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Emergent Infection : a Global Health Threat

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ABSTRACT

The world today is in a state of turbulence and rapid change. We are facing an alarming proliferation of emerging and re-emerging infectious diseases which is but one manifestation of instability and stress in the system. Many social, economic and political factors are contributing to the global spread of infectious disease. Changes in ecology and climate, the evolution of microbes and antimicrobial resistance also contribute to disease emergence. No nation can be complacent regarding human vulnerability to the microorganisms with which we share our environment. Emerging infections transmitted by contaminated foods and public water supplies place entire communities at risk. Emerging infections contribute substantially to the ongoing burden of infectious diseases on the public worldwide, resulting in economic losses and days of disability. Current public health systems are poorly prepared or inadequate to confront the present and future challenges of emerging infections. Meeting the broad challenge of emerging infections requires interaction, co-operation, and co-ordination among a wide range of public and private organisations. Multi-disciplinary approach to tackle the problem, approaching the problem at system level, investing in surveillance, information systems and research, capacity building, EID funding pool and emergency preparedness are worthy of top policy attention.

Key words: Emergent infection, microorganism, surveillance, infrastructure, capacity building, evolutionary potential, funding pool, emergency preparedness

Fatal interchange of disease between animal and human being is the story of civilization itself. Disease is a social development no less than the medicine that combats it. It is the price we have paid and are still paying for development. Societies shape patterns of disease-in part create diseases they experience.

The world today is in a state of turbulence and rapid change. The emergence of infections in many geographical areas is but one manifestation of instability and stress in the system. Infectious diseases remain the most common single cause of death in the world today. Once thought to be on the verge of being eliminated as a public health problem, infectious diseases are responsible for worsening the living conditions of many millions of people around the world. Infectious diseases thwart the economic development of the world's poorest countries and strain

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already overburdened health care infrastructures.

In 1991, Cholera in Peru affected 300,000 people resulting in 3,000 deaths and amounting to $700,000 in expenses. Estimates are that in 1994, plague in India resulted in a loss of $2 billion due to the reluctance to report and lack of preparedness (1). Food borne pathogens such as *E.Coli* in the United States were linked to under cooked meats. While many infectious disease outbreaks have resulted in substantial economic and human loss, others have been better managed. For example. Zaire dodged a "bullet" in 1995 when the Ebola outbreak occurred.

Patterns of infectious disease are changing globally and on a massive scale (2). Emerging infectious diseases [EID] have been reported in all regions of the world. Three general forces can affect the burden of infectious diseases in humans: change in abundance; virulence, or transmissibility of microbes; an increase in probability of exposure of humans to infection and to the consequences of infection. A wide range of biological, physicochemical, behavioural, and social factors influence one are more of these forces. Many are interrelated, and multiple synergies exist (3).

The spectrum of infectious diseases is changing rapidly in conjuction with dramatic changes in our society and environment. Worldwide there is explosive population growth with expanding poverty and urban migration. Technology is rapidly changing: international travel and commerce is increasing all of which affect our risks to exposure to the infectious agents with which we share our environment. Other causative factors include: the emergence of new diseases, the re-emergence of old threats , inappropriate use of prescription drugs, human behaviour, economic development and change in land use, breakdown in public health infrastructure and microbial adaptation and selection. With the global population growing from 2.5 to 5.8 billion over the last 25 years, large urban centers throughout the developing countries are overcrowded and have inadequate sanitation, a setting ideal for the emergence of infectious diseases. By 2025, the global population will reach 8.6 billion. In developing world this represents an 84% increase, which will intensify overcrowding in these areas. In industrialized countries, an ageing population base, the advent of immuno-suppressive medications, and the emergence of human immunodeficiency virus [HIV] infection and acquired imunodeficiency syndrome [AIDS] are combining to increase the risk for opportunistic infections. Moreover, with increased travel, clinicians see increasing member of patients with exotic diseases acquired abroad. The emergence of multidrug-resistant tuberculosis [MDR-TB] in the United States and elsewhere, and recent migration of epidemic diphtheria from the former Soviet Union to Europe are but two examples of infections resulting from international travel (4).

