 1990s led to a devastating outbreak of Nipah virus, carried by forest bats fleeing to agricultural lands. Malaria, dengue fever and schistosomiasis have increased in areas wherever artificial water bodies have been created.

**Global warming:** During the last three years, there has been growing consensus about global warming. It now appears quite likely that the earth will be 1° to 4°C warmer in the 21<sup>st</sup> century. This will change the distribution of vectors and enable them to thrive in previously inhospitable areas. At warmer temperatures, parasites develop more rapidly in mosquitoes. Consequently, there will be an increase in the incidence of malaria and dengue fever. Even if effective measures are instituted, it will take many years to negate the effect of global warming.

### ***Inadequate public health infrastructure***

Having a well functioning public health infrastructure can prevent many infections, particularly those that are food-borne or water-borne. Defects in the health system can result in massive epidemics. An efficient public health system not only quickly detects and responds to the epidemic during its initial phase but is also sensitive and sophisticated enough to spot a new or hitherto unidentified infection. Achieving an effectively functioning public health infrastructure is thwarted by inadequate funding and low priority accorded by the national governments.

## **2.3 Existing Response Capacity**

The success achieved in eradication of smallpox and guineaworm disease, and appreciable progress made towards eradication of poliomyelitis and elimination of leprosy has resulted in a perceptible national desire and political will to address problems of infectious diseases. This is evident from the support that initiatives for elimination of kala azar and lymphatic filariasis have received from various governments of the Region. Excellent progress is being made in expanding DOTS and implementing greater access to antiretroviral therapy in the Region. Malaria incidence is now static and has started showing signs of decreasing.

The commitment of national authorities has received a further boost through some international initiatives like the Millennium Development Goals (MDGs) which are the expression of global solidarity in improving quality of the life. In many ways MDGs aim to directly or indirectly influence the prevention and control of emerging diseases. The MDGs address the issues of

HIV/AIDS, TB and malaria; resolve to reduce mother and child mortality; improve sanitation and safe water supplies and favour special attention to slums and least developed countries which usually act as trigger sites for emerging diseases.

If Asia is considered a cradle for the emergence of some new infections, it also has Centres of Excellence for training and research on emerging infectious diseases and some of the finest WHO Collaborating Centres. It has a vibrant pharmaceutical sector with significant capacity to manufacture drugs and vaccines. The countries are working towards a strategy for integrated disease surveillance and response. In addition, there are public health institutions with a capacity to investigate and control infectious disease outbreaks and provide appropriate human resource development (Field Epidemiology Training Programmes) to upgrade the skills of public health professionals.

All countries have public health institutions that respond to outbreak investigations and the institution of control measures. Though there is a need to improve the efficacy and efficiency of the response mechanism, the basic infrastructure for the same has been created. Rapid response teams have been constituted in some countries to quickly initiate action in times of outbreaks. Surveillance activities are integral to several national health programmes mainly malaria, tuberculosis and HIV/AIDS. The need to expand these programmes to include early warning functions for emerging infections is gaining ground across the Region.

Global alert and response systems have also been created which countries from this Region are benefitting from. In 2000, WHO launched the Global Outbreak Alert and Response Network (GOARN) which links more than 100 networks, institutes and experts to provide support to countries on behalf of the international community in responding to disease outbreaks. Health Canada has instituted a Global Public Health Intelligence Network (GPHIN) which is a customized search engine that continuously scans the internet for rumours and reports. The data from GPHIN are available to WHO as well as to all countries for early detection of outbreaks and initiation of rapid response. Advanced information technology was successfully used by WHO during the SARS epidemic to create virtual networks of experts and institutions to gather and consolidate global experiences and knowledge in fighting SARS.

Upgradation of skills of public health professionals has been an ongoing process. Field Epidemiology Training Programmes are being regularly conducted in India and Thailand for all the countries. Almost 40 WHO Collaborating Centres are currently operational in Region in the area of communicable diseases.

Though the modern sophisticated laboratory and entomological support system is available to a limited extent in the public health area in most countries of the Region, their importance is widely recognized.

There is also a growing realization that emerging diseases can be better fought collectively. The existing regional organizations such as SAARC and ASEAN, initiated with the central objective of economic cooperation between countries, are now being utilized to extend collaboration in public health as well.

Global efforts against SARS demonstrated that emerging infectious diseases require a similar joint response for rapid containment. Global networks of laboratories, epidemiologists and clinicians were quickly identified by WHO and concerted efforts yielded commendable results. WHO is strongly advocating strengthening of surveillance, especially institutionalization of the integrated disease surveillance programme. Integrated surveillance will consolidate surveillance activities, improve outbreak/ epidemic detection, intercept early warning signals, strengthen early detection and confirmation of outbreaks as well as anticipate or predict outbreak and ensure preparedness for an early and effective response for disease prevention and control. GOARN is another example of global cooperation to combat outbreaks where national capacities fall short to contain the same.

Implementation of the revised International Health Regulations (IHR) is likely to commence from 1 January 2006. The IHR shall facilitate containment of the international spread of emerging infectious diseases with minimal disruption in the trade and human activities across borders. Even with extensive advocacy and preparations, the commitment and capacity of countries to combat emerging infectious diseases in the Region requires considerable strengthening.

