Focus

Emerging diseases present a major health challenge

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Introduction

Travel is seen as the way of the future: last year about 1.4 million New Zealanders travelled overseas. The speed and volume of international travel are cited as primary factors contributing to the global emergence of infectious diseases.[1] Mass migrations of refugees, displaced persons and workers have led to a steady growth of urban centres. These population movements have been ideal conduits for the global spread of new and re-emerging infectious diseases, just as they have in the past.

These days, virtually any place in the world can be accessed within 36 hours, less than the incubation period for most infectious diseases. Infectious agents can spread diseases from person to person directly or to vectors at the travellers' destination. Mass migrations have facilitated the rapid and immediate spread of communicable diseases, such as cholera and typhoid, among refugees and displaced persons.

Emergent diseases past and present

Diseases such as malaria, yellow fever, plague, filariasis and other vector-borne diseases were responsible for more disease and death in the 17th to early 20th centuries than all other causes combined.

During the 19th and 20th centuries, vector-borne diseases prevented the development of large areas of the tropics, especially in Africa, and it was not until these diseases were controlled that engineering feats such as the Panama Canal could be completed. Vector-borne infectious diseases are examples of emergent diseases: emerging or resurging due to changes in public health policy, insecti

cide and drug resistance, demographic and societal changes, and genetic changes in pathogens. In New Zealand there is increasing concern over the potential for dengue viruses, Ross River virus and Barmah Forest viruses to spread into susceptible areas. Effective prevention strategies can reverse

Key points

- These days, virtually any place in the world can be accessed within 36 hours, less than the incubation period for most infectious diseases
- Malaria is the most common disease imported into New Zealand
- Complacency, dwindling resources and a shift from vector control to case control along with technical problems of insecticide and drug resistance have contributed to the resurgence of disease such as malaria and dengue

this trend and indeed the Ministry of Health is facilitating such strategies.[2]

fever.
- Reversing the trend requires great financial and human resources for surveillance and vector control

Types of diseases

Evidence of the re-emergence of vector-borne diseases such as malaria and yellow fever was first observed in the 1970s in Asia and the Americas. Warnings, however, were largely ignored until recently, and now it may be difficult to reverse the trend.

Malaria _ The resurgence of malaria in Asia in the late 1960s and early 1970s provides a dramatic example of how quickly vector-borne disease trends can change. Malaria, transmitted to humans by anopheline mosquitoes, had been nearly eliminated in Sri Lanka in the 1960s, with only 31 cases reported in 1962. In 1968, however, a major epidemic caused 440,644 cases. In 1969, 537,705 cases were reported; the disease has never been effectively controlled since then. In India, a similar resurgence of malaria occurred, with sporadic outbreaks of disease beginning in the 1970s and nearly 7,000,000 cases by 1976. Sri Lanka and India are classic examples of the lack of sustain-ability of vertically structured prevention/control/elimination programmes.

Complacency, dwindling financial and political support, and a change in strategy from vector control to case finding and drug treatment were mainly responsible for the resurgence of malaria in these countries.

In 1999, malaria remains the most important tropical disease with an estimated 300 million cases and two million deaths each year. Widespread drug resistance of the parasites and insecticide resistance among anopheline mosquito vectors have complicated malaria control. Malaria is the most common imported disease in New Zealand, with approximately 100 suspected malaria cases each year.

Plague _ Plague is the original emerging disease, having caused major pandemics; the most recent of which (late 19th century), is believed responsible for its current global distribution. Plague is spread by rats on ships and, like many other vector-borne diseases, was controlled with antibiotics, insecticides, and rat control in the latter half of this century.

The number of cases reported to the WHO decreased to an all-time low of 200 cases in 1981. In recent years, however, epidemic plague has resurged, most notably in Africa, with an average of nearly 3000 cases reported annually (about 65 per cent from Africa). The decrease in plague incidence from 1950 to 1980 was followed by decreased financial support and, ultimately, the deterioration of surveillance systems.

Many countries were no longer capable of making a laboratory diagnosis of plague in the 1990s. In 1994, when an outbreak of plague occurred in Western India (which had reported its last case in 1966), lack of laboratory capacity for diagnosis led to confusion as to the cause of the outbreak and panic within the population. An estimated 500,000 people fled Surat for other major cities, some of which subsequently reported secondary plague transmission.

