MONASH University
Accident Research Centre

A centre within the Monash University Injury Research Institute

Land Use, Transport and Population Health: Strategic Opportunities

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Overview

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

Introduction

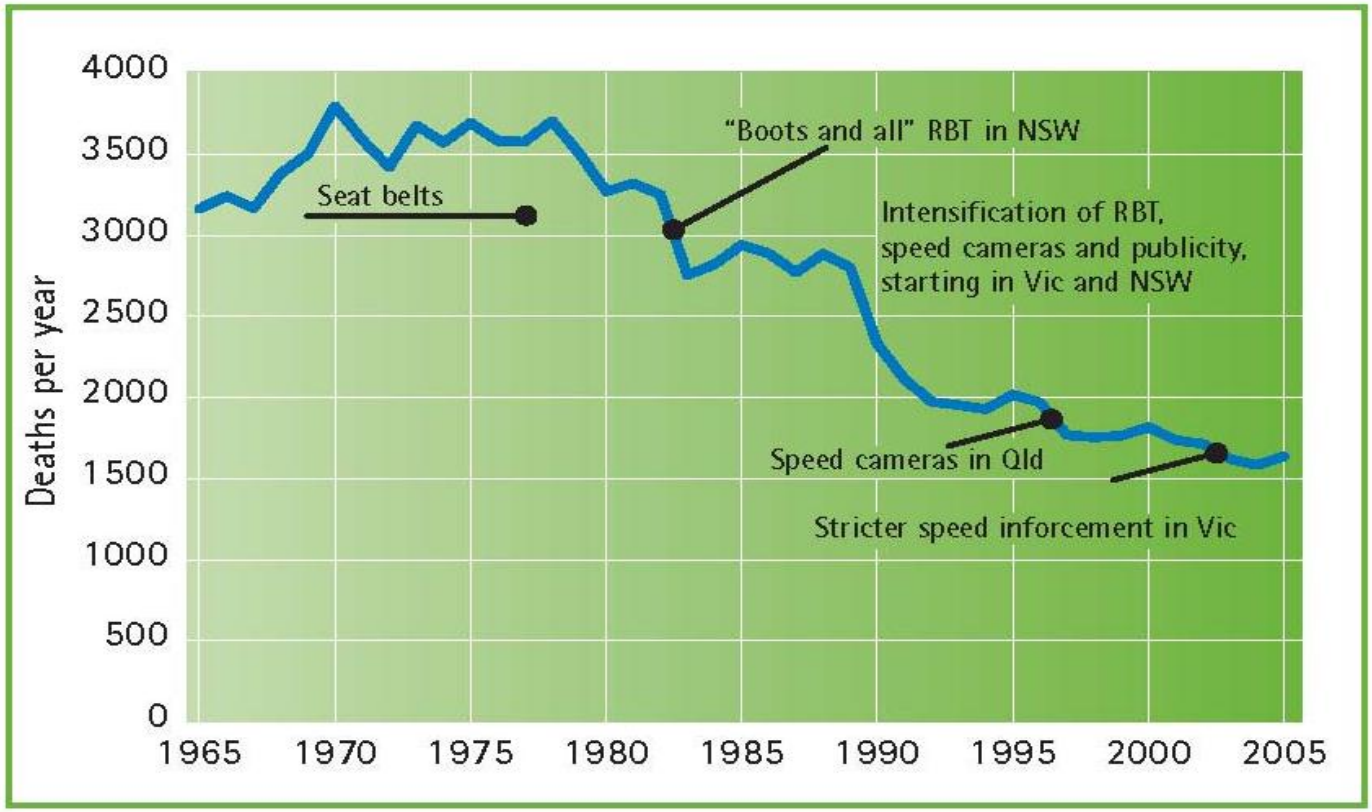
MAJOR TRANSPORT CHALLENGES

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 heath outcomes were derived

Model Development and Application to 6 Cities

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)

