Global warming

# Climate change: the implications for policy on injury control and health promotion

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## Using less energy will reduce climate change and prevent injury

Climate change is a reality. It is not something that may happen in the future. Parts of the world are already suffering from it and evidence points to an accelerating process of impacts if preventive action is not taken as a matter of urgency. A World Health Organization (WHO) report has estimated that over 150 000 people in developing countries are dying each year from the effects of global warming mostly attributable to the burning of fossil fuels.[1] This aspect of our lifestyles is adding alarmingly to levels of carbon dioxide in the atmosphere, a ''greenhouse gas'' which acts as a radiation blanket causing the average global temperature to rise. The Intergovernmental Panel on Climate Change predicts an increase of between 1.5℃ and 6℃ by 2100 depending on the extent of future emissions.[2] With such a wide temperature range, the potential influences, both negative and positive, could be considerable. There are inevitably uncertainties in climate change predictions, particularly in regard to the timing, extent, regional patterns, and health impacts of climate change. Nevertheless, it would be inappropriate to wait until there was complete scientific certainty and decisions necessarily have to be made now on the basis of the best available information. This article puts forward some thoughts on the implications for the art and science of injury control and for policy.

### CLIMATE CHANGE AND WATER SHORTAGE

Lack of access to essential resources has been identified as an important risk factor for regional and national conflict.[3] Water is essential for life, whether for drinking or agriculture. Increased global temperatures will lead to increased evaporation of surface water.[2] In some regions this will be compensated by increases in precipitation but where precipitation is unchanged or decreased there will be less water available. Decreased runoff from glaciers may also threaten water supplies in some regions.[2 4] Increased frequency and severity of droughts as a result of climate change might therefore increase the extent of violence between states and regions. Although some politicians have suggested that ''the wars of the 21st century will be fought over water'', given the difficulty in establishing clear causal connections for exposures and outcomes as complex as drought and war, it is not surprising that there is little epidemiological evidence for climate change induced conflict.[5] Absence of evidence however, is not evidence of absence, and the potential for climate change inducted conflict remains an open question.

### CLIMATE CHANGE AND SEA LEVEL RISES

Each year, approximately half a million people in the world, a disproportionate number of them children, die from drowning.[6] Nearly all of these deaths are in low and middle income countries, especially in the Western Pacific. Thermal expansion of oceans and glacial melting are predicted to cause sea level rises of between 10 cm and 90 cm by 2100.[2] This could well put more people at risk. More than half of the population of the world lives within 60 km of the sea. Storm surges associated with cyclones regularly cause extensive flooding with massive loss of life. In Bangladesh about 250 000 died in a storm surge in 1970 and about 100 000 in 1991.[2] It has been estimated that a 40 cm sea level rise would increase the number of people at risk from storm surge flooding worldwide from 40 million to 160 million.[2] However, drowning may not be the most important impact. The same sea level rise would result in a loss of about 8% of arable land in Bangladesh. Even small sea level rises are very likely to force substantial populations living in low lying delta regions, such as Bangladesh and Egypt, to move to higher ground—if this is available. The conflict and violence that could accompany the displacement of large numbers of people who already live on the margins of subsistence could outweigh the numbers drowning.

### CLIMATE CHANGE AND EXTREME WEATHER EVENTS

Because of increased evaporation from oceans and surface water a warmer atmosphere is also a wetter one. While climate change will lead to droughts in some parts, others will experience more intense precipitation events, with more heavy rain, thunderstorms, and flooding. In 1998 Hurricane Mitch, probably the most damaging hurricane ever, hit Central America with 600 mm of rain in 48 hours. Around 9000 people died in floods and mud slides during that single event. There were also huge economic losses. Recent river floods in Europe caused extensive damage with over 100 people killed.[7] There have been reports of increased mental health problems after flooding, in some cases manifesting as increased suicide rates. However, to date there is no strong epidemiological evidence that the increase in suicides is attributable to the flooding.[8] Higher temperatures also result in increases in all-cause mortality rates from heat stress, particularly in urban populations. Over 20 000 extra deaths in Europe were registered during the excessively hot summer of 2003.[7]

### CLIMATE CHANGE AND TRANSPORT INJURIES

Most of the world's energy comes from burning fossil fuels. This generates carbon dioxide emissions which are the prime cause of global warming. Over 40 years ago, Gibson recognised the central role of energy in the causation of physical injury when its transfer to the body exceeds the threshold for tissue damage.[9] Thus, climate change and injury have energy use as a common source. At present, transport accounts for a quarter of carbon dioxide emissions worldwide and is the sector in which emissions, especially from air transport, are growing most rapidly. In industrialised countries, over 80% of these emissions are from road transport.[2] Traffic crashes on the roads are responsible for a quarter of injury mortality worldwide and death rates are growing rapidly. In 2000, an estimated one and a quarter million people died in these crashes, with millions more permanently disabled. These numbers are predicted to rise by 65% by 2020 with an increase of 80% in low and middle income countries.[10]