WHY ARE THEY EMERGING NOW?

Many factors, can contribute to disease emergence. Newly emergent infectious diseases may result from changes or evolution of existing organisms; known diseases may spread to new geographic area

or new human populations; or previously unrecognized infections may appear in persons living in areas undergoing ecological changes, such as deforestation or reforestation, that increase their exposure to insects, animals, or environmental sources that may harbour new or unusual infectious agents (5-7).

Re-emergence of infectious diseases may occur because of the development of antimicrobial resistance in existing agents [e.g., malaria] or break down in public health measures for previously controlled infections [e.g. cholera, tuberculosis].

The process of emergence and re-emergence of infectious diseases is a co-evolutionary one. No genomes are more plastic than those of viral predators: even within a single infected individual, genomic change plays a large role in the pathogenesis of HIV, as well as in malaria or trypanosomiasis. Larger bacterial populations have exhibited dramatic shifts in antibiotic resistance. These resistant bacteria can then display promiscuous genetic exchange and resuffering through conjugal plasmid transfer (8). Accommodation by compensatory evolution is too costly to contemplate Human gene frequencies would diverge only after drastic natural selections, the sacrifice of a substantial past of the susceptible herd (8). Human genomic change is not the answer for this feasible future. Extensive cross-species contact among humans and certain domestic animals can dictate antigenic shifts in influenza viruses. The likelihood of emergence of a new influenza virus in the near future increases with the growth of the frog populations in China. The emergence of new viruses such as HIV and filoviruses, indicates the virtually unlimited capacity of pathogenic organisms to mutate and rapidly adopt to environmental changes and selective pressures.

Tens of millions of cases of dengue and hundreds of thousands of cases of dengue haemorrhagic fever are reported annually, and more than 2.5 million people are at risk for infection (4). Factors contributing to the emergence of dengue include unplanned and uncontrolled population growth associated with urbanisation in tropical regions; lack of effective mosquito control, deteriorating water systems that increase densities of *Aedies aegypti*, and viral migration among tropical urban centres due to international travel.

The exponential increase in ecologic change, both environmental and behavioural, is the major driving force for the increasing human risk for viral infection. Travel of infected humans and international transport of microbes and vectors help provide the maximum possible microbial evolutionary opportunities in the minimum amount of time.

In prior illnesses such as Creutzfeldt-Jakob disease, risk factors and iatrogenic factors are important. The illness is thought to be linked to Bovine spongiform encephalopathy [BSE]. Mathematical modelling suggests that 75,000 to 80,000 cases will occur in the foreseeable future.

Poverty, changing immigration patterns, and the emergence of HIV contribute to rate of increased incidence of tuberculosis. Poorly managed tuberculosis control programs, suboptimal access to

health care, an inadequate doctor knowledge base, and poor patient compliance have combined to increase the incidence of tuberculosis and especially MDR-TB. Sensitivity testing is critical in the management of resistant TB. Effective control of TB will require social, political, and cultural change as well as medical innovation (4).

General approach to antibiotic resistance include [i] source control, particularly hand washing, and the need to wear gloves during contacts with all patients; [ii] improved antibiotic use and control; [iii] improved infection control devices; and [iv] better use of pathology and immunologic modulation.

EVOLUTIONARY POTENTIAL OF MICROBES

We face an ever-evolving adversary: microbes a billion fold more numerous than ourselves, vested with high intrinsic mutability and replication times measured in minutes, not years. Within every infected person, we see a Darwinian struggle mobilizing the genetic diversity of our immune cells to respond to the efficiency of that machinery. But many microbes have learned their own trick of jamming or coming in under the radar scan, masking their antigens or simply multiplying faster than our immune system can respond for these, a strategy of mutual attrition, or evolutionary competition, is doomed. Pitted against microbial genes, we have mainly our wits (9).