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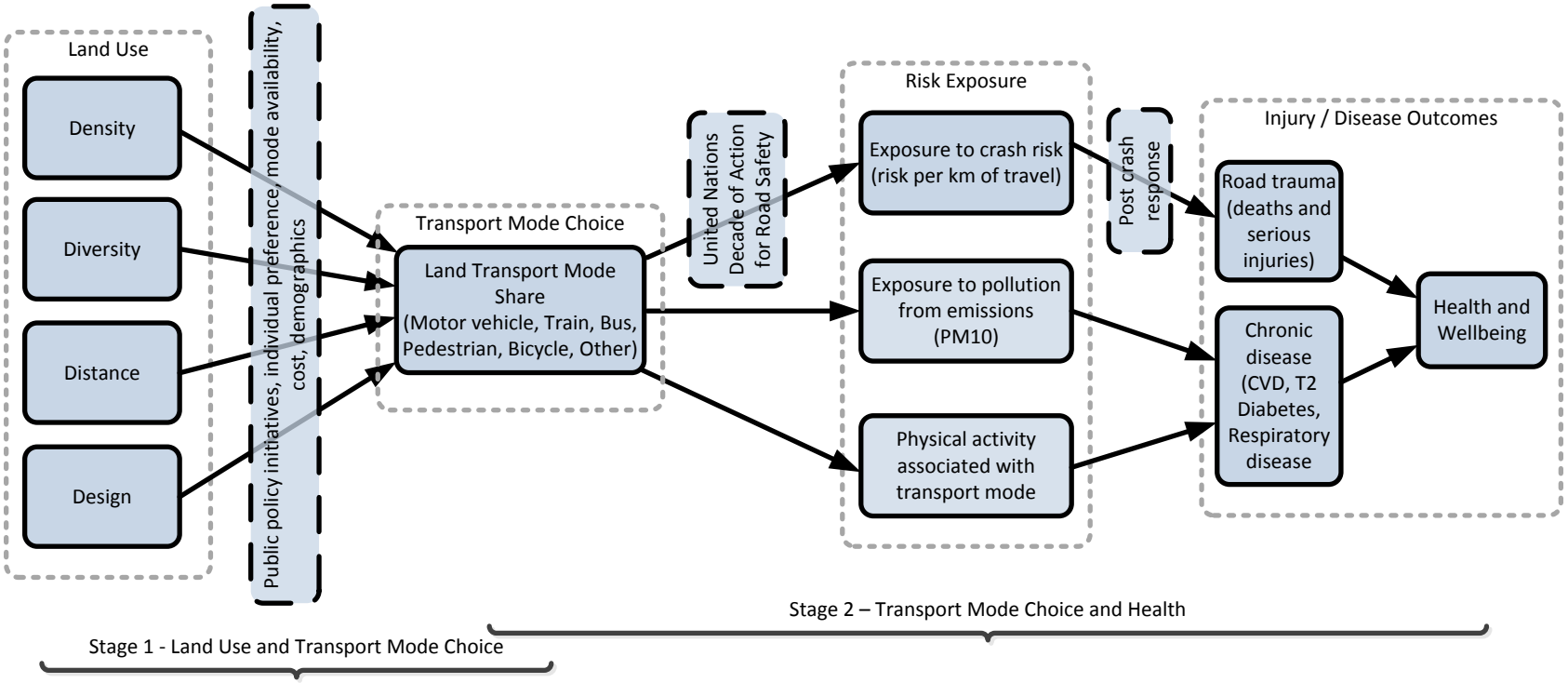

Baseline Model

- Data were obtained for 6 international cities
  - Melbourne

  - Delhi

  - Beijing

  - New York

  - London

  - Copenhagen

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Baseline Model: Transport Mode Share and Road Trauma

	Melbourne		Beijing		Delhi	
Transport Mode	**% of total km by mode**	**Risk of Death per km**	**% of total km by mode**	**Risk of Death per km**	**% of total km by mode**	**Risk of Death per km**
Vehicle Driver	60%	7.3 E-08	35%	2.5 E-08	10%	6.7 E-08
Vehicle Passenger	25%	7.2 E-08	7%	2.5 E-08	10%	6.7 E-08
Train	10%	5.8 E-10	21%	6.0 E-09	8%	4.3 E-08
Bus	2%	3.3 E-09	30%	6.0 E-09	48%	4.6 E-08
Walking	1%	7.5 E-08	1%	1.0 E-07	7%	1.9 E-08
Bicycle	1%	1.3 E-08	16%	1.9 E-07	7%	1.8 E-08
Other (including motorcycle)	1%	1.6 E-07	2%	1.6 E-07	10%	5.6 E-08

Baseline Model: Transport Mode Share and Road Trauma

	London		New York		Copenhagen	
Transport Mode	**% of total km by mode**	**Risk of Death per km**	**% of total km by mode**	**Risk of Death per km**	**% of total km by mode**	**Risk of Death per km**
Vehicle Driver	35%	1.6 E-09	39%	2.3 E-09	37%	2.4 E-09
Vehicle Passenger	19%	1.7 E-09	21%	1.9 E-09	16%	2.8 E-09
Train	29%	2.4 E-10	15%	8.2 E-11	24%	9.7 E-10
Bus	11%	6.2 E-10	8%	1.5 E-10	7%	3.4 E-09
Walking	4%	5.9 E-08	6%	3.3 E-08	3%	3.1 E-08
Bicycle	1%	4.3 E-08	1%	3.6 E-08	12%	5.7 E-09
Other (including motorcycle)	1%	1.3 E-07	10%	5.0 E-09	1%	3.4 E-08

Active Transport Simulation

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

Transport Mode	Melbourne	Beijing	Delhi
Vehicle Driver	-9%	-7%	-17%
Vehicle Passenger	-10%	-7%	-17%
Train/Tram	14%	14%	14%
Bus	14%	14%	15%
Walking	100%	125%	24%
Cycling	242%	18%	36%
Physical Activity Change in travel-related METS per week	22%	8%	15%
Particulate Matter Change in transport-related particulate emissions	-8%	13%	20%