Although the contribution of road transport to climate change and injury mortality is similar, the link between energy use and injury is not a simple one because of the ways in which societies change with a greater take-up

of fossil fuel dependent activities. Changes in the use of public space and a reduction in physical activity, particularly walking and cycling, have confounded the relation between fossil fuel use and injury occurrence.[11] Nevertheless, the sudden fall in energy use during the 1973 and 1979 oil crises resulting in a lower volume and a lower speed of traffic was linked to reductions in road deaths, especially of pedestrians.[12 13]

A second important link between fossil fuel energy use and injury arises from the fact that when economies become car dependent, oil—which is the largest source of fossil fuel energy—becomes an essential resource and thus a potential source of conflict. The Carnegie Commission on Preventing Deadly Conflict identified factors that put states at risk of violent conflict. These include population changes that outstrip their capacity to provide essential services and the control of valuable natural resources by a single group. Both of these may have been factors in the current war in Iraq. Vehicle kilometers travelled in the US continue to rise and the growing market share of sports utility vehicles has decreased the energy efficiency of the US vehicle fleet. The US transportation sector accounts for nearly 70% of oil use, most of which is imported. Every major oil shock of the last 30 years has been followed by a recession.[14]

## REDUCING ENERGY USE IS ESSENTIAL TO CONTROL CLIMATE CHANGE

To prevent catastrophic climate change, the concentration of carbon dioxide in the atmosphere must not be allowed to get out of control. As it remains in the atmosphere for about 100 years, stabilizing its concentration is not the same as stabilizing emissions. Stabilizing concentrations at a safe level requires emissions to fall to a fraction of their present level.[2] Before the Industrial Revolution, levels were around 270 ppm (parts per million). Burning fossil fuels has increased this to the current level of 375 ppm. Although predicting the climatic effects of any given level is fraught with uncertainty, there is a growing consensus that a runaway effect of global warming could occur if the level exceeds 400 ppm. This requires that we urgently embark on a substantial and accelerating degree of reduction—a reduction that is highly unlikely to be achieved solely by improvements in energy efficiency, greater use of renewable energy, or technical fixes such as capturing and storing the carbon dioxide emissions from fossil fuel use.[15] Although these strategies could make an important contribution to emissions reduction, a failsafe strategy is essential.

One practicable and equitable approach to reducing carbon dioxide emissions is the Global Common Institute's framework proposal described as Contraction and Convergence.[16] It is based on two fundamental principles: first, that global emissions of carbon dioxide must be reduced to an internationally agreed level (contraction); and second, that global governance must be based on justice and fairness requiring speedy progress to equal per capita carbon emission shares globally (convergence). Contraction and Convergence has been endorsed by many national and international bodies, ranging from the Africa Group of Nations to the World Council of Churches.[15 16]

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## CLIMATE CHANGE AND INJURY CONTROL: WIN-WIN SOLUTIONS

The introduction of carbon rationing will have important implications for injury control.

The imperative of achieving a massive reduction of carbon dioxide emissions will set the policy context in which future injury control activities take place. As an example of this, consider the available strategies for the prevention of road traffic crashes. The *World Report on Road Traffic Injury Prevention* outlined five main strategies for preventing traffic injuries:

- Managing exposure to risk through transport and land use policies
- Shaping the road network for road injury prevention
- Providing visible, crash protective, ''smart'' vehicles
- Setting and securing compliance with key road safety rules
- Delivering post crash care.

Given the direct and indirect role of energy used for transport purposes in injury causation, it is likely that there will also be injury control benefits from carbon rationing. A key outcome of a low carbon society will be the reduction of road danger and crashes as a consequence of the steady reduction in the volume of traffic. This would follow urban planning changes to reduce the need for travel and the distance travelled, greater use of electronic communication to make road trips unnecessary, increased use of local facilities for shopping and leisure, walking and cycling to replace car use for short trips, public transport to replace car use for longer journeys, and the movement of freight by sea or rail rather than by road.

