Bicyclists' Injuries & the Cycling Environment . . .

Results of a case-crossover study in Toronto and Vancouver

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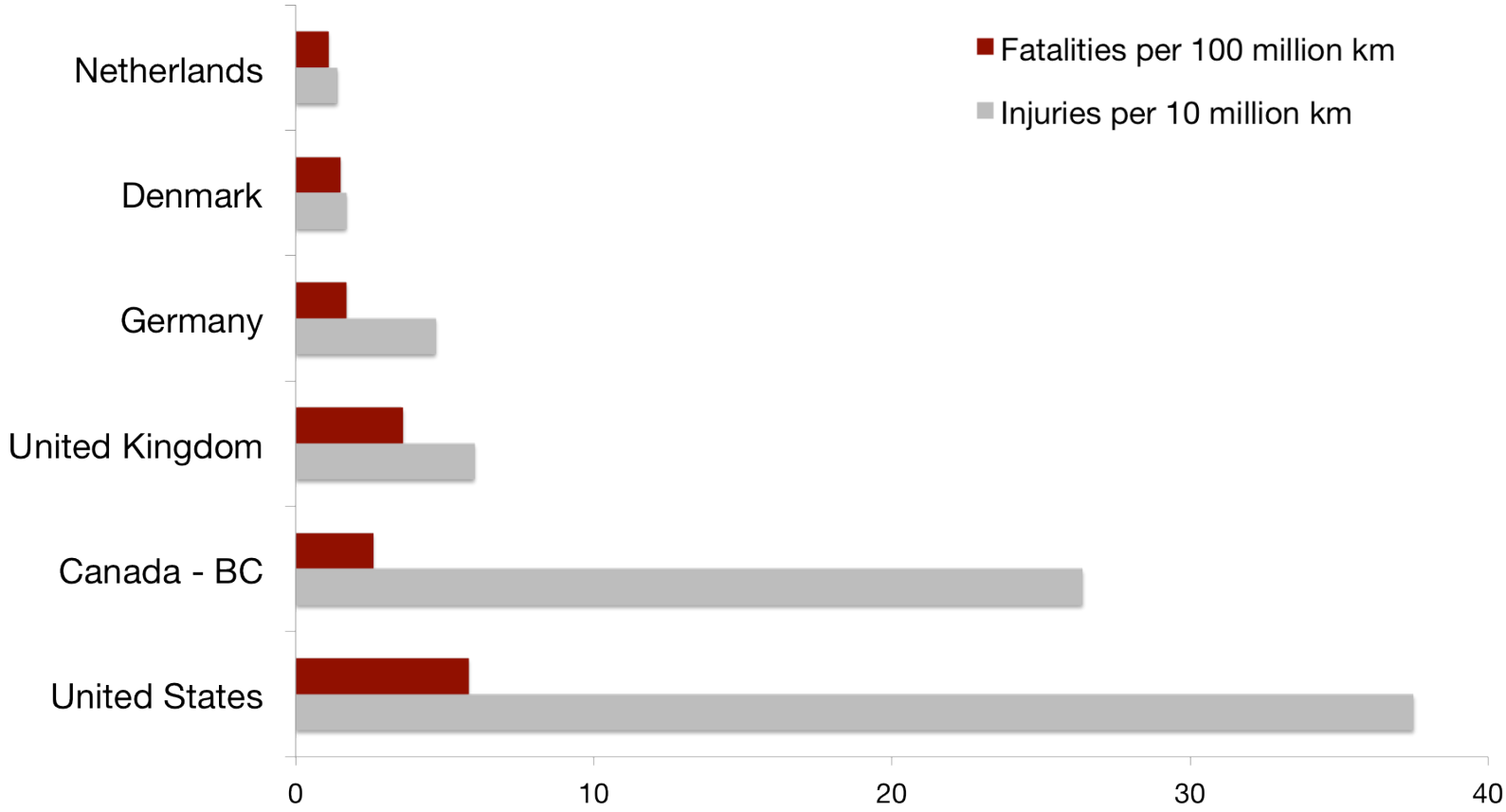
safety concerns deter cycling

Survey of 1400 cyclists & potential cyclists in Metro Vancouver, top deterrents all related to safety

- ice & snow on route
- car, bus & truck traffic
- vehicles driving faster than 50 km/h
- glass or debris on route
- motorists who don't know how to drive safely near bikes
- risk of injury from car-bike collisions

So how do we make cycling safer?

differences in cycling injury rates - Europe & NA



[data sources: International - Pucher & Buehler *Transport Reviews* 2008;28:495-528
BC - Motor Vehicle Branch, 2005 to 2007, TransLink's 2008 Trip Diary Survey, Census 2006]

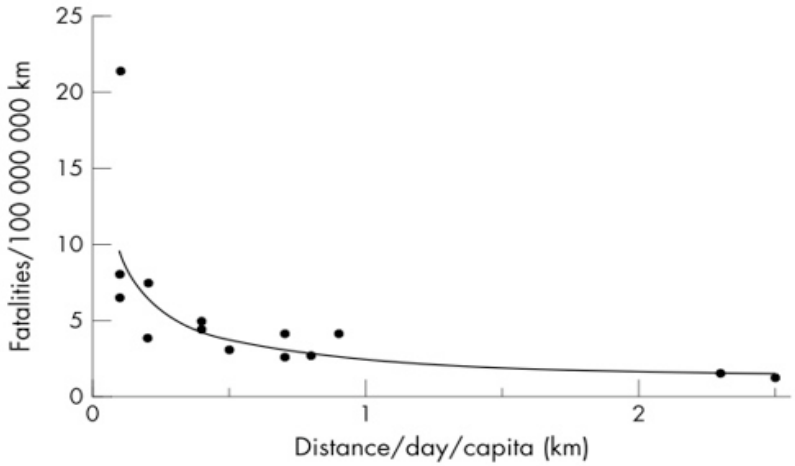
why the differences?

