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Global warming

Health impacts may be abrupt as well as long term

See also Reviews p 1323

The doomsday film thriller *The Day After Tomorrow* is based on global warming theory, whereby the infusion of freshwater into the north Atlantic from the melting of Greenland's glaciers stops the circulation of water via the Gulf Stream. Although the probability of this event is low, according to climatologists, the scenario of abrupt climate change has certainly caught Hollywood's imagination.

Not surprisingly, the prospect of extreme weather events also has caught the real concern of health experts (not just their imaginations), following on the heels of last year's devastating heat wave, as a result of which an estimated 15 000 people in France died in a matter of a weeks. The extent to which the severity of the European heat wave falls far outside the current distribution of weather is consistent with expectations of future climate change scenarios.[1] Climatologists have long remarked that global warming will not simply manifest itself by a gradual climb in average temperatures. Rather, it is the frequency and intensity of extreme climatic events—such as heat waves, droughts, floods, and storms—that are expected to occur.[2]

Extreme weather events such as severe storms, floods, and drought have claimed millions of lives during the past 20 years and have adversely affected the lives of many more as well as costing enormous amounts in property damage.[3] On average, the number of people killed annually by weather disasters between 1972 and 1996 was about 123 000, most of them in Africa and Asia.[4] For every one person killed in a natural disaster, 1000 people are affected, either physically or through loss of property or livelihood.[5]

River floods in central Europe left over 200 000 people homeless; more than 100 people were killed,[5] and due to climate change such floods are projected to increase. Degradation of the local environment can also contribute to vulnerability from flooding. For example, Hurricane Mitch, the most deadly hurricane to strike the western hemisphere in the past two centuries, caused 11 000 deaths and thousands of others were missing in Central America. Many fatalities occurred as a result of mudslides in deforested areas.[6]

Studies of the effect of climate change on food production show that yields of cereal grains are likely to decrease in the tropics where many countries are already under water stress. In particular there is concern that climate change may increase the extent of malnutrition in Africa, and there is currently widespread evidence of under-nutrition in countries of central, southern, and eastern Africa.[7] Drought also leads to forest fires, which in some locations (especially Malaysia and Brazil) have been associated with an increased risk of respiratory disease, eye problems, injuries, and fatalities.

The El Niño phenomenon is the strongest short term driver of climate variability worldwide (excluding seasonal variability). It already causes natural disasters that pose health risks, particularly droughts, on a global scale. The difference in numbers of people affected by disasters between a pre-El Niño and post-El Niño year is on average around 2.7% of the world's population.[8] A large number of case reports and a smaller number of time series analyses over more than one event show a range of impacts of El Niño on health.[9] The most consistent associations are with malaria epidemics in parts of Latin America and South Asia, but outbreaks of cholera, hantavirus infection, Rift Valley fever, and other diseases have also been associated with El Niño.[10] Although this is still being debated, more and more climatologists believe that global warming may increase the frequency and intensity of El Niño events: not good news for the health sector.

Although extreme weather variability affects injuries, fatalities, and the incidence of diseases such as malaria, we must not lose sight of the myriad of other diseases and health outcomes affected by more subtle long term climate change. Mosquito borne diseases, such as dengue fever and encephalitis, are generally more influenced by ambient conditions than diseases passed directly from human to human. Formation of ozone air pollution is hastened by warmer temperatures.[11] Excessive rainfall and runoff can lead to large numbers of micro-organisms entering drinking water, and outbreaks of waterborne disease have been associated with heavy rainfall events in the United States and elsewhere.[12]

Although the doomsday scenarios may be far from reality, the slower march of climate change still presents a formidable challenge for the health sector and society as a whole. A tidal wave inundating a city is an easily identifiable disaster that, given enough warning, people may escape from. The many health effects posed by climate change will arrive through numerous convoluted pathways and will require interdisciplinary analyses and integrated prevention planning.

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Antibiotics, resistance, and clinical outcomes

Data at the individual level are needed to direct policies

Concern exists worldwide about the threat posed to human health by antibiotic resistance in common microbial pathogens. In response the World Health Organization has launched a global strategy for containment of antimicrobial resistance and the United Kingdom has an antimicrobial resistance strategy and action plan.[1 2] Fundamental to any action is an accurate understanding of the relation between prescribing and resistance. This is especially important where most prescribing occurs—in the community.

At the level of individual patients a link between prescribing and resistance has been found for many bacteria.[3] In the United Kingdom, data about antibiotic prescribing are usually available only at the practice level. These have been investigated in relation to bacterial resistance to antibiotics, with only a weak association found.[4] The validity of such analysis can be questioned, however, because exposure and outcome in any one individual are not linked and controls are not available. These potential flaws can be overcome by use of individual patient data; however, this raises important issues of confidentiality. For such data to be collected and used it needs to be shown that this approach has added value. Few studies have compared these methods directly.

A North American study showed only a weak association between data for group level prescribing and resistance to a number of antibiotics in gram negative bacilli, whereas when data were analysed at the level of the individual patient, exposure to antibiotics was strongly related to resistance.[5] In this issue Donnan et al have performed a similar analysis comparing the frequency of resistance to trimethoprim in gram negative bacilli in urine samples with trimethoprim prescribing.[6] (p 1297) At a practice level, trimethoprim prescribing was not related to trimethoprim resistance, but at an individual level a strong association existed between the two. These studies, therefore, confirm the association between the use of antibiotics and the development of resistance, but also show that the ecological fallacy introduced by using group level data may mislead strategies to combat antibiotic resistance. Analyses of data of individual patients appear to be essential. Similar studies in other common infection groups (for example, the respiratory tract) are required.

Reduced prescribing is an essential component of strategies to combat antibiotic resistance. Cost analysis data for prescriptions in England (based on prescriptions dispensed) showed a rise in antibiotic prescriptions from 43.7 million items in 1991 to 49.4 million items in 1995, since which time there has been a 25% decrease to 36.9 million prescriptions in 2000.[7] In paediatrics this reduction has been more dramatic at 47%.[8]

Reduced prescribing should mean the cessation of such prescribing where inappropriate, but the continuation of prescribing where appropriate. Reduced prescribing for the latter group might be followed by harm. Unnecessary alarm may have been caused by three studies suggesting that harm might be occurring from reduced prescribing in respiratory tract infections. Two of these studies in children have found an association between a higher incidence of mastoiditis and low rates of antibiotic prescription,[9] and higher rates for hospital admission for mastoiditis and quinsy with lower use of penicillin in primary care.[10] However, the differences were small, and the authors did not conclude that an increase in antibiotic prescription was warranted. The third study was in adults and found an association between a rise in mortality due to pneumonia and reduced prescribing for respiratory infection.[11] All three studies may suffer from the ecological fallacy described above for population studies relating prescribing and resistance, and the method of the latter paper has been heavily criticised.[12] Analysis of outcomes related to prescribing at an individual level was not performed. Comparisons of individual linked data with group data for prescribing and outcome are required to clarify relations that may be obscured by group level analysis.

We must approach data about reductions in antibiotic prescription with caution when the reason for this reduction is unknown. Some 50% of antibiotic prescription in the community is for presumptive respiratory tract infection. Presentations for such respiratory infections to general practitioners declined between 1995 and 2000.[13] The reduction in antibiotic prescription might be for reasons other than altered prescribing behaviour.

Weak and potentially inaccurate data about antibiotic prescription and either resistance or outcome should be recognised for what it is and not used to

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