Health in the 'Low-Carbon' Economy

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Abstract

There is growing evidence that activities to mitigate climate change by reducing emissions of greenhouse gases and other climate active pollutants, can have beneficial impacts on public health not only as a consequence of helping to limit the magnitude and speed of climate change but also, in the nearer term, as a result of changes in exposure to environmental pollution and health-related behaviors. Dietary changes, for example reductions in dietary saturated fat intake and replacement with unsaturates of plant origin, may help prevent cardiovascular and other disease risks in high-consuming populations. Transport interventions, especially those that promote active travel (increased walking and cycling), can help increase physical activity, although potentially at some additional risk of road injury, while fuel switching or more efficient vehicles could help reduce air pollution, especially in urban settings. Energy efficiency improvements to housing have the potential for positive and negative effects on indoor air quality and may help protect against the adverse health effects of low and high temperatures. Switching to low-carbon forms of electricity generation has the potential to reduce the health burdens of outdoor air pollution.

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Such "health co-benefits" of climate change mitigation policies provide an important additional rationale for accelerating the transition to 'low-carbon' economies and could help to counterbalance the inertia and vested interests that support unsustainable patterns of development.

Keywords

Climate change mitigation • Health co-benefits • Air pollution • Noncommunicable diseases

Definition

This paper describes the potential health co-benefits that can result from the implementation of policies to reduce greenhouse gas emissions.

Background

Meeting the world's growing energy demands will be one of the critical challenges for the twenty-first century. The efficient exploitation of energy resources has been crucial to the development of modern industrial societies. Yet while the science and technologies that underpin, and flow from, industrial development have been transforming for health (as for societies in general), dependence on fossil fuel energy coupled with extensive land-use changes (notably deforestation) has also brought substantial penalties. The scientific evidence for anthropogenic global warming is now strong. The changes to the climate over this century, though still uncertain in magnitude, are likely to be rapid and unprecedented in scale since the dawn of recorded history. They are predicted to have multiple adverse effects on the environment (disruption of ecosystems and ecosystem services, species loss), social integrity (population displacements, effects on livelihoods), the economy (reduced growth, altered agricultural viability, regional/local economic dislocations), as well as population health.

At the same time, the most accessible fossil fuel resources are growing increasingly scarce, so that extraction of oil and other fuels can be achieved only at increasingly high financial and environmental costs, as shown by the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, and from a diminishing number of sources of production (Wilkinson 2008). There is also growing recognition of the damage that overdependence on fossil fuels has on population health because of the associated emissions of toxic air pollutants, and because of its role in declining levels of physical activity (e.g., through increased private car use and labor-saving devices), increasing levels of overnutrition (arising from the production and supply of processed energy-dense foods) and increasing demand for animal products in emerging economies at the same time as food insecurity is increasing for many poor people, along with transport-related injury and mortality, and adverse effects on the quality of life within congested urban environments (Haines et al. 2009).

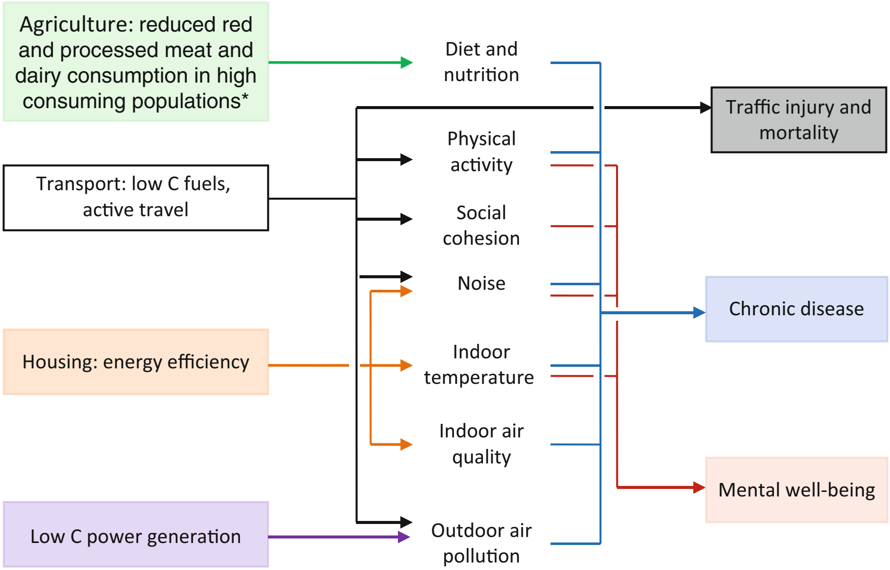
With a world population rapidly growing in size and energy demands, concerns about the potential consequences of global environmental change, volatile food and energy prices, and both food and energy insecurity have become of primary importance. These concerns are motivating the search for newer, reliable, and less environmentally damaging sources of energy, particularly ones with lower greenhouse gas (GHG) emissions (some particles such black carbon can also contribute to climate change but for simplicity we use the term GHG emissions). The need for collective action to tackle the anthropogenic climate change has been comprehensively articulated in the assessment reports of the UN Intergovernmental Panel on Climate Change. However, policy makers in many countries are still showing reluctance to make the policy changes needed to move decisively towards a much lower level of GHG emissions. Concern that negative economic and social consequences may arise from policies to reduce greenhouse gas emissions is one factor holding back the necessary policies changes. In part this is due to perceived higher costs of low GHG technologies and reluctance to embrace major changes in lifestyle which might result in lower consumption patterns. Yet, relatively little attention has been given to the health and social impacts (many of them beneficial) that may follow the transition to 'low-carbon' economies in a range of different geographic and socioeconomic settings. (The term low carbon is used for simplicity to imply low emissions of GHGs, although they do not all contain carbon.)