Our ability to develop method to counter infectious agents so far have not matched the myriad strategies employed by the sea of microbes that surround us. Their sheer numbers and the rate at which they can evolve are daunting. Although new vaccines, new antibiotics, improved global communication and new modalities for treating and preventing infections will be developed, pathogenic microbes will continue to develop new strategies of their own, presenting us with an unending and dynamic challenge. (10)

ANTIMICROBIAL RESISTANCE

Evolution of resistant bacterial strains threaten to outpace development of new drugs and the ability of public health professionals to protect the community. Antimicrobial resistance comes of age. Diseases are fighting back.

Wide use of antimicrobials has led to high rates of resistance among many bacteria (11). Modern medical techniques applied with inadequate training and resources have had disastrous consequences, as shown by dramatic outbreaks of nosocomial lassa fever in Nigeria and Ebola disease in Zaire (12). Transmission of Virus resulted from exposure to contaminated needles and from lack of adequate barriers during surgery. Mass processing and distribution of food has resulted in occasional massive outbreaks of infections such as Salmonellosis and *E. Coli* 0157:H7. Changes in climate lead to creation of new habitats that are energy expensive and provide new avenues for spread of infection (3). With over 250 systemically usable antibiotics available worldwide. We are certainly not on the verge of a post-antimicrobial era. Control of interaction

measures and agreed policies of restricted drug use can do much by way of mitigation. Wasteful prescribing is not merely money down the drain, it increasingly adds to selective pressure for microbial drug resistance. Bacteria possess endless resources to ensure their revival. We have enough antimicrobial agents, but we must learn to use them more circumspectly. Governments should regulate, more effectively the use of antimicrobials. It is time for medical schools to introduce formal teaching of the principles of rational prescribing in infection. There is a need for continuing education and training of health professionals to bridge the gap between social behaviour, political structure and economic power. There is a need to reassess use of antibiotics in animal feed.

ERADICATION OR CONTROL

The advent of molecular biology, modern developments in newly available opportunities for earth-orbiting, satellite-based surveillance as a means of predicting certain regional epidemics, and the introduction of remarkable raw antibiotics which can cure some awesome problems would have astonished anyone only a few decades ago. Just the same, even with these laudable advances, malaria is still with us, tuberculosis, poliomyelitis and EID are growing worldwide problems.

Eradication may be considered an ultimate goal. Smallpox was a major human scourge that has now been eradicated. Eradication requires permanently breaking a link in the chain of events that maintain an infection. However, in most cases, control is the practical goal.

Narrowing the gap between discovery and production of new technologies and their practical deployment will be one of the cardinal challenges of public health in the 21st century.

There is an urgent need to integrate knowledge about infections diseases with knowledge of climate and environmental change, migration and population of growth, demography and the consequences of conflict.

GLOBAL RESPONSE

The global threat requires a global response. Tackling emergence of infectious disease is worthy of top level policy attention. The burden of protecting the people from emergent infection cannot and should not be shouldered solely by the medical community. If the public were aware of the dangers and of simple, common-sense strategies that can protect their families, many people could be spared from debilitating and even tragic illness.

Concerted global and domestic surveillance and diagnosis of disease outbreaks and endemic occurrence is needed. There is need for the installation of sophisticated laboratory capabilities at many centers. Vector management and monitoring and enforcement of safe water and food supplies should be ensured. Public and professional education need our attention. Scientific research on causes of disease, pathogenic mechanisms, bodily defenses, vaccines, and antibiotics should be a priority. Cultivating the technical fruits of such research with the full involvement

of the pharmaceutical industry, and a public understanding of the regulatory and incentive structures, are needed to optimise the outcomes (9). Investing in research activities and in health education to enhance the diagnosis, treatment, prevention of disease will go a long way to raise public awareness of the dangers such diseases pose and the measures we can take to protect ourselves.

Response to infectious disease outbreaks whenever and wherever they occur requires international preparations and planning. Each country must train medical workers and laboratory technicians and supply them with appropriate equipment and diagnostic resources. Several international elements must be in place to provide the wherewithal for effective and timely disease control and prevention efforts.

