Sustainable Transport, Health and Equity

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Greenhouse gas emissions from transport have been rising and are expected to continue to rise both in higher & lower income countries. Transport is seen as a hard area for mitigation.
• However, there can be good news in climate change mitigation & transport.
• Transport & its energy use lie at the centre of major social, economic & environmental problems.
• We are talking here of social determinants of health: climate change, rising oil prices leading to rising food prices, the injury epidemic & the obesity epidemic.
• Reducing transport’s energy use by less car use & increasing walking & cycling could help us tackle all these problems
• Specifically looking at health in middle income countries like Brazil transport impacts directly on a number of the biggest killers

• More walking & cycling reduces the risk of depressive disorders (1), heart disease (2), and stroke (3)

• Less air pollution increases the risk of heart disease, stroke and COPD (6)

• Less traffic noise increases the risk of heart disease

• And of course fewer cars can means fewer road traffic injuries (4)
To try and quantify how changes to transport could benefit health and reduce greenhouse gas emissions we have developed ITHIM- the integrated transport and health impact modelling tool.

ITHIM – spreadsheet model but we hope to have web version developed next year.

It can be used for quantifying Transport scenarios.

Changes in exposures from scenarios.

Changes in health outcomes from changes in exposures.

**Integrated Transport & Health Impact Modelling Tool**

<table>
<thead>
<tr>
<th>Person travel time, speeds and distance</th>
<th>Results</th>
<th>Scenario 3</th>
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</thead>
<tbody>
<tr>
<td><strong>Time person walk or cycle</strong></td>
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<tr>
<td>Pedestrian</td>
<td>1.1</td>
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<tr>
<td>Truck</td>
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<td>Car</td>
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<tr>
<td><strong>Time person drive</strong></td>
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<td>Pedestrian</td>
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**Air Pollutants: Median PM England & Wales**

<table>
<thead>
<tr>
<th></th>
<th>10%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
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<td>PM10</td>
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**Total DALYs**

-247/793

-2.8

**Physical Activity Risk (activity > 3.5m, energy cost > 2.00j/kg/hr)**

-1
• ITHIM specifically includes air pollution, physical activity, road traffic injuries- links these to changes in greenhouse gas emissions
• It compares population distributions of active travel time under alternative scenarios and uses these to estimate disease burden changes
• It uses a risk and distance based injury model to estimate injuries under alternative scenarios
• We are using this approach in modelling scenarios for these settings: England & Wales, California, Auckland NZ, and Delhi, India
• Health impact modelling tools can also be used for modelling policies- another model was recently used for modelling the bike hire scheme (Bicing) in Barcelona
• Will talk about project modelling scenarios for English & Welsh urban areas
• We excluded London- travel patterns very different & covered in previous study
• Linked to Visions 2030 Walking & cycling Study
• This project uses Visualisations & Videos
• Participatory project- involving the public & policy makers
• Largely qualitative
• ITHIM used to help quantify scenarios
• Baseline- based on English & Welsh data from 2002- 2008- National Travel Survey
• Vision 1 is based on the widespread implementation of current best practice-
large increase in walking & cycling, reduction in car use
• Vision 2 represents a more far-reaching scenario
• In this Vision there are very few cars
• More walking & cycling
• Very high levels of public transport use
• Vision 3 has similar car use to Vision 2 but instead of high public transport dominated by walking, cycling & alternative electric vehicles with speeds more like bicycles than cars