Co-Benefits of 'Low-Carbon' Development Pathways

There is a range of potential ancillary (or co-) benefits of 'low-carbon' development pathways which could prove attractive to policymakers in their own right and help to offset, to a greater or lesser extent, the costs of implementing low-carbon policies (Fig. 75.1). Many current estimates do not allow for the wider externalities impacts (from an economic perspective) that arise from these positive health of impacts (Haines and Dora 2012).

The evidence to date is that many actions aimed at reducing greenhouse gas emissions have the *potential* for near-term, direct, and positive impacts on health. As Haines et al. (2009) note, these positive health effects "are important not only because they can provide an additional rationale to pursue mitigation strategies, but also because progress has been slow to address international health priorities such as the UN Millennium Development Goals (MDGs) and reductions in health inequities. Mitigation measures offer an opportunity not only to reduce the risks of climate change but also, if well-chosen and implemented, to deliver [substantial] improvements in health almost immediately." These health co-benefits are additional to the benefits that are also expected to occur from reducing the magnitude of climate change. Quantitative estimates of these impacts are also subject to fewer uncertainties than those arising from reductions in future climate change.

There are multiple pathways by which policies to reduce GHG emissions can also benefit health. Electricity generation based on the combustion of carbonaceous fuels gives rise to air pollution with quantifiably large adverse impacts on



*Assumes replacement of animal source saturated fats with unsaturated fats of plant origin to achieve reductions in cardiovascular disease. Increased fruit and vegetable consumption would achieve additional health benefits.

Fig. 75.1 Key pathways to health from a low-carbon economy

population health. The fuels that are most damaging in terms of carbon dioxide emissions are also those with the most seriously adverse health effects mediated through fine particulate ($PM_{2.5}$) air pollution, with coal and especially lignite being particularly damaging. Road transport also contributes to fine particulate air pollution as well as tropospheric ozone and other pollutants. Globally, ambient fine particulate air pollution has been estimated to be responsible for around 3.2 million deaths annually, with some contribution from household sources' (Lim et al 2012). The mortality in cities with high levels of pollution exceeds that observed in relatively cleaner cities by 15–20 %. Even in the EU, average life expectancy is reduced by an estimated 8 months or so due to exposure to $PM_{2.5}$ produced by human activities. A number of studies have estimated the health benefits from low-carbon electricity generation. In the case of India, for example, it has been estimated that around 90,000 premature deaths annually could be averted by such policies as a result of reduced atmospheric concentrations of fine particles (Markandya et al. 2009). In high-income nations the benefits would be less because of existing more stringent air pollution legislation and controls, but the gains are still substantial.

Very high levels of particulate air pollution are experienced in indoor environments where solid fuels are used for cooking and heating. Recent estimates suggest around 3.5 million deaths per annum worldwide due to household air pollution

(Lim et al 2012), particularly from acute lower respiratory infections in children and chronic obstructive pulmonary disease in women. Even when solid fuels are from potentially renewable sources such as wood, they may contribute to climate change though products of incomplete combustion such as black carbon which acts as a greenhouse pollutant and accelerates the melting of glaciers when it is deposited on them. A hypothetical program to install 150 million improved cooking stoves over a decade in India was estimated to avert around two million premature deaths, largely in children and in women, as well as yielding useful reductions in greenhouse pollutants (Wilkinson et al. 2009).

In high-income countries there is also the potential for policies that improve health while reducing greenhouse gas emissions through improved energy efficiency (insulation, ventilation control) of homes and by switching to cleaner fuels. Improved energy efficiency may help reduce cold- and, often, heat-related exposures in the home, and tighter air control can protect against the ingress of pollution from the outdoor air, especially in urban settings. However, reduced air exchange can exacerbate levels of indoor pollutants derived from indoor sources (combustion products, radon, second-hand tobacco smoke, volatile organic compounds from furnishings and other materials) and mold growth. In dwellings that are very airtight, this can be offset by the use of mechanical ventilation with heat recovery (MVHR) systems if the incoming air is filtered. But MVHR systems and their filters need to be well installed and properly operated and maintained. Additional, but as yet uncertain, benefits to health could accrue as a result of increased indoor winter temperatures in temperate climates and their impact on fuel poverty.

One study identified 14 measures targeting methane and black carbon emissions that reduce projected global mean warming by ~0.5 °C by 2050. These yield a reduction of 0.7–4.7 million annual premature deaths from outdoor air pollution and increase annual crop due to ozone reductions in 2030 and beyond. The value of the benefits is substantially greater than the marginal costs of mitigation (Shindell et al. 2012).