It’s not the Europeans who wear **helmets**

- helmets do reduce post-crash severity of head and face injuries
- but they don’t prevent crashes

why the differences?

Best evidence: **safety in numbers**



[source: Jacobsen. *Injury Prevention* 2003;9:205-9]

why the differences?

What about **route infrastructure**?

- typical in North America to provide little or no bike infrastructure
- in high cycling European countries, usually provide separated facilities where motor vehicle traffic volumes and speeds are high

North America:
John Forester

‘vehicular cycling’

Bicyclists' Injuries & the Cycling Environment

participating cities

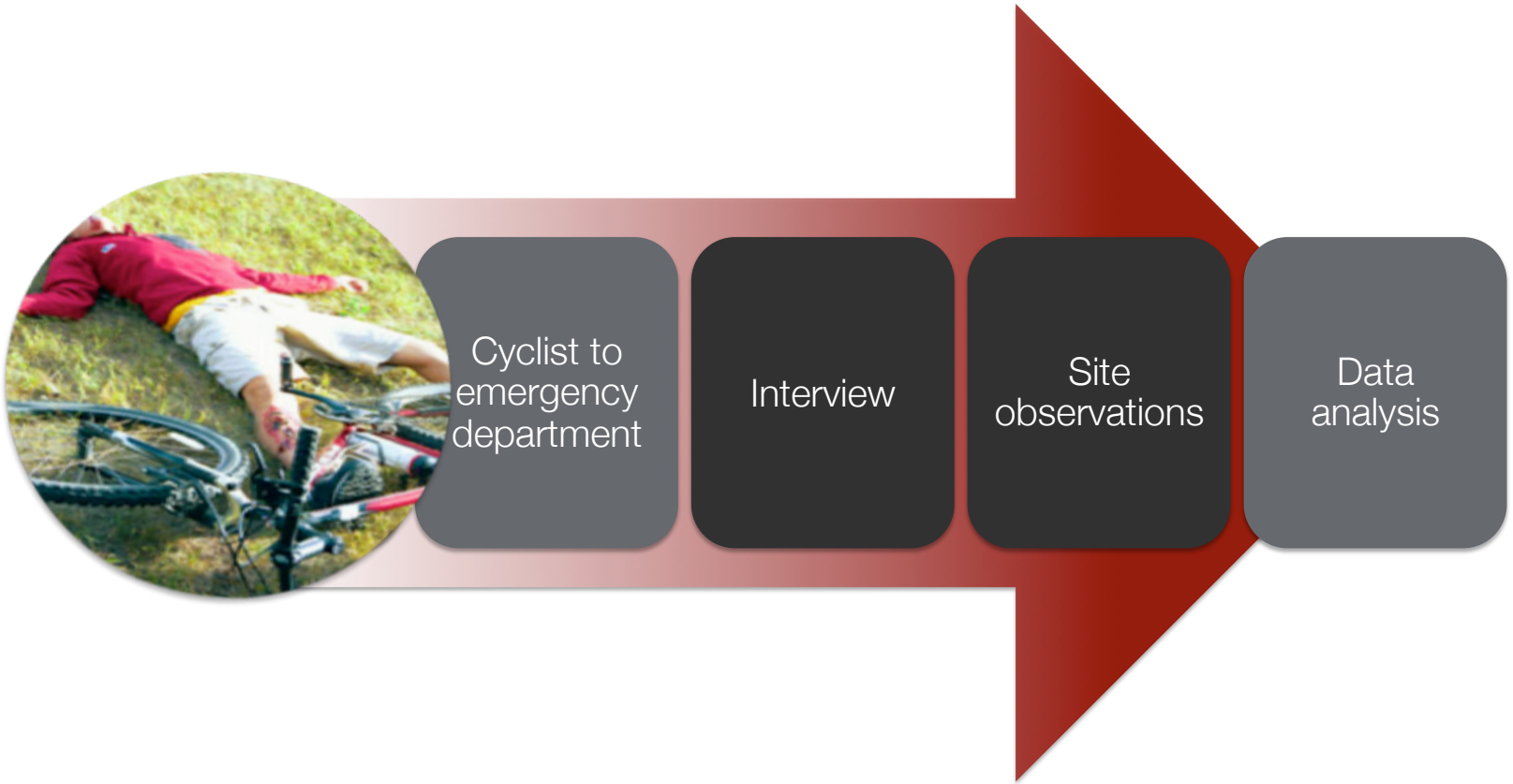
Vancouver

- 2 participating hospitals
- 0.6 million people
- rain in winter, temperate summer
- lots of hills
- 26 km of bike lanes & paths per 100,000 population
- 3.7% of trips by bike

Toronto

- 3 participating hospitals
- 2.5 million people
- snow in winter, heat in summer
- mostly flat
- 11 km of bike lanes & paths per 100,000 population
- 1.7% of trips by bike

study overview



interview to map route & choose control sites

Sequential Number: _____

Hospital: 1. St. Michael's
2. TGH
3. St. Paul's
4. VGH

Date Attended ED: ___ / ___ / _____
DD MM YYYY

Came by ambulance: 0. No
1. Yes

Admitted to Hospital: 0. No
1. Yes

CTAS: _____

INTERVIEW FORM

Thanks so much, *[name of participant]*, for agreeing to take part in this study. The interview should take about 45 minutes.

