TACKLING METHODOLOGICAL ISSUES OF STUDYING BICYCLING SAFETY:

An Illustration Using the Bicyclists' Injuries and the Cycling Environment (BICE) Study

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Objectives

- **Identify challenges to current study designs used to evaluate the safety of road infrastructure for cyclists.**
- **Introduce the advantages of an epidemiological case-crossover design.**
- **Provide a methodological overview of the Bicyclists' Injuries and the Cycling Environment (BICE) study.**

Injury/Safety Study Designs Challenges to comparing:

Locations

(e.g. before/after studies or within city comparisons)

- **Accurately characterizing the denominator of persons at risk at each site (e.g. number of people riding past the location)**
  - If before/after study, has the implementation of new infrastructure changed the usage or **number of people at risk**?
  - Are city-wide or entire street averages adequate?
  - Does the number of people at risk change throughout the day, week or season?
  - Are the personal characteristics of users that could affect injury risk distributed equally between comparison sites?

People

(e.g. Case-control , cohort designs)

- **Ensuring comparability of those being compared**
  - Do individuals have the same **exposure to risk** (e.g time bicycling each day or distance travelled)?
  - Possible confounding by **personal factors** such as age, sex, risk-tolerance, cycling experience?

The Case-Crossover design

- A variant of the case-control design (injured cases compared to uninjured controls), but instead
  - Individuals act as their own controls, and
  - Sites are compared: the injury site is compared to a randomly selected point on the same trip.
- Ideal for examining the effect of transient risk factors (such as infrastructure) on acute outcomes (such as injury).
- For a first principles description, please see Maclure (1)

↑**Figure 1.** Overview of the design of the Bicyclists' Injuries and the Cycling Environment (BICE) study and the advantages conferred by the design.

Major variables and categories to be considered

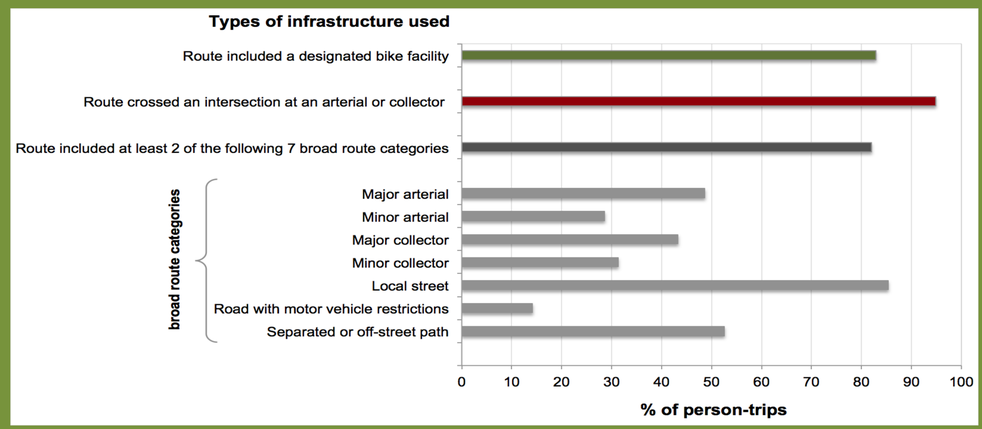
Type of route

- **Major city streets** (>2 marked traffic lanes)
  - With bike lane
  - With shared lane, symbols or bike signage
  - No bicycle specific infrastructure
- **Minor city streets** (2 marked traffic lanes)
  - With bike lane
  - With shared lane, symbols or bike signage
  - No bicycle specific infrastructure
- **Local or residential streets** (no marked traffic lanes)
  - Residential street designated as bike route, with traffic calming
  - Residential street designated as bike route, no traffic calming
  - No bicycle related designation
- **Separated from motor vehicle traffic**
  - Cycle track (next to major street, separated by barrier)
  - Bicycle path
  - Sidewalk or other pedestrian path
  - Multi-use path

Intersection type

- **Uncontrolled**
- **Traffic circle**
- **Stop sign**
  - 4-way
  - 2-way, cyclist travelling in right of way direction
  - 2-way, cyclist travelling in stop direction
- **Traffic light**
  - no cyclist control
  - cyclist control

→ **Figure 2.** Types of infrastructure used in the Bicyclists' Injuries and the Cycling Environment (BICE) Study, based on preliminary analyses of 409 of 690 injury trips (all within Vancouver).
The diversity of route types observed suggests that we will observe sufficient variance for meaningful comparisons of infrastructural characteristics.



Other variables to be considered

Adjacent car parking, streetcar tracks, surface paving, motor vehicle traffic speed and volume, width of bicycle lanes, types of bicycle signage and road markings.

STAY TUNED!

Please visit our study website to follow our progress:
http://www.cher.ubc.ca/cyclingincities/injury.html
Results expected in Fall of 2011.

References:
1) Maclure, M. The Case-Crossover Design: A Method for Studying Transient Effects on the Risk of Acute Events. Am J Epidem. 1991. 133: 144-153.

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