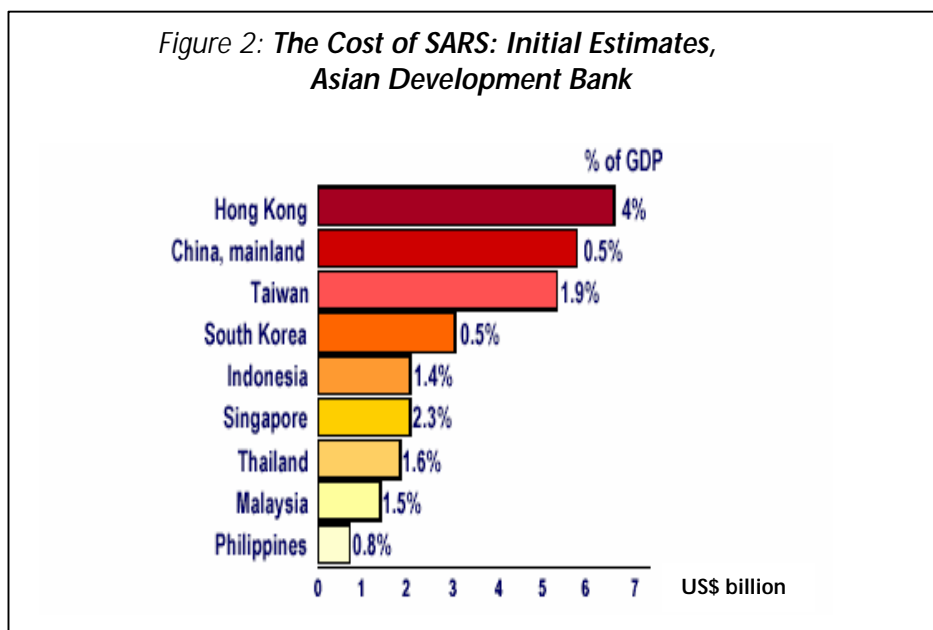
### **3. WHY FOCUS ON EMERGING INFECTIOUS DISEASES NOW ?**

In spite of an increase of 22 years in life expectancy in low income countries between 1960 and 1995, infectious diseases continue to be the leading cause of mortality and mortality. Nearly 30% of all deaths in developing countries are of people aged 15-59 years. This represents a problem of premature adult mortality with strong economic implications. Most of these deaths are due to infectious diseases. This group of diseases accounts for 90% of avoidable mortality in developing countries.

The impact of infectious diseases on national economies is overwhelming. The evidence generated recently by the Commission on Macroeconomics and Health conclusively showed that the impact of health on economic development has been underestimated. Health has both consumption and investment aspects. It is valued for its own sake and is a means to achieve other goals including generating good income. Common health problems viz infectious diseases impact productive activities and unexpected outbreaks of emerging infectious diseases can devastate national economies.

It is difficult to measure the social and psychological impact of these outbreaks. Estimates on the cost of the SARS outbreak (Figure 2) range from US\$10 billion to US\$30 billion. This can be compared to the 1994 locally-contained outbreak of plague in Surat, India, estimated to cost US\$2 billion and the 1997 avian influenza in Hong Kong which is estimated to have cost hundreds of millions of dollars in lost poultry production, commerce and tourism. A study by the US National Center for Infectious Diseases in 1999 estimated that the economic impact of an influenza pandemic in the United States would range from US\$71.3 billion to US\$166.5 billion.





Countering the influencing factors can mitigate many emerging infectious diseases. Safe water and sanitation are just two examples. The importance of safe water and sanitation has been recognized globally. However, achieving the MDGs of halving the percentage of unserved people with improved water and sanitation services globally will cost an estimated US\$ 23 billion per year. The estimated budget in SEAR countries ranges between \$3 billion to \$10 billion, depending upon the technology used. Till this becomes a reality, public health has to devise the means to tackle emerging infections that spread through unsafe water and poor hygiene.

Though concerted efforts are needed to effectively tackle the scourge of emerging infectious diseases, it shall be left to health authorities to evolve the mechanism and responses to outbreaks. It has been often shown that irrespective of the cause of an outbreak, the public health machinery has to face the outbreak as well as the fury of the people. A strong state of preparedness and institution of mechanisms for early detection and effective response are clearly needed.

Emerging infectious diseases are associated with high mortality, widespread panic, staggering economic loss and loss of credibility of the

health system as well as the national authorities. These aspects require the utmost attention of national health authorities. Emerging infectious diseases are important, evolving, complex public health problems. Their prevention and control will increasingly require application of sophisticated epidemiological and molecular biological technologies, change in human behaviour and a national perspective. The fight against these diseases requires a comprehensive vision and an efficient roadmap that stimulates action at all levels of the health machinery. Emerging infectious diseases will continue to challenge the public health infrastructure, test the credibility of the health services, and threaten to devastate health and economic development unless a strategic vision and an effective plan of action is developed to combat them.