I'll ask you about the route you cycled when you were injured, including the injury site, and two other sites, randomly selected along the route.

Did you receive a copy of the consent form with our letter of introduction to the study?

*[If **no**, give a copy.]*

*[If **yes**:]* Do you have it with you?

*[If **no**, give a copy.]*

Do you have any questions about it?

If you haven't already done so, could you please read it and sign 2 of them? I'll keep one, and you keep one.

[Proceed when the consent form has been signed.]

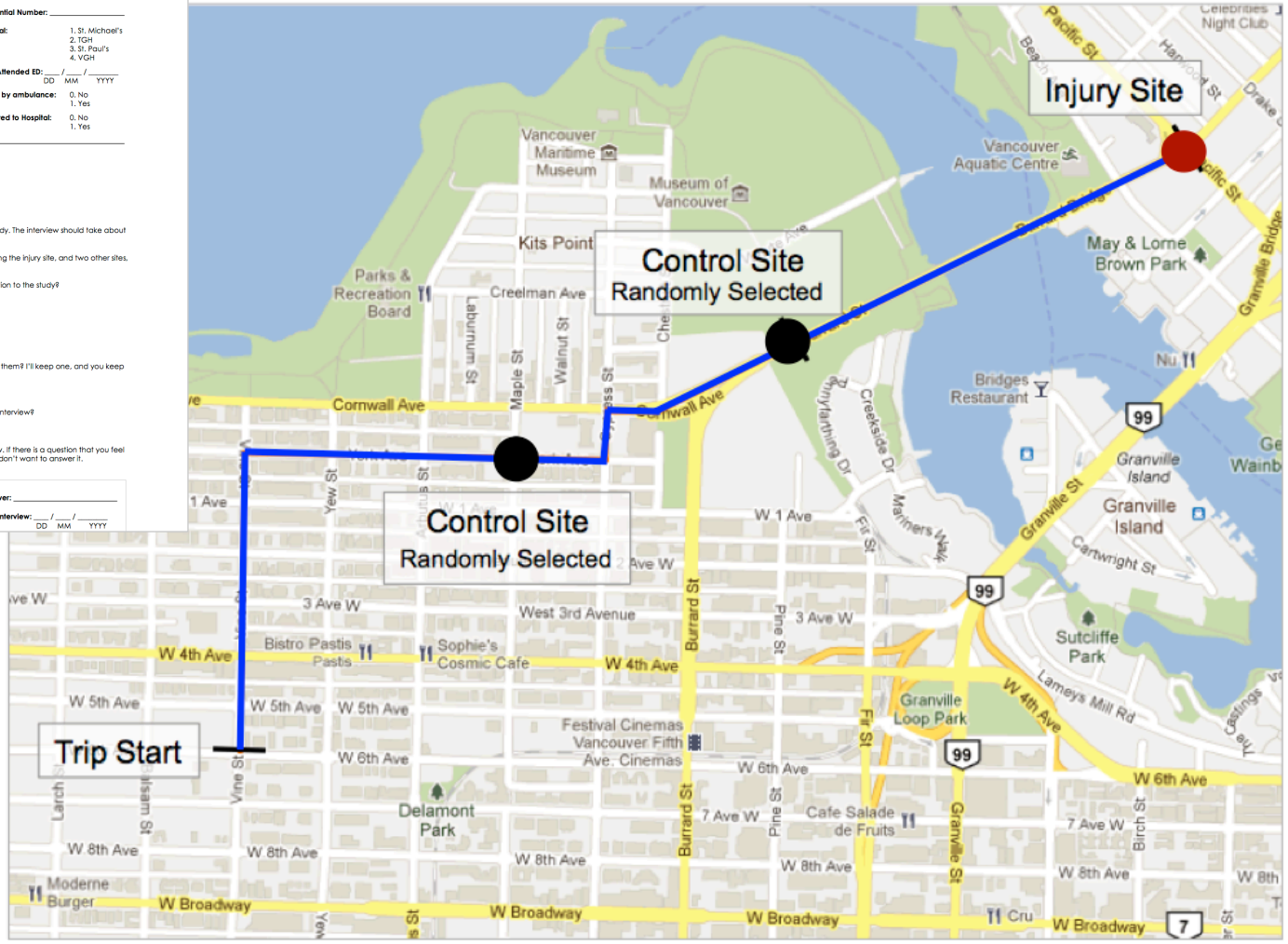
Are there any questions you'd like me to answer before we begin the interview?

[Give time to answer.]

