Motorized Traffic and Health: Implementing Interventions to Mitigate Impacts

Urban Traffic Calming

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Outline

Traffic calming: definitions
Political dimensions
The literature review
Health inequalities

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Workshop
A concept with various uses

1. Calmed new developments: e.g. Radburn, N.J.

http://www.ncchpp.ca/175/Publications.aspx?id_article=648

Source: Wikimedia
Author: Fgrammen
A concept with various uses

“Retrofitting” of existing street networks through

2. discrete measures

3. systemic measures

http://www.ncchpp.ca/175/Publications_group?d_article=676
Our working definition of traffic calming

Interventions on street networks that involve the installation of various measures in order to reduce speed or volumes of motorized vehicles according to one of two broad approaches:

- Black-spots
- Area-wide
Interventions on street networks that involve the installation of various measures in order to reduce speed or volumes of motorized vehicles according to one of two approaches:

- **Black-spots**
- **Area-wide**

Source: City of Edmonton, 2008, p. 29.

Political dimensions

Part of strategy to mitigate impacts of more car-km

Source: City of Edmonton, 2008, p. 29.

Part of a strategy to reduce car-km


http://www.ncchpp.ca/175/publications/cnpps?id_article=676
Political dimensions

Municipal de-normalization of 50km/hr speed limit on residential streets

State codifications of reduced speeds and new hierarchies of uses of residential streets

What are the effects of these two approaches?

Our literature review:

- Methodology
- Logic model
- Results

http://www.nochpp.ca/175/Publications.pdf?id_article=686
Methodology

1. **Systematic search** of peer-reviewed (n=19) and grey literature (n=10) for **evaluative studies** of urban traffic-calming interventions on four determinants of health:

   - **Collisions**
   - **Air quality**
   - **Noise**
   - **Active transportation**
Methodology

2. A broader search for peer-reviewed (n=36) and grey literature (n=38) to identify:
   - research gaps
   - methodological issues
   - mechanisms of action

3. A comparison of the black-spots and the area-wide approaches

E.g., The relationship between speed and noise

Source: Abbott et al., 1995, p. 9.
Black-spots approach
Area-wide approach

TRAFFIC-CALMING POLICY

Reduction of speeds
Reduction of volumes

PRINCIPAL MECHANISMS OF ACTION

Reduction of the number and severity of collisions
Improvement of air quality
Reduction of environmental noise
Increase in active transportation

EFFECTS ON HEALTH DETERMINANTS
Results: Collisions

- **Black-spots and area-wide**: substantial reductions in the number and severity of collisions for all users of the streets (drivers, cyclists, pedestrians, children, etc.).

Single-lane roundabout: -77% injury collisions  
(Retting et al., 2001)

399 20-mph (32-km/h) zones in London:  
-42% injury collisions  
(-49% children)  
(Grundy et al., 2009)
Effectiveness and scale


Sites where 8 or more pedestrians were injured (37)
Road network


Sites where one or more pedestrians were injured
Road network

*Victim of a road crash that resulted in an intervention by Urgences-santé
Projection: NAD83, MTM zone 8
Sources: City of Montréal, Urgences-santé
Cartographic prod.: MS Cloutier, 2004
©Direction de santé publique de Montréal

(Adapted from Morency & Drouin, 2008)
Results: Air quality

- **Black-spots and area-wide**: increase in per vehicle emissions ($\text{CO}_2$, VOC, CO, NO$_X$, PM), for most interventions (speed reduction & speed variations).

- **Area-wide**: can reduce overall emissions (volume reduction).

- **Ambient air quality**: little or no effect.


An exception:
Replacing stop sings with a mini-roundabout
Results: Noise

• **Cars**: noise reduction, for most interventions (speed reduction).

• **Heavy vehicles**: noise increase, for most interventions (speed variations and/or vertical deflections).

Vertical deflections:

- residential streets
- heavy vehicles

Results: Active transportation

- **Perceived road safety:** amelioration for pedestrians, parents, and drivers.

- **Cyclists:** concerned about horizontal deflections and narrowings forcing them closer to moving vehicles.

- **Number of active trips:** uncertain effects.

- **Physical activity:** uncertain effects.

Source: www.flickr.com, Photographer: Greg Raisman.