**Lessons learnt from recent outbreaks of  
SARS and Avian Influenza**

In the world today an infectious disease in one country is a threat to all: infectious diseases do not respect international borders

Emerging infectious disease outbreaks have tremendous negative economic impact on tourism, travel and trade

Infectious disease outbreaks reveal weaknesses in public health infrastructure

Emerging infections can be contained with high-level government commitment, international collaboration if necessary, and strengthening of epidemiological and public health services

The compliance for early notification as per the International Health Regulations is paramount

Communication, especially on risk factors, with the public, media and other stakeholders is a key element

Global partnership and rapid sharing of data/information enhances preparedness

WHO and other international technical agencies can play a critical role in catalyzing international cooperation and support

There is a strong need to build up the confidence and strength to meet the challenge of emerging infectious diseases. History is the best teacher. Lessons need to be learnt from SARS and avian influenza outbreaks (Box ) and appropriate measures applied to effectively meet the challenge of emerging infectious diseases.

## **4. COMBATING EMERGING DISEASES: MOVING FROM EVIDENCE TO ACTION**

### **4.1 Goal and Objectives**

The goal of the new initiative is safeguarding people's health and developmental gains in the face of the threat of emerging infectious diseases.

The objectives are to detect, identify and monitor emerging infectious diseases; understand factors influencing their emergence and spread; and develop effective interventions for prevention and control of these infections.

### **4.2 The Strategy**

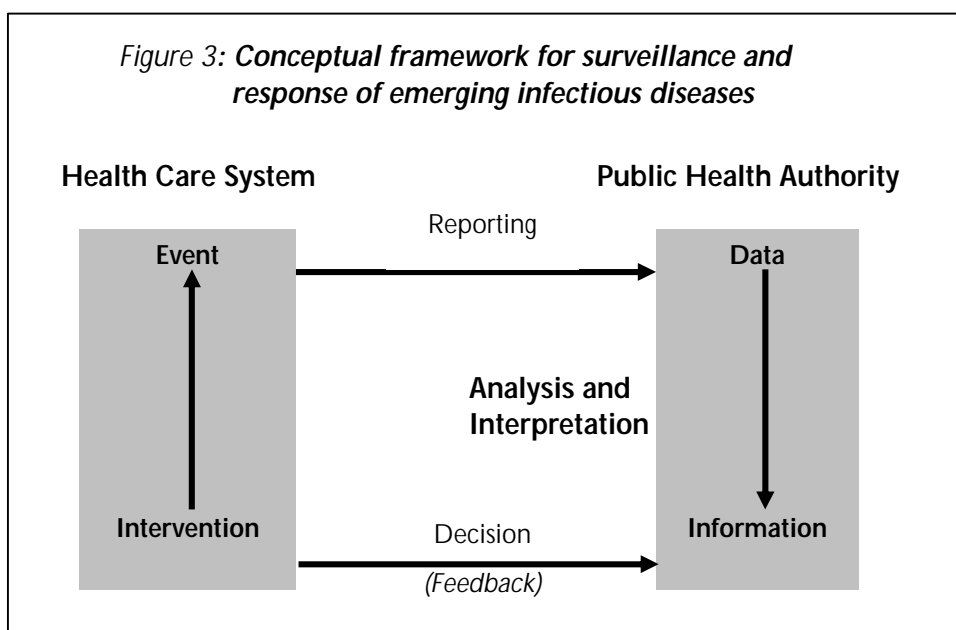
There are five strategic elements that are needed to combat emerging diseases. These include:

- (1) Epidemic preparedness and rapid response
- (2) Public health infrastructure
- (3) Risk communication
- (4) Research and its utilization
- (5) Advocacy for political commitment and partnership building

#### **(1) Epidemic preparedness and rapid response**

Surveillance in its simplest form is collection of information for action. A disease or an event under surveillance is first picked up by the health care system which reports it to the public health authority for interpretation and initiating action. The conceptual framework for the surveillance and response system for emerging infectious diseases is essentially the same as for any other communicable disease (Figure 3). However, in many developing countries implementation of this framework is hampered by several deficiencies. Prominent among these are inadequacies in data collection and capacity for its analysis by health care workers; weak feed-back mechanism and

inadequate public health laboratory support system. Some of the vertical programmes have their own data collection mechanism which is used only by them. They need to be integrated and horizontally linked. Similarly, the quality of epidemiological data needs improvement. Implementation of an Integrated Disease Surveillance Programme, as advocated by WHO, and an increasing use of information technology in health management information systems in countries of the Region are steps in the right direction in improving data management systems.



Implementation of a national plan requires strengthening of capacity, development of infrastructure and the availability of qualified and trained human resource. The capacity needs to be built or enhanced for scaling-up the known interventions and application of newly discovered technologies and solutions once these have been assessed to be useful in field conditions.