Feel free to stop me and ask questions at any time during the interview. If there is a question that you feel uncomfortable answering, you are welcome to let me know that you don't want to answer it.

Interviewer: _____

Date of interview: ___ / ___ / _____
DD MM YYYY

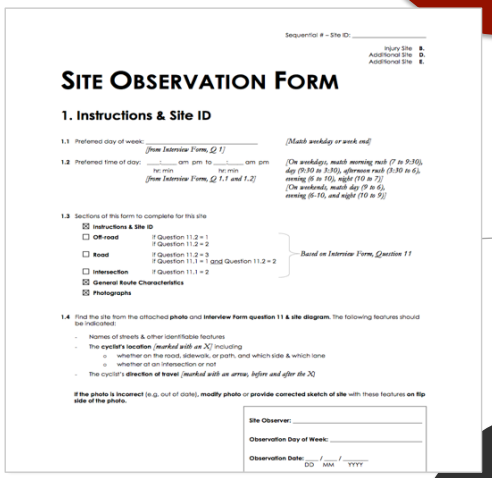


observations of injury & control sites

injury site

control site 1

control site 2



Sequential # – Site ID: _____

Injury Site **S.**
Additional Site **O.**
Additional Site **T.**

SITE OBSERVATION FORM

1. Instructions & Site ID

1.1 Preferred day of week: _____ *[From Interview Form, Q 1]* *[Match weekday or week end]*

1.2 Preferred time of day: ___:___ am pm to ___:___ am pm *[From Interview Form, Q 1.1 and 1.2]* *[On weekdays, match morning rush (7 to 9:30), day (9:30 to 3:30), afternoon rush (3:30 to 6), evening (6 to 10), night (10 to 7)] [On weekends, match day (9 to 6), evening (6-10), and night (10 to 9)]*

1.3 Sections of this form to complete for this site

- ☒ **Instructions & Site ID**
- ☐ **Off-road** — If Question 11.2 = 1 / If Question 11.2 = 2
- ☐ **Road** — If Question 11.2 = 3 / If Question 11.1 = 1 and Question 11.2 = 2
- ☐ **Intersection** — If Question 11.1 = 2

Based on Interview Form, Question 11

- ☒ **General Route Characteristics**
- ☒ **Photographs**

1.4 Find the site from the attached **photo** and **Interview Form question 11 & site diagram**. The following features should be indicated:

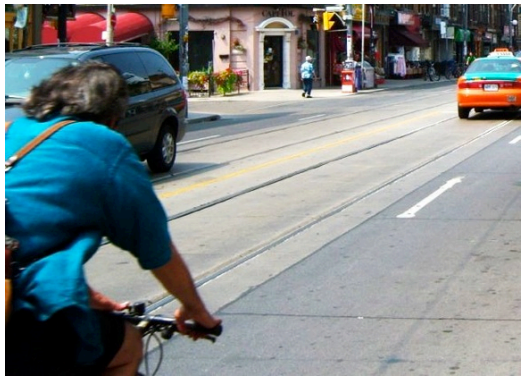
- Names of streets & other identifiable features
- The **cyclist's location** *[marked with an X]* including
  - whether on the road, sidewalk, or path, and which side & which lane
  - whether at an intersection or not
- The cyclist's **direction of travel** *[marked with an arrow, before and after the X]*

If the photo is incorrect (e.g. out of date), **modify photo** or **provide corrected sketch of site** with these features **on flip side of the photo.**

