Public health benefits of strategies to reduce greenhouse gas emissions

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Scope

Case studies in four sectors responsible for large emissions of greenhouse gases (GHGs)

• Household energy
• Urban land transport
• Food and agriculture
• Electricity generation

Health effects of strategies to reduce GHG emissions by ~ 50% in developed countries

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Health Effects

Comparisons
• Comparison of 2010 population with and without intervention: Household energy, Food and agriculture

• Comparison of 2010 population but using exposures derived from 2030 projections (business-as-usual vs GHG reductions): Transport, Electricity generation

Calculation
• Change in burdens of disease and premature deaths averted

• Methods adapted from Comparative Risk Assessment approach (WHO)
# Health and GHG Benefits in UK households

<table>
<thead>
<tr>
<th>Impact in UK 2010 population in 1 year</th>
<th>UK household energy efficiency (combined improvements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature deaths averted</td>
<td>~ 5400</td>
</tr>
<tr>
<td>Mt-(\text{CO}_2) saved (vs 1990)</td>
<td>55</td>
</tr>
</tbody>
</table>
1.6 m deaths worldwide from indoor air pollution, mainly in women and children

Per meal
~15x less black carbon and other particles
~10x less ozone precursors
~5x less carbon monoxide

Traditional Biomass Stove
Gasifier Stove with Electric Blower
(battery recharged with cell phone charger)
Health benefits of the Indian stove programme

<table>
<thead>
<tr>
<th></th>
<th>Deaths from ALRI</th>
<th>Deaths from COPD</th>
<th>Deaths from IHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoided in 2020 (%)</td>
<td>30.2%</td>
<td>28.2%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Total avoided 2010-20</td>
<td>240,000</td>
<td>1.27 million</td>
<td>560,000</td>
</tr>
</tbody>
</table>

ALRI=acute lower respiratory infections. COPD=chronic obstructive pulmonary disease. IHD=ischaemic heart disease.
GHG benefits of Indian stove programme

• Reductions in black carbon, methane, ozone precursors could amount to the equivalent of 0.5-1.0 billion tonnes of CO$_2$ eq over the decade

• Cost <$50 per household every 5 years
Urban Transport Pathways modelled: London and Delhi
## Estimated Health Effects of Increased Active Travel in London

<table>
<thead>
<tr>
<th>Disease</th>
<th>Change in disease burden</th>
<th>Change in premature deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischaemic heart disease</td>
<td>10-19%</td>
<td>1950-4240</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>10-18%</td>
<td>1190-2580</td>
</tr>
<tr>
<td>Dementia</td>
<td>7-8%</td>
<td>200-240</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>12-13%</td>
<td>200-210</td>
</tr>
<tr>
<td>Road traffic crashes</td>
<td>19-39%</td>
<td>50-80</td>
</tr>
</tbody>
</table>
Health effects of sustainable transport strategy: by disease (Delhi)

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<tr>
<td>Ischaemic heart disease</td>
<td>11-25%</td>
<td>2490-7140</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>11-25%</td>
<td>1270-3650</td>
</tr>
<tr>
<td>Road traffic crashes</td>
<td>27-69%</td>
<td>1170-2990</td>
</tr>
<tr>
<td>Diabetes</td>
<td>6-17%</td>
<td>180-460</td>
</tr>
<tr>
<td>Depression</td>
<td>2-7%</td>
<td>NA</td>
</tr>
</tbody>
</table>
Electricity Generation
EU, India, China

Comparison calculated: Deaths due to particulate air pollution from electricity generation, and costs.

2030 business as usual (BAU)

2030 with global mitigation target (carbon trading)

- More renewables
- More nuclear
- Some coal with carbon capture and storage
- Less coal otherwise
Premature Deaths Avoided in 2030
Costs of Mitigation US$/Tonne CO2
Food and Agriculture Sector

- 80% of total emissions in sector from livestock production
Strategies modelled

To meet UK target of 50% reduction in GHG emissions on 1990 levels by 2030 with focus on livestock sector

- Assumed agricultural technological improvements
  - necessary but not sufficient to meet target

- Decrease overall livestock production
  - estimated that a 30% cut in production, in addition to technological improvements would meet GHG target
Health effects

• Case studies: UK and the city of São Paulo, Brazil

• Assumed that 30% reduction in livestock production would decrease consumption of animal source saturated fat by 30%

• Estimated association of intake of animal source saturated fat with risk of ischaemic heart disease

• Substantial benefits from decreased burden of heart disease
  – UK: ~15%↓ (~ 18,000 premature deaths averted)
  – São Paulo: ~16%↓ (~ 1000 premature deaths averted)
Conclusions

• Many climate change mitigation strategies can result in major benefits for public health

• Impact assessment is needed because not all strategies are beneficial e.g. Biofuels

• The co-benefits can (partly) offset the costs and are additional to those benefits from reducing climate change.
Thank you

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Involving 55 researchers from UK, USA, India, Canada, Australia, Spain, France, New Zealand, WHO Geneva