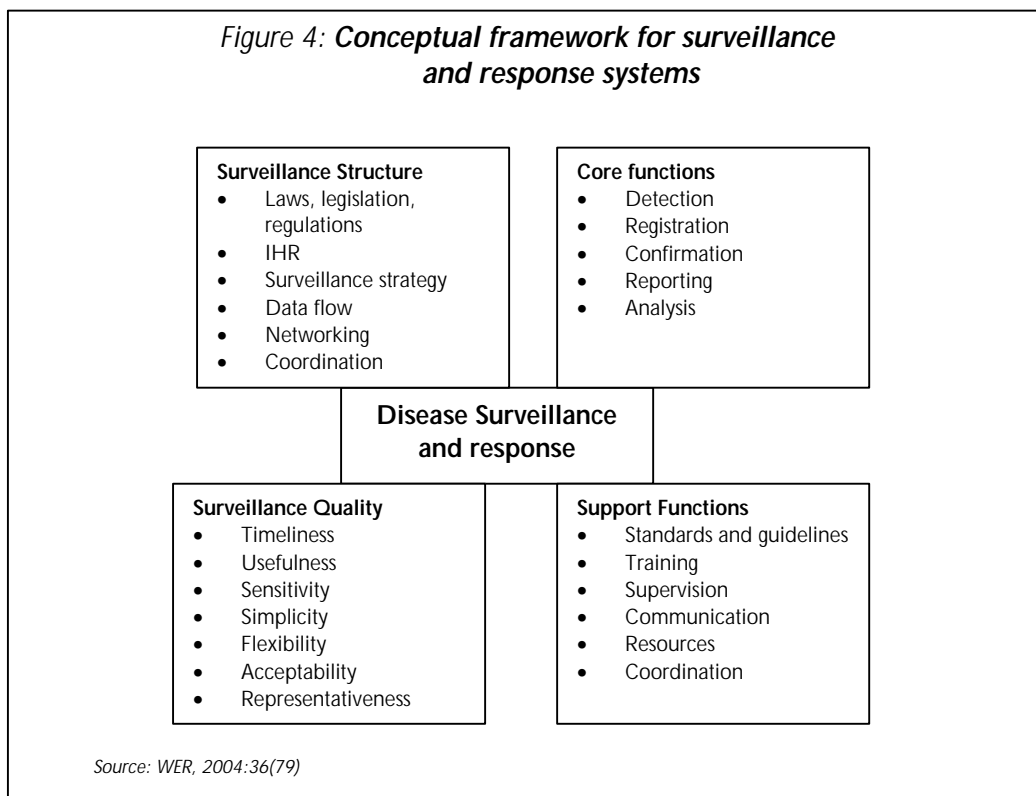
The objectives should include strengthening of routine in-country surveillance for emerging infectious diseases; enhance detection of outbreaks by the development of early warning systems and forging strong surveillance networks to facilitate flow of information and initiation of appropriate action.

### ***Key activities in preparedness***

- Assess national capacities, gaps and needs for prevention and control of emerging infectious diseases
- Establish a regional database of expertise and Centres of Excellence in various areas especially epidemiology, public health laboratories, entomology, training, clinical care and research. Develop a mechanism through which a specific regional expertise can be mobilized at short notice in support of a Member Country in need of such expertise
- Establish a situation/control room and a help desk for responding to queries from countries and general public regarding emerging infectious diseases and rapid dissemination of information through greater use of tools provided by information technology
- Build capacity through training of health staff on disease surveillance and epidemic preparedness and by strengthening a system of management including coordination and networking
- Work with Member Countries to prepare epidemic preparedness plans
- Promote establishment of surveillance and alert teams at national and state levels
- Plan and mobilize resources
- Conduct periodic evaluation of progress

Outbreak alert and rapid response is a process of anticipating, preparing for, detecting, responding to and controlling disease outbreaks. It is multifaceted and includes several components like an early warning system for prediction, an epidemic or pandemic preparedness plan to take prompt and effective control measures and a monitoring and evaluation strategy to assess the response. For an efficient alert and response system, an effective surveillance mechanism and quality laboratory support services are critical. A conceptual framework for a surveillance and response mechanism is shown in Figure 4.

**Figure 4: Conceptual framework for surveillance and response systems**



The capacity of the health systems to detect early warning signals should be created and frequently tested. In most instances, the initial cases of any emerging infectious disease are often detected by the clinician, while an unusual or new pathogen can be detected by an alert and efficient laboratory. Therefore, an astute clinician or a laboratory technician is able to identify a cluster of cases of similar nature. They should, however, have knowledge and skills to access the public health system in order to alert it to investigate and institute appropriate control measures. This process needs to be institutionalized. More often than not, clinical and public health services tend to operate independently of one another whereas the reality is that both are intensely interdependent.

An important component of outbreak response and management includes environmental and occupational response which would develop guidelines for efficient infection control practices in health care settings. A

minimum level of safe practices including standard precautions supplemented by risk-based precautions need to be established.

Outbreak response warrants extensive planning and a continuous state of preparedness. Priority actions to improve response include development of contingency plans, better mechanism for coordination between various agencies/institutions preferably through a designated focal institute, much greater surge capacity at regional and national levels including capability to quickly put together trained rapid response teams, strengthened laboratory capacity and systems for information technology. The revised International Health Regulations stress strengthening the core competence of countries in these areas.

A mechanism to implement the revised International Health Regulations that provide a powerful tool for harmonizing public health action among various countries and a framework for the notification, identification and response to public health emergencies of international concern should be established. The existing infrastructure should be strengthened and a new multidisciplinary infrastructure created with expertise and skills in different specialties (epidemiology, virology, entomology, mammology, clinical medicines, biotechnology). Centres of excellence for emerging infections should be identified and charged with undertaking continuous population-based studies, collate information from various centres and investigate outbreaks of emerging infectious diseases apart from augmenting national capacity and imparting training to various levels of health care workers.