Yellow Fever _ Yellow fever caused major epidemics from the 17th to the 20th centuries and was effectively controlled in the Americas by the *A. aegypti* elimination programme in the 1950s and 1960s. Yellow fever is maintained in forest cycles involving monkeys and canopy-dwelling mosquitoes in both Africa and the

Americas. Human infections since the 1950s have been primarily in persons associated with the forest. Since the mid-1980s, however, epidemic yellow fever has resurged in West Africa, and, for the first time in history, an outbreak occurred in Kenya in 1992.

These are only a few examples of emergent and resurgent vector-borne diseases, but there are many more causing increasingly frequent epidemics… such as hantavirus in the Americas, South American haemorrhagic fevers, Japanese encephalitis in South East Asia and monkey-pox in Kenya. Many others go unreported because laboratory-based surveillance systems are not available.

Facing the problem

Public health policy decisions have greatly decreased the resources for surveillance, prevention, and control of vector-borne diseases since the 1960s and 1970s, primarily because control programmes reduced the public health threat from them. Those decisions, the technical problems of insecticide and drug resistance, and excessive emphasis on insecticide sprays to kill adult mosquitoes, contributed greatly to the resurgence of diseases such as malaria and dengue. Decreased resources for infectious diseases in general resulted in the discontinuation or merger of many programmes and ultimately to the deterioration of the infrastructure required to deal with them.

As a legacy of this, we are now faced with a critical shortage of appropriately trained specialists.

Major global demographic and societal changes of the past 50 years have directly affected the emergence and resurgence of infectious diseases. Unprecedented population growth, mostly in developing countries, have resulted in major movements of people, primarily to urban centres.

This unplanned and uncontrolled urbanisation (inadequate housing, deteriorating water, sewage and waste management) has produced ideal conditions for increased transmission of mosquito-borne, rodent-borne and water-borne diseases.

The prospects for the future are not good; nearly all of the world's population growth in the next 25 years will be in the urban centres of developing countries, many of them in tropical areas where vector-borne diseases occur most frequently.

Finally, the aeroplane provides the ideal mechanism for transporting pathogens between population centres. The result is a constant movement of viruses, bacteria, and parasites among cities, countries, regions and continents.

The effects of climate

While meteorological factors such as temperature, rainfall and humidity influence the transmission dynamics of vector-borne diseases, climate changes have not yet been proven to have caused the emergence or resurgence of any vector-borne diseases.

In New Zealand, there is increasing vigilance regarding the introduction of vector-borne diseases. In 1996 the Ministry of Health reviewed the New Zealand programme for exclusion and surveillance of exotic mosquitoes of public health significance.

The local media have propelled interest in exotic diseases by broadcasting reports of

the spread of dengue fever in the Pacific basin, by noting that a New Zealand doctor contracted dengue fever at the recent Commonwealth Games, by blaming every change in weather and disease on the El Nino effect and by reviewing relevant world disasters such as that in Papua New Guinea.

Finding solutions

Prevention and control programmes are based on the arthropod vector. Yellow fever in Cuba was the first vector-borne disease to be effectively controlled in this manner, followed quickly by yellow fever and malaria in Panama.

Most of these programmes established vertically-structured vector control organisations that emphasised elimination of arthropod breeding sites (source reduction) through environmental hygiene along with limited use of chemical insecticides. By the 1960s, vector-borne diseases were no longer considered major public health problems outside Africa. Urban yellow fever and dengue, were effectively controlled in Central and South America and eliminated from North America; malaria was nearly eradicated in the Americas, the Pacific Islands and Asia.

The discovery and effective use of residual insecticides from the 1940s onwards contributed greatly to these successes. However, the benefits of vector-borne disease control programmes were short-lived. A number began to re-emerge in the 1970s, and this has greatly intensified in the past 20 years. Although the reasons for the failure of these programmes are not well understood, two factors played important roles: 1) the diversion of financial support and subsequent loss of public health infrastructure, and 2) reliance on quick-fix solutions such as insecticides and drugs.
Reversing the trend is a major challenge. In the next decade, vector control will be required to interrupt disease transmission. Environmentally safe insecticides and research on alternatives (such as biological control) are needed. Human resources are needed to develop and implement sustainable prevention programmes. Adequately trained personnel are lacking in most developing countries, as are academic institutions with training programmes. Policy changes must be made to support public health approaches to disease prevention. All these are needed to rebuild public health infrastructures.

Ultimately, however, demographic trends that have resulted in increased urban population pressure and changes in agricultural practices must be reversed. Only then will we be able to effectively reverse the trend of emergent/resurgent vector-borne disease in the 21st century.

- *References available on request.*