

## Flooding and human health

*The dangers posed are not always obvious*

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Over the past few weeks England and Wales have endured the most widespread flooding for more than 50 years. By the end of the first week of November more than 3000 homes had been flooded and transport had been disrupted; in some areas water supplies have been contaminated, and a hospital has been evacuated.<sup>1</sup>

Flooding accounts for 40% of all natural disasters worldwide and causes about half of all deaths from natural disasters.<sup>2</sup> Most floods occur in developing regions and tropical regions where the impact on public health is substantial, the number of people displaced is often large, and the number of deaths is high. In the aftermath of a flood deaths and injuries not only result from the physical characteristics of the event but are also determined by the prevailing socio-economic and health conditions of the community and any endemic infectious diseases. Increased rates of diarrhoea (including cholera and dysentery), respiratory infections, hepatitis A and E, typhoid fever, leptospirosis, and diseases borne by insects have been described as occurring after floods in developing areas.<sup>3-4</sup> Malnutrition caused by inadequate supplies of food and problems with distribution compounds the effects of disease.

Flooding is the predominate cause of death associated with natural disasters in the United States, with most deaths caused by drowning.<sup>2-5</sup> Flash flooding, with rapidly rising water levels, is particularly deadly. Many instances of drowning occur as motorists attempt to cross moving flood waters in their vehicles. Other causes of death or serious injury include hypothermia, electrocution, burns, and carbon monoxide poisoning (associated with the use of petrol powered electric generators and pressure washers in poorly ventilated areas indoors).<sup>5</sup>

Short term morbidity caused by flooding in industrialised countries is the result of both injury and illness. The number of orthopaedic injuries associated with flooding in North Carolina in 1999 increased steadily over time and peaked several weeks after the event as people returned to their homes to clean and make repairs (unpublished data). Individuals who have been affected by flooding are more likely to present to acute medical care facilities for skin rashes and exacerbation of asthma and for outpatient medical needs, such as dialysis or refills of prescriptions or oxygen.<sup>5</sup> Although some clusters of cases of gastroenteritis and respiratory infection have been attributed to flooding in the developed world they are usually minor, seen in

low numbers and often ascribed to increased crowding among people who have been displaced.<sup>3-5</sup> Epidemics are not expected, but people are often still extremely concerned about the possibility of contracting an infectious disease from flood waters or from property damaged by floods, and false rumours of outbreaks often circulate within communities.<sup>6</sup>

There are few data on the long term health impact of flooding. A case-control study of people forced from their homes by flooding in Bristol found that the number of clinic visits, hospital admissions, and deaths from all causes was greater in the year after the flood among those who had been affected by flooding than among those who had not.<sup>7</sup> No single disease or illness seemed responsible for the findings. An Australian study found no difference in mortality between those who had been affected by flooding and those who had not, but the researchers did note that those who had been affected made a greater number of visits to medical providers.<sup>8</sup> Heightened psychological stress was thought to have played a part in the increase in visits in both studies.

People affected by floods are often apprehensive about the potential, long term adverse effects of exposure to contaminants, mould, and toxic substances that may be present in their homes after clean up. Unfortunately there are no data that address these concerns.

The long term effects of flooding on psychological health may perhaps be even more important than illness or injury. For most people the emotional trauma continues long after the water has receded. Making repairs, cleaning up, and dealing with insurance claims can be stressful. If there is a lack of support during the recovery process, stress levels may increase further. Research from the United States indicates that providing increased social support can significantly lower illness burdens after natural disasters.<sup>9</sup> Flood victims frequently report feeling depressed and isolated.<sup>10</sup> Furthermore, being evacuated from home and losing personal possessions may undermine people's sense of place as well as their sense of attachment and self identity.<sup>11</sup> Behavioural changes may also occur, such as the daily monitoring of river levels that occurred as a result of anxiety after the Easter 1998 flood in the United Kingdom.<sup>10</sup> One longitudinal study found that 15-20% of people affected by a natural disaster have symptoms of post-traumatic stress disorder.<sup>12</sup>

The medical community and the public health community should be prepared to address the needs of people who have been affected in England and Wales

and those who may be affected by floods in future. The public should be cautioned against attempting to cross flooded roads in their vehicles and advised on how to prevent physical injury and exposure to flood waters or contaminated property during clean up. The public should boil or chlorinate tap water if their water company advises them to do so or if private supplies have been contaminated. Disease surveillance should be increased during floods, and information should be disseminated rapidly to dispel false rumours of contagion or outbreaks. Most importantly, those who provide medical care need to be aware of the increased

medical and mental health needs of people who have experienced floods, which may continue for months and possibly years after the event. For some providers this may not be an easy task because a flood may also have a direct impact on staff and healthcare facilities.

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## Fossil fuels, transport, and public health

*Policy goals for physical activity and emission controls point the same way*

The recent protests in Britain over the price of fuel initially seemed to enjoy public support: any cause that might put more money in the public's pocket is superficially attractive. But our dependence on motor vehicles powered by fossil fuels incurs an array of external costs to the environment and the public's health. Further, the resultant accumulation of carbon dioxide—a greenhouse gas with a very long life—is storing up trouble for us and for future generations.

In 1994 the Royal Commission on Environmental Pollution pointed out that methods of transport had changed dramatically over the previous 25 years. In Britain the average daily distance travelled per person has risen by 75% to around 18 miles.<sup>1</sup> Most of this reflects an increase in the use of cars, amounting to a 10-fold increase in distances travelled over 40 years. This has been accompanied by a decrease in travel by bus, coach, bicycle, and in walking. Transport of freight by road has also increased but at the expense of rail travel. Yet if the external costs of road freight (in terms of accidents, road congestion, air and noise pollution, etc) are calculated and added to the costs of providing and maintaining transport infrastructure, public revenue from heavy goods vehicles contributes only 49-68% of total costs.<sup>1</sup>

The potential adverse effects of transport on health include accidents, air pollution, noise, the social exclusion of vulnerable groups, and the development of sedentary lifestyles which lead, for example, to obesity.<sup>2</sup> Our increasing reliance on private transport has created an urban environment that is unfavourable to walking and cycling. Over the past two decades there has been a marked reduction in the proportion of

children who walk or bicycle to school and a substantial rise in childhood obesity in the United Kingdom and a number of other countries.<sup>3</sup> The daily energy expenditure of British adults has declined since the 1950s by the equivalent of 2-3 hours of walking per day. It is no coincidence that the prevalence of obesity—the precursor to many diseases in adulthood that shorten life, particularly high blood pressure, heart disease, and diabetes—has risen markedly in recent decades.<sup>4</sup> The prevalence of obesity in adults and its rising trend over the past two decades is much less pronounced in the Netherlands than elsewhere in Europe<sup>5</sup>; this probably reflects the fact that the Dutch rely on bicycling, walking, and using trams to travel.<sup>5</sup>

A recent report assessed the contribution of traffic related air pollution to mortality and morbidity in Austria, France, and Switzerland. It used effect estimates from two cohort studies in the United States and found that particulate matter was responsible for about 6% of total mortality. About half of this was attributable to motorised traffic.<sup>6</sup> Cohort studies suggest that the long term effects of outdoor air pollution are greater than is evident from analyses of daily mortality over time.<sup>7</sup> Air pollution from traffic may be responsible for the excess number of lung cancers in urban areas that remain after adjusting for smoking.<sup>8</sup> Although in recent years technical improvements have resulted in reductions in air pollutants related to transport there is no room for complacency, and the government of the United Kingdom has acknowledged that its provisional air quality objectives for fine particles are unattainable in the near term.<sup>9</sup>

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