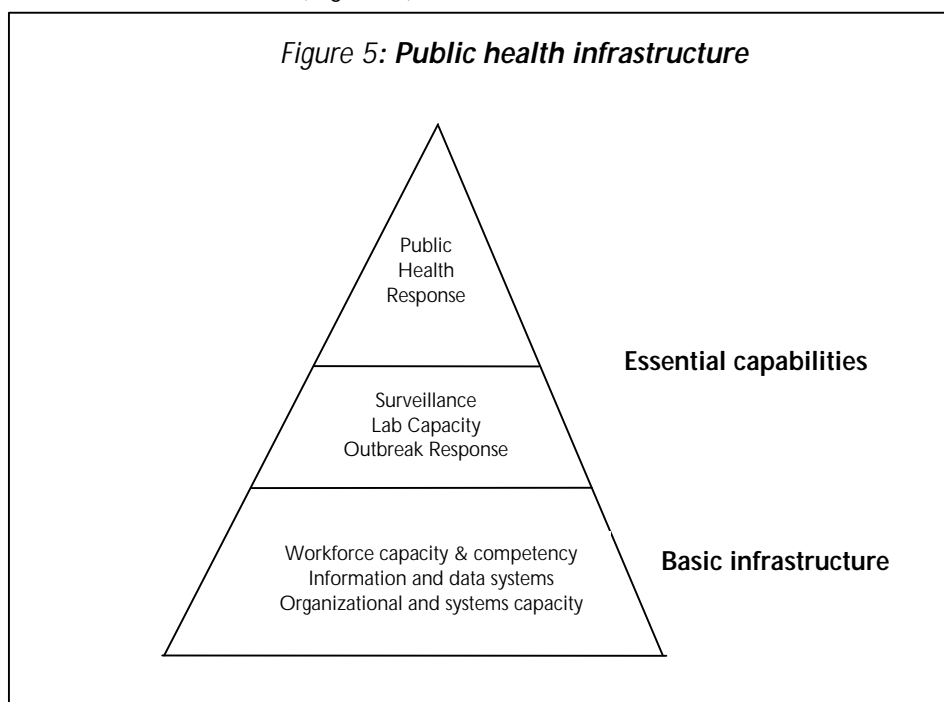
### ***Key activities for outbreak response***

- Identify institutes and Centres of Excellence and establish/strengthen networking between them by assigning specific roles for each institute
- Develop a mechanism for rapid access and mobilization of expertise for targeting outbreaks
- Institute a system of regular updates and feedback bulletins
- Formulate simple, practical and socially acceptable messages for action at community level to mitigate the impact of outbreaks

- Develop an efficient event management system and orient people for its effective utilization

## (2) Public health infrastructure including laboratory capacity

Public health infrastructure is the backbone of any efficient public health activity. It consists of people who work in the field of public health, epidemiology, entomology, environmental hygiene, infection control, laboratories and information and communication specialists at provincial, state and national levels (Figure 5).



The institutions, human resource, equipment and technologies as well as quality assurance of the activities should be developed and strengthened in such a way that all contribute efficiently to achieve the objectives of combating emerging infectious diseases. These would include public health laboratories for identification and molecular characterization of causative agents, development, appropriate use, and availability of diagnostic tests and reagents; cooperation from informed communities, use of modern communication and information technology.



### ***Multisectoral involvement***

Preventing emerging infectious diseases is a multidisciplinary and multifaceted endeavour. These efforts can generate desired results only if the intended beneficiaries actively participate in mitigating the risk factors and in implementing the control strategies. A well-informed community can provide immense support to any public health intervention. The public health machinery needs a strong interface with communities through productive partnerships with mass media and several nongovernmental organizations which have wider reach and enjoy greater credibility with communities.

Emerging infectious diseases are the result of an interplay between diverse factors. It is therefore important to recognize these variables, including societal attributes, and the need for multisectoral efforts to control infectious diseases. Several key partners can play a significant role in preventing and controlling emerging infectious diseases. It is prudent for the national authorities to keep various partners on board right from the policy and planning stage to implementation. Various partners, apart from national authorities in different sectors that are critical include the private sector, academic institutes, the mass media, NGOs and various international developmental partners. An enhanced public and private mix is needed to provide services to manage emerging infectious diseases.

### ***Human resource***

The public health infrastructure of countries in the Region suffers from a major shortage of qualified and trained public health staff. Each country must ensure an adequate number of qualified, competent and trained professionals in various specialties viz field epidemiology, entomology, public health laboratories, information technology and communication. Opportunities for continuous technical education and upgradation of skills should be created. The staff should be exposed to managerial skills, as it is ultimately how an outbreak is managed that matters.

### ***Laboratory capacity and use of modern technologies***

Accurate and timely laboratory analysis is critical for identifying, tracking and limiting public health threats. An efficient national network of public health

laboratories strengthens the health system and augments its capability to respond effectively to public health needs. Similarly, emerging disease surveillance should utilize modern computing and communication technologies to transform data into useable information quickly and effectively. Accurate and efficient data transfer with rapid notification of key partners and constituents is critical to effectively address the threats of emerging diseases. New statistical and mathematical models as well as geographical information systems using satellite imagery can yield valuable information.

A network of public health laboratories should be created with strong linkages between various laboratories. Facilities for virological diagnosis should be established in a large number of laboratories with adequate biosafety measures. The expertise and infrastructure within the countries must be harnessed, especially the veterinary sciences, universities, medical colleges and research institutes.