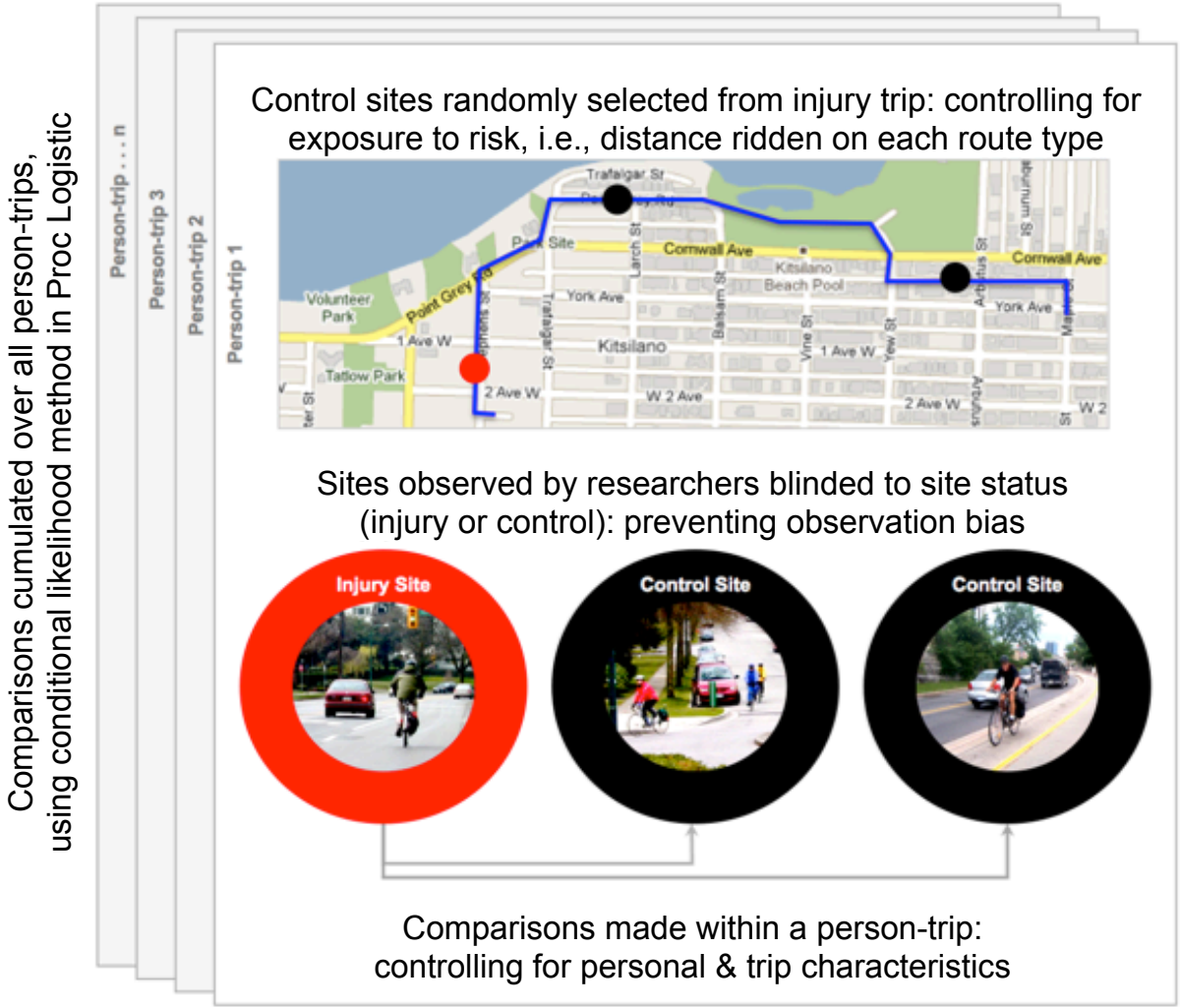
Site Observer: _____

Observation Day of Week: _____

Observation Date: ___ / ___ / _____ (DD MM YYYY)