GLOBAL PARTNERSHIP

A worldwide partnership of countries, non-governmental organization, international organization, and individuals is required to respond to the threat of emerging disease by ensuring rapid detection and effective containment. There is a need to synergise global partnership by ensuring strong national disease surveillance and control programmes, global networks to monitor and alert the world to infectious diseases, rapid information exchange through electronic links, and rapid response to contain epidemics of international importance. Reliable and solvent information on diseases and outbreaks to the world community through media should be made available. This has to be supplemented with appropriate advice to people living in or going to affected areas. There is also a need to revise international health regulations to provide an internationally agreed code of practice and control of potentially dangerous infectious diseases, according to todays epidemiological and economic realities guidelines should be provided on the application of regulations to minimize the disruption of travel and trade.

Rapid communication is vital to the functioning of a global network of monitoring centers. Through the internet we can link clinical and health research facilities around the globe so that newly emerging diseases can be recognized early and dealt with rapidly. Within limited financial resources, a small network of strategically located sentinel centers may be the effective way to begin providing early warning of serious epidemics.

Historically strategies to control infectious diseases have included quaranies and barriers to international travel and immigration. There is a need to develop and agree upon more appropriate, medically sound and practical screening options. Such policies must respond to changing societies, the evolving epidemiology of disease, the rights of individuals, and the public health needs of the community (13).

SURVEILLANCE AND INFORMATION SYSTEM

Timely recognition of emerging infections requires early warning systems to detect these diseases, so that they can be quickly investigated and controlled before

they become major public health crisis. Prompt detection of these new threats requires careful monitoring by effective surveillance systems, a thorough understanding of trends in incidence and distributions of known infectious agents, and good communication among clinicians, medical laboratories,and public health systems.

The ability to detect what is new or re-emerging depends on the capacity to identify and track the routine as well as the unusual. Surveillance with appropriate laboratory support is critical to an effective defence against these diseases. They are the most important tools for determining which infectious diseases are emerging, causing serious public health problems, or receding. Effective surveillance also provides a basis for evaluating the outcome of both health and personal medical care programs.

In, addition to comprehensive and innovative surveillance systems, effective preparation for emerging infectious diseases requires sound foundations in professional expertise, laboratory support and research capability.

To be successful we must apprehend infectious diseases in their evolutionary and ecological context (3). The elements of a global network for disease surveillance already exist but need to be strengthened, linked, and co-ordinated (1).

The modern world is a very small place, where any city in the world is only a plane ride away from any other. Infectious microbes don't recognize national borders. Without preventive public health measures, uncontrolled outbreaks can grow into major epidemics. A global system for infectious disease surveillance and response will help protect the health of people throughout the world (1).

The direct and indirect costs of infectious disease are staggering. Clearly, public health measures that prevent infectious diseases can be extremely cost-effective.

Three steps involved in responding to a disease outbreak include surveillance, evaluation, and implementation of control measures. Surveillance begins with accurate diagnosis and requires open lines of communications among doctors, scientists, and government officials. Evaluation requires epidemiologic and laboratory based investigations. Disease control requires that public health infrastructures are in place and that resources are available to procure and distribute medical supplies, such as drugs and vaccines.

To avert the threat of emerging infectious diseases and prevent their spread, health officials must be aware when epidemics occur anywhere in the world. However, reliable information can only be secured through clinical and laboratory-based surveillance that links medical and public health workers into a cooperative world wide network.

Four strategic objectives are necessary to establish a global system for disease surveillance and response strengthen existing surveillance systems; determine which common disease should be diagnosed within a country and which uncommon ones should be referred to reference laboratories, diagnostic tests be made available through a regional laboratory referral and distribution system. Develop

simpler, more cost-effective procedures to determine the causes of disease; enhance the capabilities of government agencies and existing disease-specific networks to respond to recognized outbreaks identified through improved surveillance and interdisciplinary research to support control and prevention (1).

Each nation should be encouraged to report, as early as possible, new events or trends in human or animal disease that are affecting its own population. Collaborative research to determine the cause of epidemics, devise strategies for control and prevention, and identify environmental and climatic conditions that favour the emergence of pathogenic microbes should be encouraged. There is a need to identify regional and international resources that can provide diagnostic reagents for low incidence disease, and help identify rare and unusual diseases.