National authorities should designate and strengthen national reference laboratories with linkages to WHO Collaborating Centres, create competence in molecular epidemiology and promote its use in the detection and monitoring of emerging infectious diseases. It is equally important to promote the development, availability and appropriate use of diagnostic tests and reagents.

### ***Information sharing and networking***

International surveillance and response networks have shown their utility in enabling countries to be better prepared and respond to epidemics as was seen during the SARS outbreak. Several networks are operational – some are disease specific and some have defined objectives. There is a strong need to develop an inventory of these technical networks, document models that work best, interconnect them and promote their development and utilization by countries that are otherwise poorly covered.

WHO can play a vital role in the collection, collation and dissemination of technical information to all countries. An outbreak control room in the WHO Regional Office should be established. The control room can also be used for sharing information regarding verification of outbreak rumours, risk

communication, dissemination of updates and technical guidelines and holding tele- and video conferences on prevention and control measures.

### ***Key activities for building public health infrastructure***

The following are some of the key activities to build and strengthen public health infrastructure:

- Develop and sustain an adequate number of trained and competent personnel in various public health specialties at all levels.
- Ensure continuous upgradation of the skills and knowledge of public health personnel through training and information exchange
- Utilize modern computing and communication technologies for rapid transfer of data and information and for forecasting disease trends
- Encourage the establishment and/or strengthening of national public health institutes and public health reference laboratories
- Develop public health capacity to rapidly diagnose various emerging infectious diseases using modern molecular biological tools
- Formulate standards for infection control practices and ensure their implementation in health care settings
- Promote virological and genetics-based diagnostic services in public health laboratories
- Forge networking between various institutes and harness the expertise available within the country
- Encourage indigenous production of quality laboratory reagents
- Disseminate guidelines for handling, transporting and disposing infectious material pertaining to emerging infectious diseases

### **(3) Risk communication**

Risk communication is an interactive process of exchanging information and opinion among individuals, groups and institutions with the overarching aim

of rapidly containing a crisis with as little social, economic and political disruption as possible. It is aimed at combating irrational fear, hysteria and panic that may lead to huge economic and social disruption as well as antagonize public health activities for containment of an outbreak.

The objectives of risk communication are two-fold: to ease public concern by informing them about the risk, the treatment, the transmission dynamics and clinical features of disease outbreak and secondly, to make the public aware of actions that need to be initiated by people themselves for their benefit as well as for cutting short the transmission of infection.

Risk communication targets both the general public as well as the mass media, the latter to facilitate wide dissemination of appropriate messages. A strong partnership with the mass media should be forged to reach out to a wider section of people in the shortest time. Communication technologies, when used effectively, can augment available resources and accelerate progress in both the generation and dissemination of knowledge.

The essence of risk communication is to deliver messages that inform without frightening and educate without alarming.

Sound and thoughtful risk communication can assist public officials in preventing ineffective, fear-driven, and potentially damaging public responses to serious crises such as outbreak of an unusual infection. Appropriate risk communication fosters trust and confidence that are vital in any crisis situation.

### ***Key activities for risk communication***

- Strengthen risk communication by including qualified communication professionals in the outbreak response team.
- Develop risk communication protocol to include what is to be told to whom and by whom.
- Formulate guidelines for risk communication and train people in its implementation.
- Designate a spokesperson whose credibility and authority is respected to brief the media.

- Develop and maintain lists of media contact persons to facilitate rapid dissemination of information.
- Promote logistics for risk communication.

#### (4) Research and its utilization

Research can play an important role during an outbreak, in identifying the aetiological agent, developing diagnostic tools, case management modules and preventive strategies. Knowledge needs to be generated through research and interpreted, evaluated and transferred to improve practices for prevention and control of emerging infectious diseases. Most research is incremental, building on existing knowledge to find useful advances. The entire gamut of emerging infectious diseases and the factors influencing them need to be understood in the Asian perspective by understanding:

- (a) **environmental factors** which facilitate the emergence, maintenance and transmission of these diseases, especially vector-borne and zoonotic infections. These factors mainly include deforestation, developmental projects, global warming, urban ecology, defining 'at risk' populations, dynamics of transmission between wild and domestic animals.
- (b) **evolution of pathogenic infectious agents** resulting in changes in infectivity, virulence, transmissibility and adaptations based upon identification of changes at molecular level especially the genetic composition of the organisms
- (c) **host factors** that facilitate the emergence of infections and their spread including the use of antimicrobial and immuno-suppression drugs and the protective factors in a host
- (d) **development of new diagnostic tools** that can support rapid and accurate diagnosis even in field conditions; biomedical applications of new technology such as remote sensing and GIS to improve ability to predict future infectious disease outbreaks; mathematical models that can facilitate transmission dynamics and vaccines and other interventional tools
- (e) **social inequalities and behavioural factors** that influence distribution of emerging diseases, their course and the populations that are affected most, and

- (f) **impact of environmental changes** and climatic variability on the emergence of microbes.

Scientific research is also needed to guide public policy; develop evidence-based policies for rational use of antimicrobial agents in humans, animals and the environment and the formulation of environment-friendly and safe insecticides and pesticides. For instance, scientific information is needed to formulate policy on use of antimicrobial agents in agriculture and aquaculture, as well as in treatment of human illness. Similarly, research on the impact of environmental changes and climatic variability on the emergence of microbes can inform policy discussions on land use, waste disposal, water resource management, and agricultural policy.