The urban transport sector offers major potential for improved health and reduced GHG emissions particularly because of the effect of sedentary lifestyle on increasing the risk of a number of conditions including ischemic heart disease, stroke, dementia, diabetes, and cancer of the breast and large bowel. Increased injuries are likely from greater exposure of walkers and cyclists to road danger, but these are greatly outweighed by the health benefits of increasing physical activity and can be reduced further by policies, e.g., to separate cyclists and motorized traffic. Increased efficiency of engines or electric vehicles can result in reduced air pollution but does not lead to increased physical activity. Historically increasing efficiency of fuel use has often led to increased consumption which more than offsets any reductions in GHG emissions. Thus, policies to enhance efficiency of fuel use need to be accompanied by GHG abatement policies in order to reduce overall emissions. Greater reliance on rapid transit systems and walking and cycling lead to lower air pollution and noise levels and fewer traffic injuries and promote physical activity. Transport interventions and urban planning are among the most effective interventions to promote physical activity and to reduce socially disruptive influences of busy congested roads.

The potential health benefits of policies to promote increase active travel (walking and cycling) could result in substantial savings to national health systems. One example of the impact of such policies in urban England and Wales suggested that the cost averted could amount to around £17 billion over 20 years and increase over that time because of the lag period between any increases in physical activity and the consequent health-care costs averted (Jarrett et al. 2012). The lag period is likely to vary according to the health outcome, being much longer for dementia or cancer of the large bowel or breast than, say, diabetes or ischemic heart disease. In the USA a study which included both air pollution benefits and physical activity benefits by curtailing short car journeys and replacing them with walking and/or cycling found that the resulting net health benefits were $7 billion (£4.6 billion) per annum in a US midwest population of around 30 million (Grabow et al. 2012). These are considerably greater per capita benefits than in the previous example. However, this discrepancy may be because of the different methods used to estimate the health and economic effects as well as potential differences between the populations in terms of baseline physical activity.

In the food and agriculture sector, 80 % of GHG emissions are related to animal products in part because of methane (a powerful GHG) emissions from ruminants. Agriculture is estimated to be responsible for around 10–12 % of global GHG emissions and much more if land-use change, such as deforestation, is taken into account. Dietary change, including reducing animal product saturated fat consumption with replacement with unsaturated fatty acids from plant sources (Friel et al. 2009). However, it would not be appropriate to reduce production and consumption in low-consumption societies or in pastoralist communities which depend on livestock for their livelihoods.

Poorly designed mitigation policies could however have adverse impacts on health. Examples include the potential to increase road injuries and deaths in transport policies that promote active transport (walking and cycling) without segregation or adequate additional protection of cyclists and pedestrians; the worsening of indoor air pollution quality when household energy efficiency is in part achieved through reduction of ventilation/air exchange; and the possible adverse effects on low-income families of energy policies that contribute to increases in fuel prices. The last of these may be particularly relevant in international terms, where rises in fuel cost can lead to lower-income households falling down the "energy ladder resulting in the use of more polluting but cheaper fuels." There are also important differences in the magnitude and even direction of health co-benefits, depending on the context in which they are implemented: so, for example, in the case of a scenario to substantially increase active travel in London and Delhi, there are likely to be increases in road injuries in London but decreases in Delhi because of different projections of the business as usual counterfactual scenarios (Woodcock et al. 2009). In the case of Delhi, major increases in motor vehicle use are projected under the BAU scenario but much less so under a "sustainable transport" scenario; in London under the BAU scenario, little change in traffic density is projected. Likewise, biofuel policies may have a negative impact on health by raising food prices if the crops grown to provide feed stocks compete with food crops but not if they are from crops that do not compete for agricultural land.

The detail of interventions and the mechanisms by which they are achieved matter therefore. Most of the research to date on health impacts has focused on the selected exposures that are easiest to quantify (rather than necessarily being the most important for health) and generally have assumed achievement of necessary policy changes rather than considering the processes by which such change can be attained. There has also been insufficient integration of the impacts in different policy areas and there needs to be better assessment of practicality, acceptability, and cost-effectiveness/cost-benefit in different settings.

Nevertheless, it is clear that many drivers of common diseases are closely related to the profligate use of energy and resources in industrialised societies, and the factors which undermine environmental sustainability are in many cases those which also cause a heavy burden of disease.

There are still questions however about how best to change policies to both reduce GHG emissions and improve health. It seems likely that a range of policy changes will be necessary including removal of harmful fossil fuel and agricultural subsidies and shifting the tax burden to address harmful externalities such as through carbon (and perhaps saturated fat) taxes. However, poorly designed taxes can be regressive, resulting in the poor-bearing disproportionate share of the tax burden. Thus, policies need to integrate social (including health), economic, and environmental goals in order to improve health, reduce inequities, and promote environmental sustainability.

Conclusions

The health co-benefits of climate change mitigation policies should have a higher profile in national policies and international negotiations to reduce GHG emissions. They hold promise for addressing multiple policy objectives simultaneously and counterbalancing the vested interests that are supporting current unsustainable patterns of development.

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