A public health perspective on transport, health and carbon emissions

Caroline Shaw
What Determines Health?

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

Source: McQueen et al, 2002
The determinants of health and well-being in human habitation

The health map: Barton and Grant 2006 developed from a concept by Alexander and Ishikawa 1977
I DON'T BELIEVE IN
GLOBAL WARMING

I DON'T BELIEVE IN
GLOBAL WARMING
Woodcock et al, 2009
Benchmarking cycling and walking in six New Zealand cities
Pilot study 2015
## Current travel patterns in NZ cities

<table>
<thead>
<tr>
<th>City</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>Light vehicle CO₂ emissions (tonnes/year)</th>
<th>Annual transport related injury</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>2,150,000</td>
<td>146</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>190,000</td>
<td>12</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>253,000</td>
<td>15</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>227,000</td>
<td>20</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>447,000</td>
<td>37</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>153,000</td>
<td>13</td>
</tr>
</tbody>
</table>
• Asked the slightly provocative (if you are not from Wellington) question, what would the health and carbon consequences be if the other 5 largest cities had the same transport patterns as Wellington
Health effects of the London bicycle sharing system: health impact modeling study

Abstract

Objective To model the impacts of the bicycle sharing system in London on the health of its users.

Design Health impact modeling and evaluation using a stochastic simulation model.


Participants Data from bicycle sharing system and UCL for the London region were used. The data were collected from a survey conducted by the University College London (UCL) and the Department of Transport, London.

Main outcomes measures Change in physical activity levels, change in travel times, and change in hospital admissions due to traffic accidents.

Results The study estimated that the system saved 1.6 million person-kilometers per day, resulting in a reduction of 7% of cycling days by 2012. These data were used to estimate the number of hospital admissions due to traffic accidents. Using these data, the study estimated that the system saved 1.6 million person-kilometers per day, resulting in a reduction of 7% of cycling days by 2012.
Baseline

Demographics

Travel patterns (incl VKT/CO₂ emissions)

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

Scenario

Demographics

Travel patterns (incl VKT/CO₂ emissions)

Transport-related health outcomes (PM₂.₅, PA, Injury)
If other cities looked like Wellington....

<table>
<thead>
<tr>
<th>City</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>
• Physical activity outcomes are king
  o 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>1.76 (1.26 - 2.47)</td>
<td>1.15 (0.80 - 1.65)</td>
<td></td>
</tr>
</tbody>
</table>
• Physical activity outcomes are king
  o 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
• Physical activity outcomes are king
  o 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

• Emission reductions are surprisingly large
  o Driven by PT
Long term patterns in travel to work

Source: Census 1971-2013
• Ed Randal (UOW)
• Michael Keall (UOW)
• Alistair Woodward (UA)
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 conservative

- No indication of most effective or cost-effective ways to achieve the modelled scenario