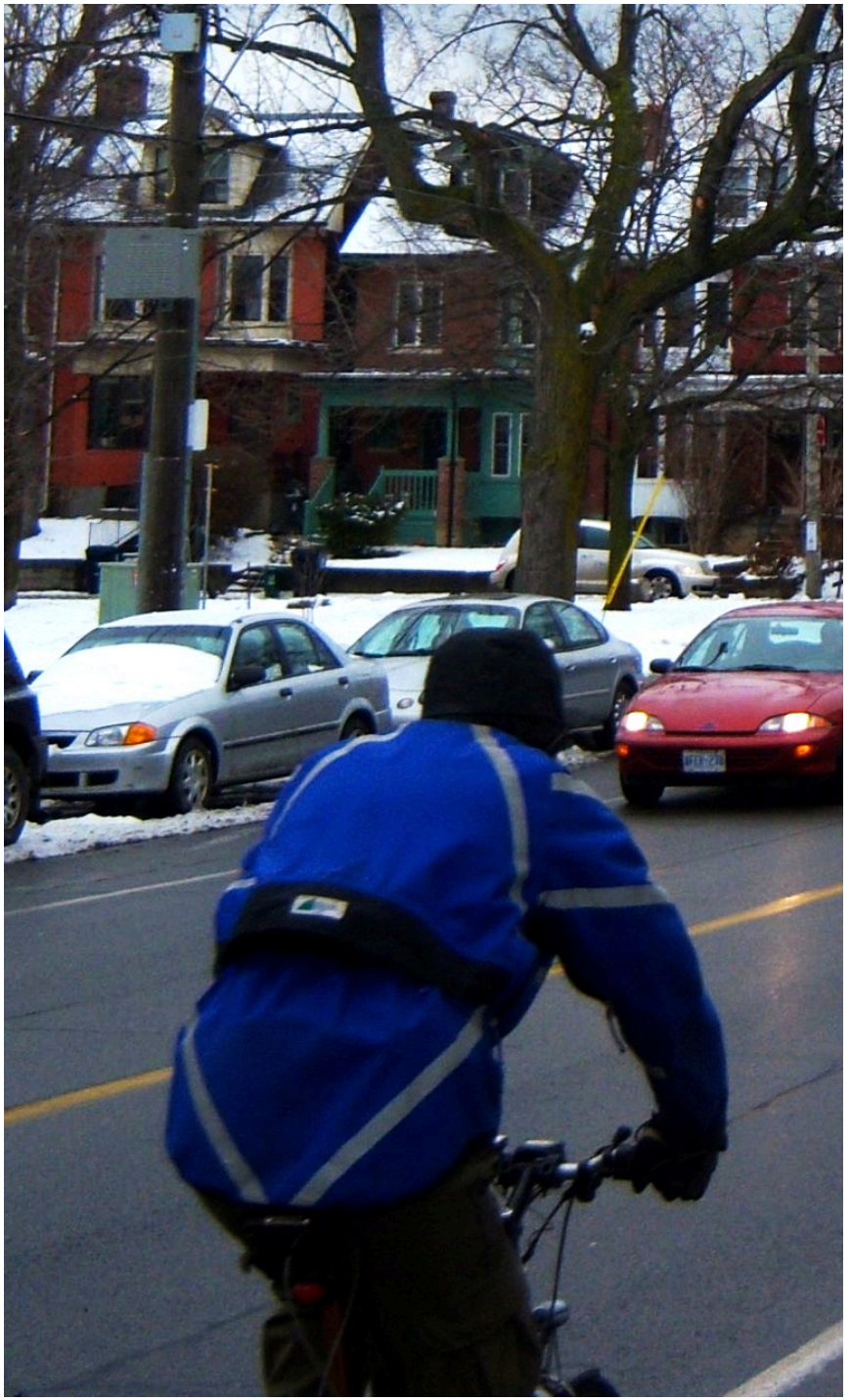
“case-crossover” design features



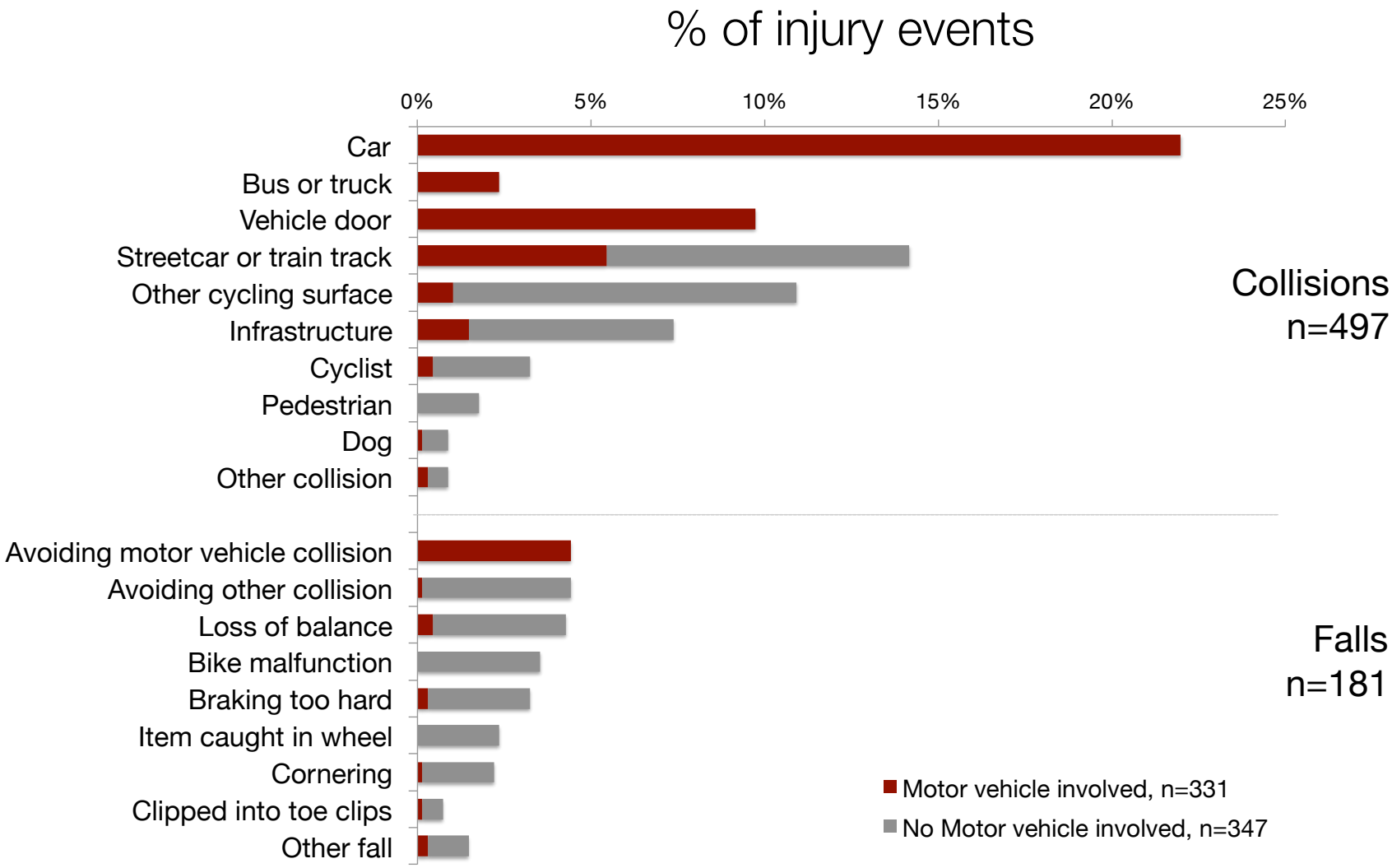
Study results

participants & trips

• Toronto	273	} 690
• Vancouver	417	
• male	59%	
• 19 to 39 years old	62%	
• income > $50,000	56%	
• cycle > 52 times/year	88%	
• wore helmet	69%	
• wore high viz clothes	33%	
• trip < 5 km	68%	
• weekday, daylight	77%	
• commute	42%	
• other transport	32%	



