Modelling Road Safety Interventions in the Asia Pacific Region using a Health Impact Assessment Framework

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Overview

1. Introduction
2. Health Impact Assessment Framework
3. Model Development and Application to 6 Cities
4. Active Transport Scenario
5. Summary
Introduction
MAJOR TRANSPORT CHALLENGES

51% → 70% Living in Cities
7 → 10.5 Billion Population
46% ↑ Road Deaths
Many Achievements....

Source: Australian Transport Council (2006)
Emerging OPPORTUNITY

Land-Use Decisions → Transport Choice ↑ Road Trauma
Health Impact Assessment Framework
Application of a Health Impact Assessment Framework

- Engaged key stakeholders and obtained baseline population information
- Systematic search of the literature related to land-use, transport and population health (chronic disease and road trauma)
- Health impact evidence gathering
- Developed a linear model for which population health outcomes were derived
Model Development
Quantifying Elements of the Model

Stage 1: Land-use and Transport Mode Choice

- Meta-analytic research by Ewing and Cervero (2010) provided elasticities for the relationship between land-use and transport choice
  - **Density** – population density, residential unit density, intersection density,
  - **Diversity** – number of separate land uses (businesses etc) assigned to a specific area
  - **Distance** – the average shortest street routes from place of residence or workplace to the nearest public transport option
  - **Design** – refers to characteristics and layout of land including streets, intersection connectivity, footpaths, aesthetics
Quantifying Elements of the Model

Stage 2: Transport Mode Choice and Population Health

- We assessed influences of land-use and transport mode choice on the following population health outcomes
  - Road Deaths and Serious Injury (ICD-AM V00-V89)
  - Cardiovascular Disease (ICD-AM I00-I99)
  - Type 2 Diabetes (ICD-AM E10-E14)
  - Respiratory Disease (ICD-AM J30-J98)
Quantifying Elements of the Model

Stage 2: Transport Mode Choice and Population Health

- Key drivers of population health associated with transport mode choice identified from the systematic review were:
  - Per km exposure to risk of injury or death associated with the mode of travel in the current environment
  - Level of physical activity (as measured by metabolic equivalents (METS)) associated with the mode choice and its effect on cardiovascular disease and Type 2 diabetes
  - Exposure to fine particulate matter ($PM_{10}$ and $PM_{2.5}$) associated with emissions from transport

- For comparative purposes, population health outcomes were reported as disability adjusted life years (DALY’s)
Baseline Model

- Data were obtained for 6 international cities
  - Melbourne
  - Delhi
  - Beijing
  - New York
  - London
  - Copenhagen
Baseline Model

- Data were obtained for 6 international cities
  - Melbourne
  - Delhi
  - Beijing
  - New York
  - London
  - Copenhagen
## Baseline Model: Transport Mode Share and Road Trauma

<table>
<thead>
<tr>
<th>Transport Mode</th>
<th>Melbourne</th>
<th>Beijing</th>
<th>Delhi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of total km by mode</td>
<td>Risk of Death per km</td>
<td>% of total km by mode</td>
</tr>
<tr>
<td>Vehicle Driver</td>
<td>60%</td>
<td>7.3 E-08</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle Passenger</td>
<td>25%</td>
<td>7.2 E-08</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train</td>
<td>10%</td>
<td>5.8 E-10</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td>2%</td>
<td>3.3 E-09</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>1%</td>
<td>7.5 E-08</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td>1%</td>
<td>1.3 E-08</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (including motorcycle)</td>
<td>1%</td>
<td>1.6 E-07</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Active Transport Scenario
Effects of Enhancing Land Use

Mode-Shift Model

- Under this scenario, we altered the baseline model to encourage active transport across the 6 cities. The model altered land use so that there was:
  - 30% increase in land-use density,
  - 30% increase in diversity, and
  - 30% decrease in average distance to public transport

- We also modelled the impact of public policy initiatives that resulted in 30% of VKT currently undertaken by vehicle drivers and passengers for short trips under 5km being transferred to cycling (66%) or walking (33%).
# Effects of Enhancing Land Use

<table>
<thead>
<tr>
<th>Transport Mode</th>
<th>Melbourne</th>
<th>Beijing</th>
<th>Delhi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Driver</td>
<td>-9%</td>
<td>-7%</td>
<td>-17%</td>
</tr>
<tr>
<td>Vehicle Passenger</td>
<td>-10%</td>
<td>-7%</td>
<td>-17%</td>
</tr>
<tr>
<td>Train/Tram</td>
<td>14%</td>
<td>14%</td>
<td>14%</td>
</tr>
<tr>
<td>Bus</td>
<td>14%</td>
<td>14%</td>
<td>15%</td>
</tr>
<tr>
<td>Walking</td>
<td>100%</td>
<td>125%</td>
<td>24%</td>
</tr>
<tr>
<td>Cycling</td>
<td>242%</td>
<td>18%</td>
<td>36%</td>
</tr>
<tr>
<td><strong>Physical Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in travel-related METS per week</td>
<td><strong>22%</strong></td>
<td><strong>8%</strong></td>
<td><strong>15%</strong></td>
</tr>
<tr>
<td><strong>Particulate Matter</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in transport-related particulate emissions</td>
<td><strong>-8%</strong></td>
<td>13%</td>
<td>20%</td>
</tr>
</tbody>
</table>
### DALY’s Gained per 100,000 population Under Active Transport Scenario

<table>
<thead>
<tr>
<th>Change in Population Health Outcomes</th>
<th>Melbourne</th>
<th>Beijing</th>
<th>Delhi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Disease</td>
<td>62</td>
<td>-243</td>
<td>-838</td>
</tr>
<tr>
<td>Type 2 Diabetes</td>
<td>8</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Respiratory Disease</td>
<td>1</td>
<td>-21</td>
<td>-45</td>
</tr>
<tr>
<td>Road Trauma</td>
<td>-8</td>
<td>-4</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>-263</td>
<td>-849</td>
</tr>
</tbody>
</table>
Effects of Road Safety Interventions under the Active Transport Scenario

![Bar chart showing the road trauma DALYs gained per 100,000 population without and with road safety interventions in different cities.](chart.png)

- Melbourne: -8 (without), 36 (with)
- Beijing: -4 (without), 139 (with)
- Delhi: 8 (without), 176 (with)
- London: -13 (without), 39 (with)
- Copenhagen: 0 (without), 76 (with)
- New York: -19 (without), 133 (with)

Legend:
- ■ Without road safety interventions
- □ With road safety interventions
Summary
The HIA framework is useful to assess the health impact of land-use and transport policies.

One approach is not applicable across all jurisdictions.

Important points from this modelling:
- Land-use and modal choice strongly linked to health outcomes.
- Importance of infrastructure to ameliorate road trauma with increases in active transport.
- Role road safety interventions contribute to reducing road trauma.
Thank You