PRESIDENTIAL ADDRESS*

GLOBAL CHANGE AND EMERGING INFECTIOUS DISEASES

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CLIMATE AND MOVEMENT OF VECTORS, PEOPLE, AND ANIMALS

Over the past 20 yr we have witnessed epizootics and epidemics involving several pathogenic diseases representing global threats to animal and human health. In the past 5 yr alone epidemiologists and public health workers have been alerted on the ProMed computer site (http://www.promedmail.org) to many human and animal diseases that were transported from one country to another. These included African trypanosomiasis, bovine spongiform encephalopathy (BSE), bovine tuberculosis, brucellosis, campylobacteriosis, cholera, Crimea–Congohemorrhagic fever, cyclosporiasis, dengue, diphtheria, dracunculus, heartwater, human immunodeficiency virus (HIV) infections, hepatitis types A, B, and E, infectious bovine rhinotracheitis (IBR), influenza A, Japanese encephalitis, Lassa fever, legionellosis, malaria, Newcastle disease, paratyphoid, plague, rabies, Ross River virus infection, shigellosis, trichinellosis, tularemia, typhoid, West Nile fever virus, yellow fever, and yersiniosis. Primarily parasitic diseases, but also a few major diseases caused by other infectious agents, are presented as examples of emerging diseases in the following discussion. Many of these infectious agents and others are vectorborne and ultimately depend for transmission on climatic conditions that are becoming more favorable for the survival of the vectors.

The earth’s climate is continually changing. The warming trend of the past 250–300 yr has seen average temperatures approach those of the Medieval Warm Period around the end of the 12th century. Although industrial pollutants were thought to contribute to global cooling recorded in the 1940s through the 1970s, increased atmospheric carbon dioxide and other gases are thought to contribute to a greenhouse effect resulting in the present global warming trend. The past 16 mo have been the warmest in recorded history, and continued warming is forecast. Discussions of the impact of global warming on emerging infectious disease frequently include those diseases associated with tropical climate, such as malaria. Some predictions warn that warmer temperatures will facilitate the spread of malaria and other tropical diseases to Europe and North America, ignoring historical evidence that malaria was once endemic in many temperate regions and that epidemics reached as far as the Arctic Circle. Although the disease is no longer present in most of these areas, the same mosquito vectors remain in many of them, suggesting that temperature is but 1 of many factors influencing disease transmission.

Malaria

In his marvelous history of malaria in England in the Little Ice Age, Paul Reiter (2000) informs us that discussion of malaria-like illness was common in European literature (The Inferno, Dante [1265–1321]) during the Medieval Warm Period. Ague, the commonly used English word for malaria, was mentioned when this period was waning—“You are so very choleric of complexion...beware...that you shall have the tertian fever’s pain...or some ague that may well be your bane” (Nun’s Priest’s Tale, Chaucer [1342–1400]). Shakespeare, in the 16th and 17th centuries mentions ague in no less than 8 of his plays. Until the 19th century many English marshlands were notorious for their ague-stricken populations.

In 1975 the World Health Organization (WHO) declared Europe free of malaria. Two years later, 83% of the world population was living in areas declared malaria free or in which control programs were in progress. The resurgence of malaria is a dramatic example of how quickly vectorborne disease trends can change.

Malaria is now the most prevalent vectorborne disease and the most important tropical disease, endemic in 92 countries, with more than 40% of the world’s population living in areas at risk (Martens and Hall, 2000). WHO estimates >1 million deaths a year, 3,000 a day, roughly 1 every 30 sec. Others estimate 2 million deaths per year (Gubler, 1998; Martens and Hall, 2000). Over 90% of the 300–500 million clinical cases of malaria are in Africa, half among children under 5 yr of age (Martens and Hall, 2000). Those that survive cerebral malaria may be left brain damaged and/or blind, and others may suffer chronic illness. Globally, malaria imposes a huge economic burden on families and governments through lost productivity, missed education, and high health care costs. This rapid resurgence has been attributed to population growth, urbanization, people movement, dwindling financial and political support, disruptions from war and civil strife, poor public health services, ecological change, deforestation, irrigation, poor vector control, insecticide-resistant mosquitoes, drug-resistant parasites, and natural disasters (Martens and Hall, 2000). In 2000 malaria is firmly established in Africa, parts of Central and South America, tropical and subtropical Asia, and is on the move in other parts of the world.

Airport malaria is a term coined to describe malaria from the bite of an infected imported anopheline mosquito acquired by persons whose geographic history excludes exposure to these mosquitoes in their natural habitat (Martens and Hall, 2000). Airport malaria cases have been reported repeatedly in Europe and North America.

With the increase in endemic malaria has come a significant increase in global travel resulting in thousands of cases of malaria transported into Europe and North America annually, a few giving rise to transmission by indigenous mosquitoes. In New South Wales, Australia, from 1969 to 1995 10–12% of malaria cases originated in Africa; by 1998 42% originated in Africa (ProMed archive 980213223415). In Italy from 1989 to...