### **Key activities for research**

Key research activities should:

- Enhance national capacity and skills in health research and support institutes with appropriate expertise and infrastructure in pursuing research for better understanding of dynamics of emerging infectious diseases leading to the development and strengthening of all the components of effective integrated disease surveillance systems
- Identify research priority areas that have a direct or indirect bearing upon the development and implementation of control strategies including identification of causative agents of emerging infectious diseases as well as identifying factors that influence the emergence of diseases
- Involve various sectors which have competence in specific areas viz. environment, veterinary sciences, molecular biology, to understand societal and ecological factors influencing these infections
- Use evidence generated by research in formulating policy, influencing public and mass media perception of the prevention and control of emerging diseases as well as public response to these diseases

- Support public policy analysis including economic analysis in relation to the prevention and control of emerging diseases
- Promote research for development of new diagnostic tools, vaccines and drugs to combat emerging infectious diseases

### **(5) Advocacy for political commitment and building partnerships**

Prevention and control of emerging infectious diseases is the responsibility of national governments. This cannot be delegated to any other agency or organization. At the same time, efficient programme management can be implemented only if there is a strong political will and commitment, adequate financial and human resources as well as productive partnerships with different sectors. The goal can be achieved through a strong infrastructure, competent and skilled human resources and an efficient inter-sectoral partnership.

The collaboration between government agencies is easier and feasible. It becomes challenging when the private sector and the mass media are to be involved. These are essential players in any endeavour to tackle emerging infectious diseases. The mass media enjoys immense power over the communities through its inherent strength of providing information. The private sector has extensive reach. Both are critical partners.

A thorough review of the public health infrastructure is warranted to create a new comprehensive national plan to develop and apply established standards for public health infrastructure. National commitment and nationally coordinated efforts are, therefore, necessary. In most countries the public health system is fragmented and a renewed commitment is needed. Planning needs to be strategic and not reactive for emerging infectious diseases because no one knows what new disease will emerge, where and how. The public health system must be prepared for the unexpected.

Government commitment and support should be formalized through the development of a national policy document to meet the challenge posed by emerging infectious diseases as well as similar infections of veterinary importance. A national plan for emerging infectious diseases should be developed and a National Technical Advisory Group established to guide,

advise and monitor the national efforts against emerging infectious diseases. A national focal point should be identified to coordinate with various sectors. National guidelines for the preparation of plans, procedures and training of human resource should be finalized in consultation with various partners.

### ***Key activities for advocacy for political commitment***

These include the following:

- Mobilize adequate financial resources to create and strengthen an appropriate infrastructure to implement the national plan on emerging infectious diseases.
- Develop adequate human resources to implement the national plan and respond to the outbreak investigation. Epidemic preparation plans could help in resource mobilization.
- Develop consensus for a national policy with full involvement of all concerned parties.
- Establish a core group consisting of skilled public health professionals and from other disciplines for efficient surveillance, effective rapid response to outbreaks and better understanding of various facets of emerging infections.
- Set-up a formal mechanism for intersectoral collaboration, public-private partnership recognizing the centrality of health in developmental and environmental issues.
- Pursue common strategies for efficient use of antimicrobial agents and insecticides for humans, as well as in the agriculture, veterinary and aquaculture sectors. Approaches for identifying factors that influence the risk of emergence of infection and occurrence of disease should be developed, evaluated and implemented.
- Communicate information on potential risk factors on a continuous basis for various target populations. Various socio-environmental factors should be collated and mathematical models developed to forecast outbreaks and the emergence of infections.



### **4.3 Monitoring and Evaluation**

Programme management should be supported by modern tools and manned by skilled professionals to ensure efficiency and the capability of responding effectively to outbreaks. A national focal point to coordinate various activities should be identified. A realistic plan of action for a defined period should be developed for implementation. Planning for emergency response should facilitate immediate and effective response.

The management of the programme and logistics should be improved. A mechanism to ensure the timely supply of adequate drugs, vaccines and diagnostic tools for use in public health must be established and periodically assessed to verify its competence. Existing cost-effective control tools should be scaled up and research encouraged to develop new interventions.

The National Technical Advisory Group should undertake monitoring and evaluation of all the activities under this programme. It may ask respective agencies or government departments to appoint a cohesive group of technical experts to oversee the activities pertaining to these diseases with periodic reporting to the National Technical Advisory Group. Monitoring should also be undertaken by these technical groups to identify the lacunae and constraints and suggest suitable remedial measures.

Monitoring and evaluation is necessary to constantly review the performance on the basis of selected indicators. This also helps to identify problems in order to institute corrective measures in a timely manner and adjust resources according to the identified needs and priorities. While monitoring helps to continuously track performance as per the plan in a timely manner, evaluation goes a step further in terms of periodic assessment of changes in targeted results/objectives attributed to surveillance and response. Both, however, should be an integral component of the surveillance and response system. There should be a plan for conducting monitoring and evaluation. This plan should clearly define the base line information, roles, objectives, expected outputs, methods, frequency and resources. The findings of monitoring and evaluation should be documented and the recommendations followed-up for improving the performance of the system.