• What we assumed specifically for Vision 3 is that
  • Mean total travel times only increase by a small amount
  • But walking increases from 13 minutes to 22 minutes per day
  • Cycling increases from 1 minute to 18 minutes per day
  • Car use falls from 36 minutes to 4 minutes per day
  • So this means that total travel distances fall from a mean of 28 km per person per day to 17 km per person per day
• In terms of CO2 what we see is the potential to achieve substantial reductions in greenhouse gas emissions from transport with a reduction in car & increase in walking & cycling
• Core of how physical activity model works in ITHIM
• From means to population distributions
• Active travel is represented as Log normal distributions
• Compare quintiles of active travel time per week under each scenario for each age group & both sexes- that is separate distributions- age & sex specific walking & cycling ratios to reference group
• We assumed that the coefficient of variation falls as the population becomes more active. This is backed by empirical data from the Netherlands
• Walking & cycling different intensity depending on speed – so standardised as MET hours per week.
• Picture from Cambridge where I work - very high rates of cycling even among older men & women
• Importance of who is doing the activity - particularly making sure people can be active as they get older
• So ITHIM allows specification of different amounts of activity by different groups and how this changes under different scenarios
• Important choice of dose response curve - based on meta-analysis & systematic review from Hamer 2008
• Those that are least active get greatest benefit but everyone benefits from increasing activity
• Road traffic injuries are affected by how much people travel – more travel increases the risk of being injured & of injuring someone else.
• In our model we include both risk of being injured & of injuring someone else.
• We use real data on injuries & fatalities- looking at who is injured by what kind of vehicle on the roads.
• We then estimate how changes in travel distances would affect injuries.
• To illustrate our assumptions on this if one considers cyclist killed by cars we assumed that if one doubles cycling & car distances than cyclist fatalities double, but if one only doubles one of these injuries increase by about 40%.
• Low cycling- may have high risk per cyclist but few fatalities.
• More cycling may mean lower risk but more fatalities.
• Very high cycling and few cars means low risk and few fatalities.
• But it also matters how far people travel – if we keep travel distances down that means fewer injuries.
• Benefits compared here as years of life gained- based on WHO approach of measuring the health gap
• Important benefits from reductions in air pollution & injuries but by far largest benefits from increasing physical activity.
• This may be context specific – UK has relatively low levels of air pollution & injuries at baseline
This slide is based on DALYs - disability adjusted life years-including both mortality and morbidity.

- Biggest benefits from reductions in those big killers heart disease & stroke
- But other benefits important too- particularly growing evidence of effect of physical activity on dementia
- And other gains including reductions in diabetes, depression, breast cancer and colon cancer
• Previous work we did – using slightly different methods for Delhi
• Compared two future scenarios- one based on lower emission motor vehicles, one based on more active travel & less motor vehicle use
• Distances per person per week by mode- bus still most popular mode
• People travel an average of 13 km by bike and 10 km on foot per week.
In a projection for 2030 there is a large increase in total travel including a large increase in car use and an increase in motor cycle and rail use.

There is a fall in cycling and a small fall in walking.
In our active travel future there is no increase in car use but a large increase in cycling (33 km per person per week) and a smaller increase in walking (12 km per person per week).
The health impact was measured in DALYs (Disability Adjusted Life Years) which combines both years of life lost and years of healthy life lost from a disability.

We found a much larger health benefit from increased active travel (1696 DALYs through combined changes in physical activity, air pollution and injury) than we found from lower carbon driving (changes in air pollution 12516 DALYs).

The benefit in the combined scenario (combining both more walking and cycling and lower carbon driving) found the largest benefit (12995 DALYs).
• If we look at the health benefits from the combined scenario by disease
• We found the biggest benefit from less heart disease (affected by both air pollution and physical activity) and stroke, with up to a 25% reduction in the disease burden.
• But we also found fewer road traffic fatalities and important benefits from less diabetes and depression.
We notice here that the benefits in terms of lower air pollution and fewer road traffic deaths are much larger than for the UK because injury risks are higher & air pollution is much worse than in the UK. But interestingly, the benefits from physical activity are still larger. This is because physical activity is falling in Delhi and the burden of non-communicable diseases is increasing.
• Moving towards an active low carbon transport system requires investment.
• But costs lower than providing for cars or mitigation in other areas.
• The green alternative is more equitable- opportunities for social participation, physical activity for all, and reducing risks for pedestrians and cyclists.
• What is needed is positive action to engage with people on these benefits and the kind of urban environment they want to live in and the willingness to take strong action to challenge the dominance of the car.
• In conclusion there is the potential for a move to active city to bring near term health benefits & and to benefit the environment.
Thank collaborators &
Thank organisers for inviting me to speak today.

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<th>Collaborators</th>
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<td><strong>ITHIM</strong></td>
<td><strong>Visions 2030 Scenarios</strong></td>
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<tr>
<td>• Phil Edwards (LSHTM)</td>
<td>• Miles Tight (Leeds University) (PI)</td>
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<td>• Zaid Chalabi (LSHTM)</td>
<td>• University of East Anglia</td>
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<td><strong>Scenarios</strong></td>
<td><strong>Plus</strong></td>
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<td>• Dinesh Mohan (TRIPP Delhi)</td>
<td>• University of Leeds</td>
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<td>• Geetam Tiwari (TRIPP Delhi)</td>
<td>• University of Oxford</td>
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<td>• Moshe Givoni (Oxford University)</td>
<td>• University of Salford</td>
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<td>• Rob Hickman (UCL)</td>
<td>• University of Manchester</td>
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<td><strong>Air pollution modelling</strong></td>
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<td>• Cathryn Tonne (LSHTM)</td>
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<td><strong>Road traffic injuries</strong></td>
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<td>• Andrei Morgan (UCL)</td>
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