APPROPRIATE TECHNOLOGY

Government must do more to promote a healthier environment. Especially for the poor who face greatly increased risks from poor sanitation, insufficient and unsafe water, poor personal and food hygiene, inadequate garbage disposal, air pollution, and crowed and inferior housing. Collectively these risks are associated with 30% of global burden of disease.

Development of suitable technologies for utilization of wastes is essential to minimize adverse health and environmental consequences. In most of the developing countries, the collection, transport, and disposal of solid waste is unscientific and chaotic causing water pollution, methane emission and said degradations. An apathetic government and crumbling public health care systems create ideal conditions for the deadly miasma of diseases that rise from the clogged drains, rotten garbage heaps and stagnant pools of water. Spread rapidly by a host of vectors like rats, mosquitoes and scavenging animals. They will claim thousands of lives and incapacitate many more. It was only when the dengue epidemic was raging in Delhi (India) that the government seemed to realize that mosquitoes breed in open bodies of water.

Surveillance, applied research, and prevention activities are critical to maintaining a strong defence against infectious disease (14). There is a need to integrate laboratory science and epidemiology to optimise public health practice.

MULTIDISCIPLINARY APPROACH

To continue and sustain improvements in health. It is necessary to combine the knowledge and skills of the public health profession with the brilliance of the clinicians to create the maximum opportunity for all to enjoy lives of good health and longevity. Better understanding of infectious agents is needed as a basis for the development of new therapies.

Dramatic advances in molecular biology and genetic engineering techniques have provided a shaft of candidate vaccines that will simply immunization. Improve the performance of existing vaccines, and protect children against diseases for which no vaccine currently

exists. Vaccine development should be based on epidemiological realities rather than current market demand in order to be cost-effective and affordable.

New approaches have, to be found which are flexible and compatible with local needs. There is a need to switch the program focus away from coverage to disease to disease control. Emergency preparedness and response of humanitarian agencies to tackle epidemics and refugee emergencies is very important. It is essential to ensure 100% coverage of immunization. Poor performing regions must be targeted. Hepatitis B and Yellow fever vaccines should be added to Expanded Program of Immunizations. BCG should be replaced with tuberculosis vaccine.

CAPACITY BUILDING

There is a critical need for co-ordination and strategic planning to rethink and upgrade efforts for emergency preparedness for responding to disease outbreaks.

Forward looking, sustained efforts to control and ultimately prevent major disease threats form the essential foundations for any plan to successfully address emerging infectious diseases. The process of responding to international microbial threats encompasses a multitude of activities, including diagnosis of disease; research to understand its modes of transmission; research to develop adequate means to treat it or prevent its spread, and production and dissemination of the necessary drugs and vaccines. Effective response to outbreaks of infectious disease include both immediate response to disease emergencies and ongoing activities to develop and maintain the tools to contain outbreaks, or better yet, to predict and /or prevent them before they happen (1).

The response component of a global infectious disease net work must rest on a complex foundation that includes skilled public health workers, national and regional laboratories for diagnosis and research, communications systems, and the commitment of national health ministries.

Disease prevention is an investment in the young people of the world and in our collective future. Prevention efforts immunisation, education to change unsafe human behaviours and other public health measures are the most cost-effective and beneficial of all measures that address the problem of infectious diseases (1).

Three ways to improve domestic surveillance of infectious diseases include: strengthen the national notifiable disease system; establish sentinel surveillance networks; and establish public health centers for emerging diseases to prevent future AIDS-like epidemics.

The effectiveness of a global disease surveillance and response system depends on each nations capacity to detect and control infectious diseases. In many developing countries, however, resources, are extremely scarce. A major objective of world bank, US AID, WHO, and developed economies should be the promotion of sustainable economic development around the globe. Helping other countries to help themselves -to improve the lives of their citizens, develop their economies, and find niches in the global economy should be a major guide for foreign assistance and aid.