injury circumstances



comparison of
15 route types

main focus of study

relative risks by route type

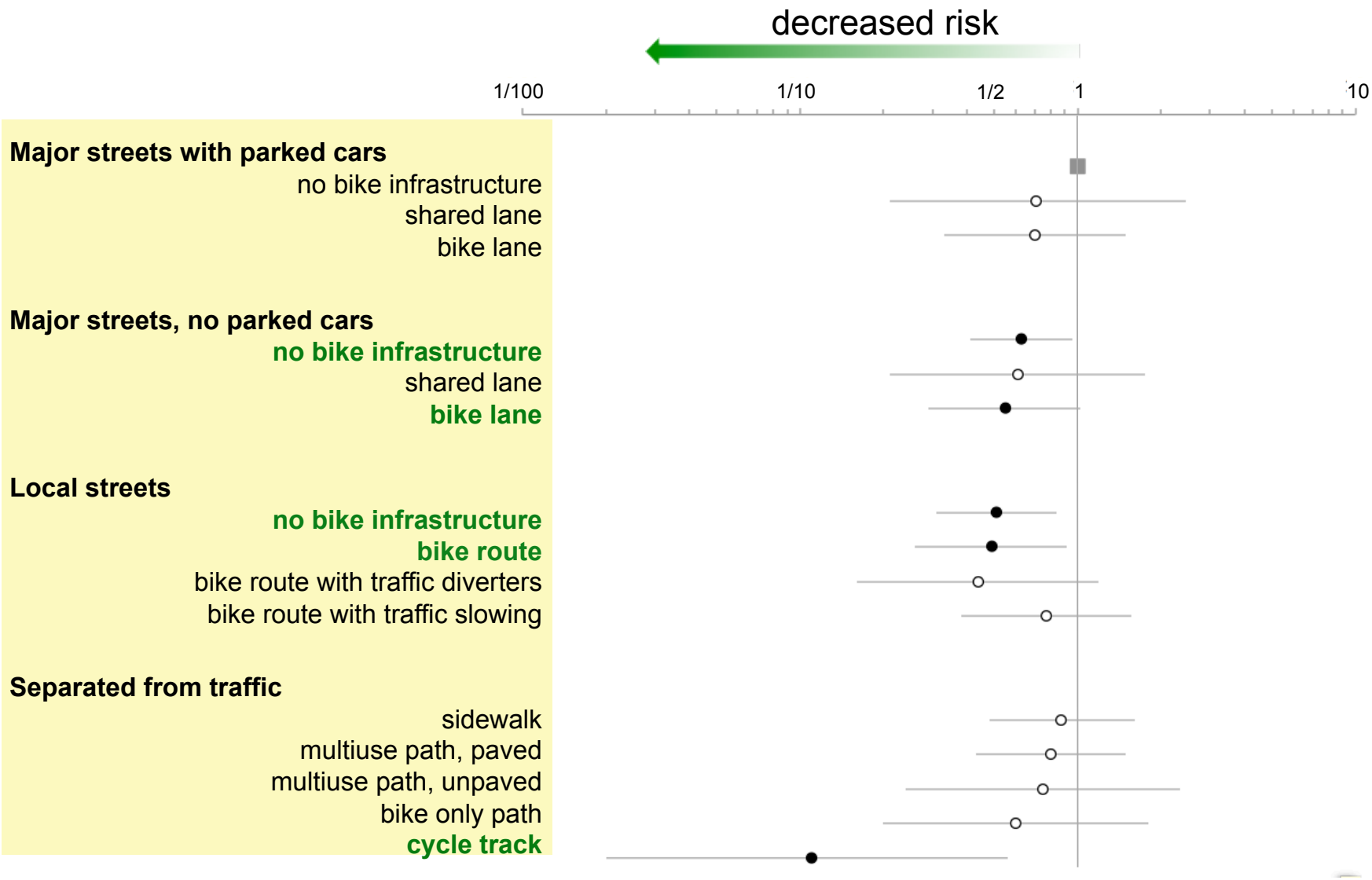
decreased risk

1/100 1/10 1/2 1 10

Major streets with parked cars

no bike infrastructure

relative risks by route type



on or alongside major streets . . .

RR = 0.70

bike lane with parked cars

RR = 0.55

bike lane without parked cars

RR = 0.11

cycle track

on residential streets . . .