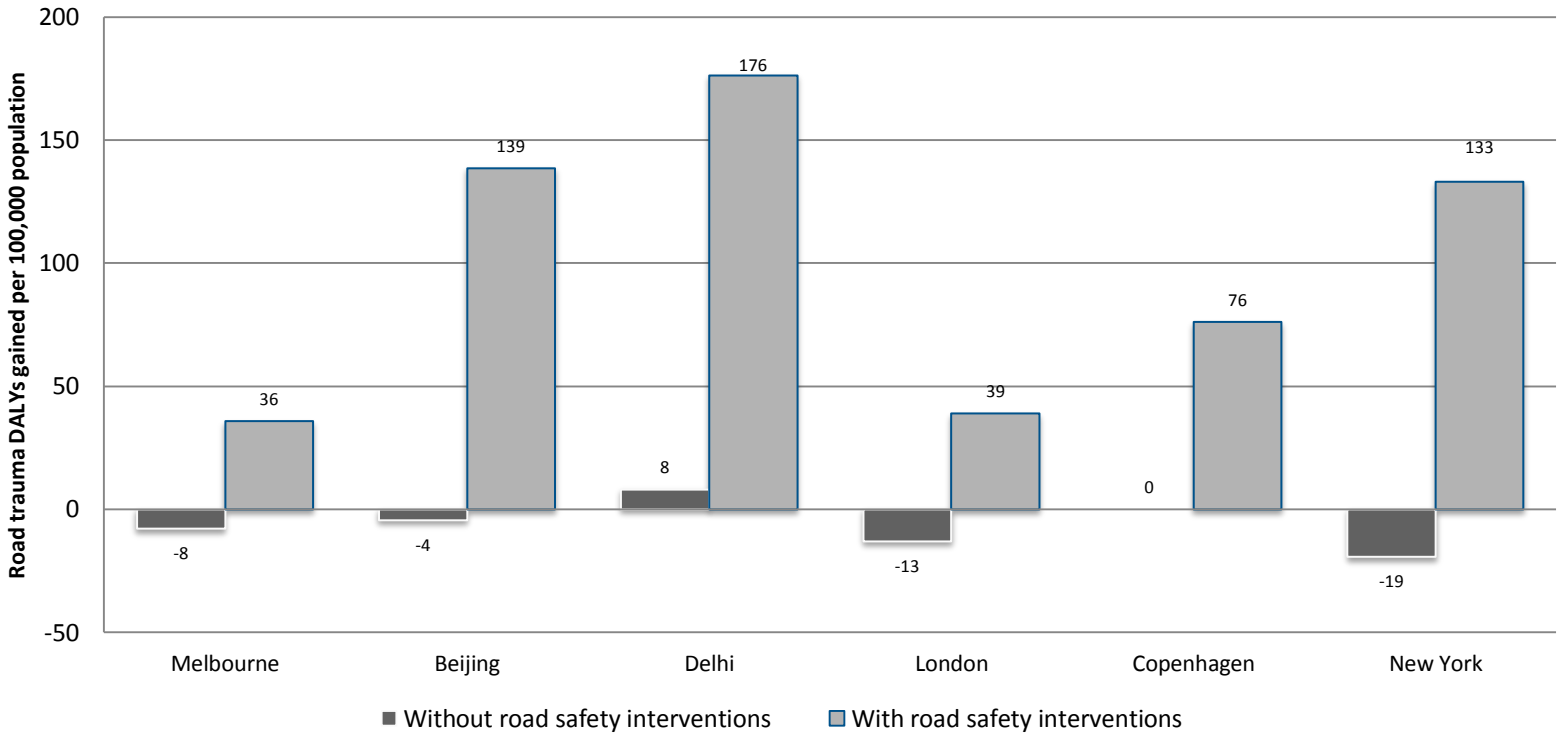
Effects of Enhancing Land Use

Transport Mode	London	Copenhagen	New York
Vehicle Driver	-10%	-8%	-12%
Vehicle Passenger	-10%	-7%	-12%
Train/Tram	14%	14%	14%
Bus	14%	14%	15%
Walking	35%	18%	33%
Cycling	257%	15%	403%
Physical Activity Change in travel-related METS per week	26%	11%	24%
Particulate Matter Change in transport-related particulate emissions	-1%	-1%	-5%

DALY's Gained per 100,000 population Under Active Transport Scenario

Change in Population Health Outcomes	Melbourne	Beijing	Delhi	London	Copenhagen	New York
Cardiovascular Disease	62	-243	-838	84	40	98
Type 2 Diabetes	8	4	9	8	5	17
Respiratory Disease	1	-21	-45	0	0	1
Road Trauma	-8	-4	8	-13	0	-19
Total	65	-263	-849	80	44	99

Effects of Road Safety Interventions under the Active Transport Scenario



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 ameriolate road trauma with increases in active transport
    - Role road safety interventions contribute to reducing road trauma
    - Importance of integrating the detail outlined from micro-simulation and driver models into the broader simulation modelling

Thank You

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