Similarly, because driving high powered vehicles at high speeds encourages more distant travel and increased fuel use, a low carbon economy would result in smaller, lighter vehicles travelling fewer miles and at lower speeds, in both instances leading to fewer pedestrian and cyclist injuries. It would also reduce the perceived risk of injury, in the process encouraging parents to let their children get around on their own—for school and leisure—at an earlier age, and thereby removing the current infringement of their rights to do so in a safe environment while at the same time promoting their physical and social development.[11] Carbon rationing would also impact on other sectors apart from transport: for instance, it is very likely to lead to more priority being given to improving the energy efficiency of

homes, thereby reducing the need for additional heating to avoid cold conditions and the risk of hypothermia.

There is a further positive outcome of the adoption of carbon rationing. A population's healthy longevity has been shown to be associated with a narrower gap between rich and poor.[17 18] The beneficiaries of rationing will be the energy thrifty who are thereby able to sell their surplus ration to the energy profligate. Moreover, as the ration is reduced year on year to reach the level of emissions that the planet can support without serious destabilization of the climate, so the value of their surplus will rise generally achieving in the process a transfer from rich to poor. And as a direct consequence of the limits on the ration, people will be strongly encouraged to organize their lives in a way that entails the minimum of motorized travel—and logically to adopt travel patterns increasingly reliant on walking and cycling in daily travel, again a process contributing to personal health and wellbeing.[19]

## CLIMATE CHANGE AND INJURY CONTROL: WIN-LOSE SOLUTIONS

In adjusting to a low carbon economy, there will inevitably be commercial winners and losers. Fossil fuel companies, road builders, and manufacturers of inefficient vehicles will be among the losers as consumers cut back on travel to live within their ration. These companies have already positioned themselves in order to better influence current and future transport policy through organizations such as the Global Road Safety Partnership and other World Bank initiatives.[20] As it is unlikely that businesses would engage in actions that would reduce their future profitability, their role in the prevention of climate change and injury control will have to be reassessed. On the other hand, strategic alliances between businesses that stand to gain from the transition to a low carbon society, for example telecommunications companies and bicycle manufacturers, could be promoted.

Because the prevention of climate change rather than the prevention of injury will set the policy context for reducing energy use, there may also be win-lose situations for injury control. Air travel has the lowest death rate per passenger kilometer with the result that reductions in air travel could increase the use of modes of travel with greater injury risk, such as car travel replacing short haul flights. On the other hand, air travel promotes long distance travel and is therefore highly energy intensive. Moreover, its contribution to global warming is two to three times greater than is indicated by its carbon dioxide emissions: not only do aircraft emit other greenhouse gases but the emissions are more damaging as they are released in the upper atmosphere. In this context, it is ironic to think of the implications of carbon rationing for large international conferences, such as the World Conference on Injury Control, which generate huge and unsustainable amounts of carbon dioxide emissions from air travel.

Motorcycles are more energy efficient than cars. Those with smaller engines (for example, engine capacity less than 400 $cm^3$) have carbon dioxide emissions per kilometer travelled of less than half those of the average car. Because of the environmental advantages of motorcycles over cars, emissions reduction initiatives encourage increased motorcycle use. For example, in 2002, the UK chancellor announced reforms to vehicle excise duty taxation to encourage the use of more efficient ''low carbon'' motorcycles rather than cars for commuting.[21] Owners of the smaller machines saw their vehicle excise duty reduce by £35 per year, a reduction of over 50%. Motorcycles are also exempt from the congestion charge in London. These changes have coincided with increases in motorcycle mileage of about 49% between 1993 and 2003. However, in 2003 the risk of a motorcyclist being killed or seriously injured per kilometer travelled was almost 50 times higher than for car drivers. Perhaps not surprisingly, motorcyclist deaths and serious injuries in the UK are rising steadily. Large modal shifts from cars to motorcycles as a result of emissions policies could therefore have a major adverse impact on road traffic injury rates. Emissions policies in other areas could have similar effects. For example, smaller, lighter vehicles could be associated with higher occupant death rates in car crashes.

## SUMMARY

Although injuries appear to be responsible for a comparatively small proportion of the potential health impacts of global warming, climate change and the imperative to reduce energy use will set the policy context for future injury control activities. As climate change is a risk factor for both violence and unintentional injury, and because controlling climate change provides substantial scope for the promotion of health, it should be the focus of policy for the injury control community. This should include further elucidation of the links between climate change and injury occurrence, research relevant to, and advocacy for, a low carbon society, and the identification of strategies to mitigate any adverse injury impacts that such a societal change will entail. It will also require changes at the professional and personal level to reduce carbon emissions. Although the high income, energy profligate countries have been responsible for most greenhouse gas emissions, it will be the most disadvantaged populations of the world, those living in low income, energy thrifty countries who will suffer most of the adverse health related impacts of climate change.

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