A public health perspective on transport, health and carbon emissions

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What Determines Health?

- Genetics: 20%
- Health Care: 20%
- Social, Environmental, Behavioral Factors: 60%

Source: McGinnis et al, 2002
The determinants of health and well-being in human habitation
Energy intensive transport

Health impacts

Climate impacts
I DON'T BELIEVE IN
GLOBAL WARMING

I DON'T THINK I
WILL
Policy sweet spot

Zone of co-benefits

GHGs

Health
Benchmarking cycling and walking in six New Zealand cities
Pilot study 2015

Source: Census 1971-2013
## Current travel patterns in NZ cities

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>HH with two or more vehicles (%)</th>
<th>Trips walking (annual %)</th>
<th>Trips cycling (annual %)</th>
<th>Trips by public transport (annual %)</th>
<th>CO₂ emissions per capita (tonnes/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland</td>
<td>1,493,210</td>
<td>55</td>
<td>16.1</td>
<td>0.5</td>
<td>3.3</td>
<td>1.44</td>
</tr>
<tr>
<td>Tauranga</td>
<td>119,830</td>
<td>51</td>
<td>14.1</td>
<td>2.1</td>
<td>1.3</td>
<td>1.59</td>
</tr>
<tr>
<td>Hamilton</td>
<td>150,180</td>
<td>49</td>
<td>13.8</td>
<td>1.2</td>
<td>1.9</td>
<td>1.68</td>
</tr>
<tr>
<td>Wellington</td>
<td>197,460</td>
<td>36</td>
<td>27.5</td>
<td>1.3</td>
<td>6.2</td>
<td>1.15</td>
</tr>
<tr>
<td>Christchurch</td>
<td>356,750</td>
<td>53</td>
<td>18.9</td>
<td>3.1</td>
<td>3.3</td>
<td>1.25</td>
</tr>
<tr>
<td>Dunedin</td>
<td>123,540</td>
<td>46</td>
<td>23.5</td>
<td>1.3</td>
<td>1.4</td>
<td>1.24</td>
</tr>
</tbody>
</table>
Health effects of the London bicycle sharing system: health impact modelling study

Abstract

Objective To evaluate the impact of the bicycle sharing system on the health of its users.

Design Health impact modelling and simulation, using a stochastic simulation model.


Data sources The London cycle hire scheme and GP datasets for London (2004-2009) and control data for the year before.

Participants Those aged 20-80 years, classified as non-disabled and with no previous records of death or park injury.

Results After one year, the system provided 14.7 million rides per year, with a 0.3% increase in the number of accidents, indicating a safety improvement.

Conclusion The London bicycle sharing system has a positive impact on health, with potential benefits for public health and reducing traffic-related injuries.
Baseline – current travel

Demographics

Travel patterns (incl VKT/CO₂ emissions)

Transport-related health outcomes (PM₂.₅, PA, Injury)

Scenario – “Wellington”

Demographics

Travel patterns (incl VKT/CO₂ emissions)

Transport-related health outcomes (PM₂.₅, PA, Injury)
<table>
<thead>
<tr>
<th></th>
<th>Premature deaths averted (total)</th>
<th>Deaths averted (Physical activity)</th>
<th>Deaths averted (Injury)</th>
<th>Deaths averted (air pollution)</th>
<th>CO₂ emission reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland</td>
<td>57.3</td>
<td>41.2</td>
<td>15.1</td>
<td>1.0</td>
<td>20%</td>
</tr>
<tr>
<td>Tauranga</td>
<td>49.7</td>
<td>46.5</td>
<td>1.8</td>
<td>1.3</td>
<td>27%</td>
</tr>
<tr>
<td>Hamilton</td>
<td>51.7</td>
<td>47.2</td>
<td>2.9</td>
<td>1.5</td>
<td>32%</td>
</tr>
<tr>
<td>Christchurch</td>
<td>31</td>
<td>29.1</td>
<td>1.5</td>
<td>0.4</td>
<td>8%</td>
</tr>
<tr>
<td>Dunedin</td>
<td>12.3</td>
<td>12.3</td>
<td>0.4</td>
<td>0.3</td>
<td>7%</td>
</tr>
</tbody>
</table>
What does this research tell us?

- Policies that promote physically active transport will have the most health gain
  - Estimates are conservative
NZ Health Survey

Meeting NZ PA Guidelines (odds ratios)

<table>
<thead>
<tr>
<th></th>
<th>AT vs car</th>
<th>PT vs car</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.76 (1.26 - 2.47)</td>
<td>1.15 (0.80 - 1.65)</td>
</tr>
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What does this research tell us?

• Policies that promote physically active transport will have the most health gain
  o Estimates are conservative

• But injury reductions are important too, especially in Auckland
  o Likely to be conservative estimate
  o ITHIM assumes increase in injury from increased cycling and a safety in numbers effect
VISION
ZERO
NO MORE TRAFFIC DEATHS
What does this research tell us?

- Policies that promote physically active transport will have the most health gain
  - Estimates are conservative
- But injury reductions are important too, especially in Auckland
  - Likely to be conservative estimate
  - ITHIM assumes increase in injury from increased cycling and a safety in numbers effect
- Emission reductions are surprisingly large
  - Driven by PT
What doesn’t this research tell us?

• The specific policies that would be most effective to achieve the change in mode of the ‘Wellington’ scenario
  o Complex trade offs in some policies that aim to reduce emissions
Domain Impact

Injury
- Air pollution: Worse
- GHG emissions: Increase

<table>
<thead>
<tr>
<th>Domain</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injury</td>
<td>✓</td>
</tr>
<tr>
<td>Air pollution</td>
<td>Worse</td>
</tr>
<tr>
<td>Physical activity</td>
<td>✓ (?)</td>
</tr>
<tr>
<td>GHG emissions</td>
<td>Increase</td>
</tr>
</tbody>
</table>
Domain Impact

Injury - Air pollution Made it worse
Physical activity - GHG emissions Neutral or made worse

Zone of co-benefits

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</thead>
<tbody>
<tr>
<td>Injury</td>
<td>-</td>
</tr>
<tr>
<td>Air pollution</td>
<td>Made it worse</td>
</tr>
<tr>
<td>Physical activity</td>
<td>-</td>
</tr>
<tr>
<td>GHG emissions</td>
<td>Neutral or made worse</td>
</tr>
</tbody>
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Domain Impact

Injury - Air pollution

Physical activity - GHG emissions Improve (depending on electricity source)

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<td>Injury</td>
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What doesn’t this research tell us?

• The specific policies that would be most effective to achieve the change in mode of the ‘Wellington’ scenario
  o Complex trade offs

• Most cost-effective policies
What doesn’t this research tell us?

- The specific policies that would be most effective to achieve the change in mode of the ‘Wellington’ scenario
  - Complex trade offs
- Most cost-effective policies
- Healthcare cost savings of scenarios
Co authors

- Ed Randal (UOW)
- Michael Keall (UOW)
- Alistair Woodward (UA)
A doughnut for the Anthropocene
Model issues

- Uncertainty not dealt with
  - Not so relevant in this scenario but very relevant in ‘future modelling’

- Data limitations
  - Due to sparse PM$_{2.5}$ model used airshed and vehicle emissions model from the USA
  - Also domain specific PA from the USA as we don’t know where NZer obtain their PA from
  - Unable to disaggregate travel by road type and speed – injury reductions probably probably conservative