A narrowing adapted for cyclists
Summary

Intervention logic:

<table>
<thead>
<tr>
<th>TRAFFIC-CALMING POLICY</th>
<th>PRINCIPAL MECHANISMS OF ACTION</th>
<th>EFFECTS ON HEALTH DETERMINANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-spots approach</td>
<td>Reduction of speeds</td>
<td>Reduction of the number and severity of collisions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improvement of air quality</td>
</tr>
<tr>
<td>Area-wide approach</td>
<td>Reduction of volumes</td>
<td>Reduction of environmental noise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase in active transportation</td>
</tr>
</tbody>
</table>

Evidence:
- All street users
- Per vehicle emissions
- Total emission, with traffic volume reductions
- Little or no effect on air quality
- Cars
- Trucks
- Perceived safety (most users)
- # of active trips and physical activity

Most promising intervention:
- Area wide
- Reduces speeds
- Reduces speed variations
- Reduces traffic volume
- Reduces health inequalities
Transportation and inequalities

Inequalities between who and who?

- Socio-economic status (SES)
- Income
- Racial traits
- Place of residence
- Mode of transportation
- Age
- Gender
- ...

Inequalities of what?

- Accessibility
- Collisions, injuries, fatalities
- Air quality
- Noise
- Perceived safety (motorists, cyclists, children, etc.)
- ...

...
E.g. Collision-related injuries by Socio-Economic Status group (SES)

CIHI, 2008, p.46.
E.g. Noisy or polluted neighbourhoods by income

Figure 1: Percentage of Urban and Rural Adults Who Reported That Their Neighbourhoods Were Too Noisy or Polluted, by Household Income Category, 2006–2007

Note
Error bars indicate 95% confidence intervals.
Source

CIHI, 2011, p.11.
Explanations?

- Traffic volume
- Traffic speed
- Street designs
- Grid pattern
- Etc.

Source: NCCHPP. Photographer: François Gagnon.
How can traffic calming reduce inequalities?

- **Black-spots approach:**
  - Locations at high risk for collisions are often in low SES neighbourhoods.

Promising strategy to reduce collision-related injuries (correlation to inequalities), but not evaluated

Distribution of collision-related injuries in Montréal

Adapted from Morency, 2009, p.31.
How can traffic calming reduce inequalities?

• Area-wide approach:
  – Giving priority to low SES neighbourhoods:

  Collision-related injuries

  Pollution (air & noise)

  Perceived safety

  2 positive evaluations

  Promising, but not evaluated
E.g. 399 20-mph zones in London, U.K.

| % of km of street by deprivation quintile covered by 20-mph zones in 2006 |
|---------------------------------|-----------------|
| Least deprived                  | Most deprived   |
| 1                               | 5               |
| 2                               | 15              |
| 3                               | 12              |
| 4                               | 10              |
| 5                               | 20              |

Source of data: Grundy et al., 2008, p.39.

Prevented injuries in 2006

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<tr>
<td>Adjacent streets</td>
</tr>
<tr>
<td>In 20-mph zones</td>
</tr>
<tr>
<td>Least deprived</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
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<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
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No collision migration outside the zones

Source of data: Grundy et al., 2008, p.40.
E.g. Two similar cities, U.K.

- **City A (U.K.)**
- **City B (U.K.)**

Source of data: Jones et al., 2005
Unintended effects on inequalities?

People of low SES tend to be overrepresented near major roads + Burdens from transportation are already high

Intervention logic:

**TRAFFIC-CALMING POLICY**
- Black-spots approach
- Area-wide approach

**PRINCIPAL MECHANISMS OF ACTION**
- Reduction of speeds
- Reduction of volumes

**EFFECTS ON HEALTH DETERMINANTS**
- Reduction of the number and severity of collisions
- Improvement of air quality
- Reduction of environmental noise
- Increase in active transportation

Modal transfer (to cycling, …)
Traffic diversion (from one local street to another or from local streets to major roads)
A simple framework...

<table>
<thead>
<tr>
<th>What are the anticipated effects of an intervention on the main determinants of health...</th>
<th>...near the intervention?</th>
<th>...where some of the motorized traffic might be diverted?</th>
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<td>Who travels by what mode (car, cycling, walking, etc.)...</td>
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...with a temporal dimension

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Effects over time?

Traffic patterns over time?

Mode split over time?

Movement of vulnerable populations over time?
References


Thanks!

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Our documents are available in French and English online at:
www.ncchpp.ca.