All countries, should have the ability to provide laboratory diagnosis of "common" diseases endemic in their areas and the ability to refer specimens from "suspected" "uncommon" diseases to an appropriate reference laboratory. All the countries should have the epidemiologic capacity to investigate outbreaks, collect specimens, and analyse test results.

Capacity building in support of a national surveillance and response system encompasses a complex set of skills and resources. Many of which are readily available in industrialized nations but not in underdeveloped ones. The components of a public health infrastructure include human resources. Physical resources, systems for laboratory referral and information exchange and a favourable policy environment to encourage disease surveillance and permit disease reporting and cooperation with other countries. Recognizing, reporting, and responding to new disease threats involves each of these target areas (1).

Governments should encourage international communication among scientists and public health personnel regarding emerging infectious disease and request international assistance through WHO when disease outbreaks occurs or when unusual infections are suspected.

Epidemilogic and laboratory research are the essential foundation upon which a sound disease surveillance and response system is based. This is especially true in regard to emerging and unknown infectious diseases. To combat new diseases for which no treatments are known, it is essential to maintain an active community of epidemiologists and experimental scientists ready and able to seek new solutions for new disease threats. In addition, continued emphasis on effective social and behavioural science methods to enhance health promoting behaviour should be maintained. To meet the challenge of critical knowledge of the fundamental biology of infectious agents and the clinical disease processes they induce is essential. Scientific studies of infectious agents and the diseases they cause provide the fundamental knowledge base used to develop diagnostic tests to identify diseases, drugs to treat them, and vaccines to prevent them. In addition, the ability to intervene effectively in an outbreak or epidemic, or to implement a successful prevention strategy, requires a through understanding of the epidemiology of the disease (1). Maintaining diversity in infectious disease research will allow us to retain expertise on types of bacteria, viruses, and parasites that may emerge and or re-emerge unexpectedly. There is a need to encourage the development of tools to monitor, investigate and intervene in public health problems involving emerging or antibiotic resistant microbes. Interdisciplinary and interagency scientific exchanges and training programmes in the area of infectious diseases should be strengthened. Scientific research is also needed to guide public policy.

EMERGENCY PREPAREDNESS

Infectious diseases around the globe require serious attention from the world's policy makers. It is extremely important to prepare the world under united leadership

to address the dynamic threat to health amidst changing and mobile societies.

Policy efforts should focus on the preparation of an agreement which will lead to international legislation on EID that promotes collaboration. Establishing an infrastructure to address EID should be developed along the following lines; the protections of health and well being of people within all communities, preserving the basic human rights of individuals, balancing individual and community rights, as well as ensuring the socioeconomic stability of societies including national security, while observing and protecting the sovereignty of nations. Effective leadership should be a priority and include both the ability to anticipate change and envision a future state and the capacity to deploy and manage the implementation of an appropriate response. Leadership leaders at every level of society. Information technology for training in leadership development should be developed.

The management of EID requires a pro-active approach to ensure the appropriate prevention and control of disease by health authorities. Preparatory phase should include ongoing surveillance, routine reporting, clarity and definition of legal and ethical responsibilities, collecting and analyzing data and disseminating information about health and non-health indicators. This should be followed by investigations of possible outbreaks. Activities during the "alert" phase should include the detection, confirmation, and declaration of changes identified during preparatory phase. The "response" phase includes the ongoing assessment of information and the planning and implementation of an appropriate response which includes the co-ordination and mobilization of resources to support intervention activities.

A well planned systematic response is required which should include assessment of EID, an evaluation of existing resources capacity and the formulation of a strategic and operational plan to ensure a co-ordinated intersectoral global response. Capacity building should include strengthening global surveillance activities, strengthening infrastructure support, fostering applied research initiatives, and strengthening prevention and control efforts. Broadly defined strategic operation goals should focus on efficiency, equity, effectiveness and economy.