## 5. ROLE OF WHO AND OTHER PARTNERS

WHO is the lead UN agency in international health. With its six Regional Offices and 147 country offices, it has tremendous reach. Through the 1100 WHO Collaborating Centres, spread across the globe, it has access to most modern technology and a global knowledge-base. Historically, WHO has been providing technical support to countries in their fight against diseases and for the promotion of health. Both the normative and technical support roles of WHO are crucial to countries in developing policies, making plans and implementing them efficiently. The revision of the International Health Regulations is being expedited by WHO to strengthen intercountry efforts for sharing data and restricting the international spread of infection with the least disruption in trade and human mobility.

### ***Technical support on a continuous basis***

WHO continuously supports countries in the planning, implementation, monitoring and review of national response to epidemics. To meet the needs of developing countries, WHO facilitates national capacity building including provision of training, particularly in public health epidemiology, communicable disease surveillance and outbreak investigation, as well as in laboratory diagnosis. WHO also collaborates with various other international agencies especially OIE and FAO in containing emerging infectious diseases. Guidelines and technical documents which enhance country capacity are continuously developed, disseminated and also posted on WHO websites.

### ***Support for research***

WHO provides support to advocate for and facilitate research promotion and development in the Member States; to build and strengthen national research capability through collaboration with medical/health research councils and analogous bodies and other health research-related institutions, including national, regional and international NGOs; to elucidate and foster public debates on the social and ethical implications of science and health development in their social, economic, medical and cultural environments and to strengthen analytical capability to devise common approaches to analytical reporting within the Organization.

WHO has the advantage of providing rapid support to countries during outbreaks. Technical support can be quickly mobilized from different countries and through WHO Collaborating Centres. Diagnostic reagents, personal protective equipment and drugs can be procured internationally and made available to the countries through various WHO mechanisms. The Global Outbreak Alert and Response Network (GOARN), has been playing a very active role in galvanizing global response to emerging infectious diseases. This role of WHO in responding to the pandemics and to alerting countries was quite evident during the recent outbreaks of SARS, avian influenza and Nipah virus.

Asian countries are served by two Regional Offices of WHO, viz the South-East Asia and the Western Pacific. The geographical boundaries between the countries covered by the two Regional Offices of WHO do not limit them in fighting the menace of emerging infectious diseases. Both offices realize the need for critical support and for coordinating international response as well as in providing country-specific support. Each of these Regional offices will establish an Information and Communication centre, as an operations room, for information management and dissemination, as part of outbreak alert and response network; create a Regional Outbreak Alert and Response Network to supplement regional/national efforts against outbreaks of emerging infectious diseases; develop an inventory of institutes and experts in the Regions and forge linkages between them to construct networks of epidemiology and public health laboratories.

WHO will also proactively collaborate with other agencies including FAO and OIE for harnessing technical expertise available within UN agencies and work jointly with them to strengthen the capacity of countries in the two Regions.

### ***Other partners***

The World Organization for Animal Health (OIE) which is an intergovernmental organization, plays a significant role in the area of controlling emerging infectious diseases that originate from animals. The objectives of this organization include the promotion of animal welfare through a science-based approach, transparency in global animal disease and zoonosis situation as well as in the collection, analyses and dissemination of

scientific veterinary information. A close and continuous cooperation between public health agencies and OIE ([www.oie.int](http://www.oie.int)) is critical for the containment of any zoonotic infection. Similarly, FAO can provide invaluable collaboration in combating emerging diseases.

Various intercountry associations (SAARC, ASEAN) and bilateral arrangements are already functioning in the Region. Public health can be mutually strengthened through these mechanisms. Strengthening of disease control measures, especially those for emerging infectious diseases that have the potential to cross the borders should be discussed in the meetings of these fora to strengthen intercountry cooperation.

## **6. CONCLUSIONS**

Events that have occurred during the past three decades reinforce the fact that newer microbes will continue to appear and infectious diseases continue to emerge. Unless controlled effectively, they will take a heavy toll of human life regardless of age, gender, lifestyle, ethnic background, and socioeconomic status. These diseases will cause not only suffering and death but shall also impose an enormous financial burden on society. Some of these diseases may carry the potential of causing a pandemic. Influenza is the most likely candidate and the recent occurrence of avian influenza demands greater attention by the national authorities to immediately strengthen the recognition and response mechanism, infrastructure and expertise. While it is not known which new diseases will emerge tomorrow, populations have to be protected by staying one step ahead of the microbes by creating and sustaining a strong and vigilant public health system. The prevalence of several environmental and socio-economic factors augments vulnerability. These challenges can be met effectively through a national commitment, strengthened public health infrastructure, skilled and competent human resources, intersectoral collaboration and intercountry cooperation.

The emerging infectious diseases need to be confronted collectively by the international community. SARS and avian influenza could only be contained through global efforts. Mechanisms for forging intercountry and inter-regional linkages need to be strengthened. WHO, with its mandate of providing technical support to all countries in health development will continue to support regional outbreak investigation and disease surveillance programmes and strengthen the knowledge base of the countries to combat emerging infectious diseases.

Emerging infectious diseases are real. Their challenge is overt. With strong political support and efficient health systems the challenge can be met. Tested strategies and tools are available and so is the willingness of the international community to work together. The need of the day is continuous vigil and harnessing of national and international resources to protect mankind from the onslaught of emerging infectious diseases.