The development of information systems [the responsibility of the international community] includes addressing both the need for technology as well as ensuring the human capability to analyse and share information locally, and internationally. A comprehensive communication is required to ensure accurate and timely sharing of information. Technology for real time reporting of incidence of disease and feedback is needed. There should be regional sharing of information. Governments have to sit together for which willingness and understanding is needed. Communication to industry/corporate sector [who have a stake in it] is important. Communication should be strategically linked to other relevant issues. System of reporting [surveillance] requires good understanding of how other systems work. There is a need to establish national or

regional centers of excellence. Quality of information should be assured at all levels. Continued, on small network of strategically located sentinel centers may be the most effective way to begin providing early warning of serious epidemics.

Infrastructure and capacity building needs resources. There should be a "Funding pool" – International EID fund. This sustainable source of funding to support EID management initiatives will require innovative strategies for building public and private partnerships. Alternative mechanisms to pool public and private voluntary and commercial funds need to be explored. International travel associated with trade or leisure can be levied to enhance such funds. We must be aggressive in approaching commercial interests. There is also a need to reorganize and recapacitate present resources. Marketing campaign is required to create support that is needed to generate funds to strengthen public health services. Partnership with industry. pharmaceuticals and information technology organization is important. Cultural and institutional shifts are needed to create system to allocated scarce resource.

VISION FOR THE 21ST CENTURY

What is required is a world on the alert and able to contain communicable diseases through strong national disease surveillance and control programs; global networks of centers organizations and individuals to monitor disease: rapid information exchange through electronic links to guide policies, international collaboration, and rapid response to contain epidemics of international importance.

National and regional initiatives should include laboratory strengthening, provision of reagents, surveillance strengthening, epidemic response strengthening, and operational response should include epidemic response guidelines, surveillance case definition manual, surveillance assessment guidelines, vaccine and drug availability, epidemic response roster, research and development, and consensus meetings.

We have a responsibility to respond quickly when it is demanded. There is a need to develop a network, of multidisciplinary research centers firmly anchored in the countries around the world, especially in the tropics and near densely populated lower socioeconomic areas of third world countries. Without far better tools and a fa better understanding of disease, satisfactory disease control, let alone eradication is simply not in the cards.

Foundation has to be provided. National policies have to be devised to define specification of responsibilities: who is to do what? Quarantine needs firm guidelines, when it should be used and when it should not. Border policies should include repatriating carriers. Military should be trained to deal with refugees and quarantine measures. National activity should be supported to make things happen.

For responding to the challenge of EID, initiative has to be global and activity has to be local. We should ensure that future is better than the past.

People should share a belief that as a matter of birth. We are all entitled to basic human rights. People everywhere must

understand we are all born equal and that the border constructed between the self and others has to change. The world is continuing to move from independence to interdependence, nations must draw on strengths of other nations.

Nations need a new approach to identify, respond rapidly, and motivate translational actions. Disease and society are dynamic. Efforts to prevent and control the problem must begin with a search for a better understanding of the societal roots of disease, morbidity and mortality.

There is a need to assume a visionary perspective and to motivate change existing paradigms. Management policies are required to promote coordination of on-site operations and activities and to ensure responsiveness, preparedness and coordination.

The intervention activities may include needs assessment prioritization, the identification of barriers, contingency planning, communication strategies. Research and development of vacancies, drugs, and insect control intervention, among others.

Nations should assume responsibility for creating systems that support united leadership and which addresses the dynamic and rapidly changing social threats to health posed by EID. Effective leadership should include both the ability to anticipate change and envision a future state and the capacity to develop and manage the implementation of an appropriate response.

Development of successful communication strategy is a critical management issue during an infection outbreak. An approach to helping organizations prepare for the likely event of an outbreak and the need to manage the media is to conduct drills.

Individuals organization, and nations must manage the media proactively. Nations can identify the type of information needed or that will be needed by different audiences. Nations should be prepared to inform the media extensively.

For strategic surveillance and response capability. Addressing applied research priorities, improving prevention and control strategies, and strengthening the public infrastructure, effective partnerships are required with various agencies and organisations.

A well planned systematic response is required which should include assessment of EID. An evaluation of existing resource capacity building and the formulation of a strategic and operational plan to ensure a coordinated international global response. There is a need to pro-actively manage the global spread of EID.

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