RR = 0.69

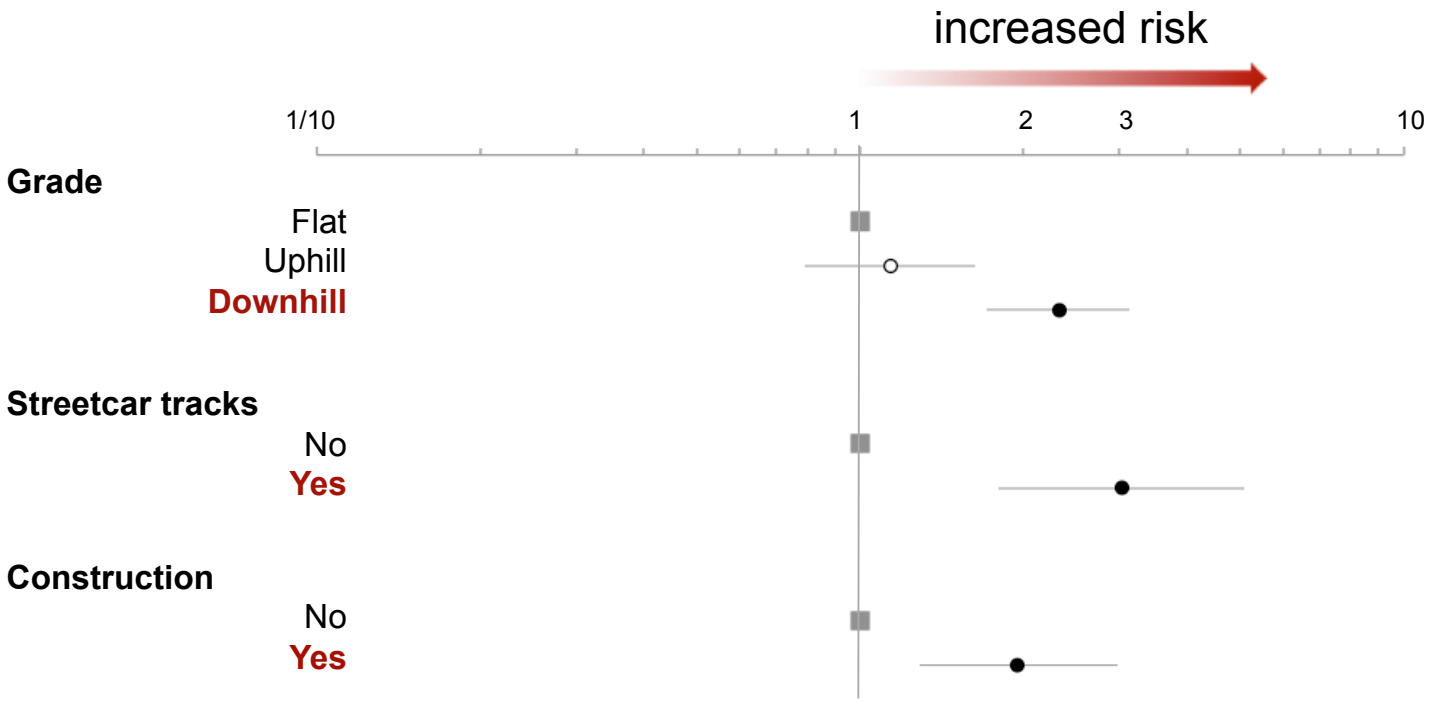
traffic slowing

RR = 0.38

traffic diversion

other features studied | these not significant

relative risks of other significant features



downhill grades . . .

a special risk in Vancouver

Sometimes compounded with difficult route features:

- limited sight lines
- traffic circles
- speed bumps

RR = 2.32

streetcar tracks . . .

a special risk in Toronto

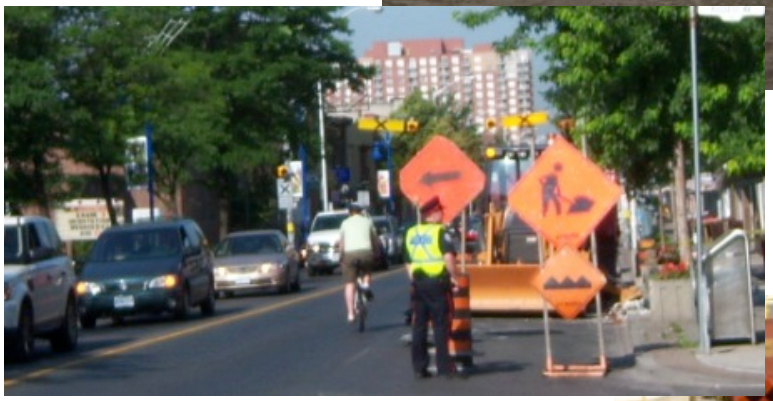
almost one-third of crashes

interactions with cars important, because many crashes begin with aviodance manouevres

RR = 3.04

construction . . .

RR = 1.95



Are safe routes also preferred routes?

cycling in cities suvey

route preferences: top 5 of 16

bike only paths
85% likely to choose

paved multi-use paths
77% likely to choose

unpaved multi-use paths
71% likely to choose

cycle tracks
71% likely to choose

local street bike routes with traffic calming
65% likely to choose

route preference vs. safety

best route types

to encourage cycling &
prevent injuries

cycle tracks
along major streets

local street
bike routes with
traffic diverters

off-street
bike only paths

[review: Reynolds et al. *Environmental Health* 2009;8:47]

limitations

Most severe and mildest injuries not included

- all injury studies focus on defined categories of injuries
- here, those who attended emergency department within 24 hours

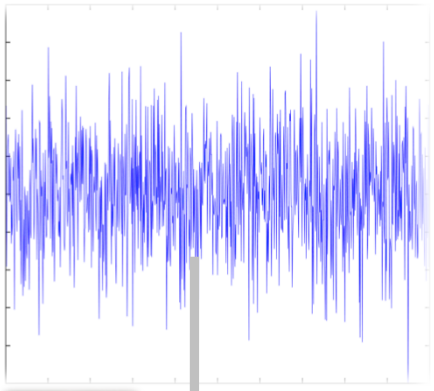
Not possible to test many route designs available in Europe:

- multiple types of cycle tracks
- innovative intersection designs

But more route designs tested than in other studies to date, all objectively measured.

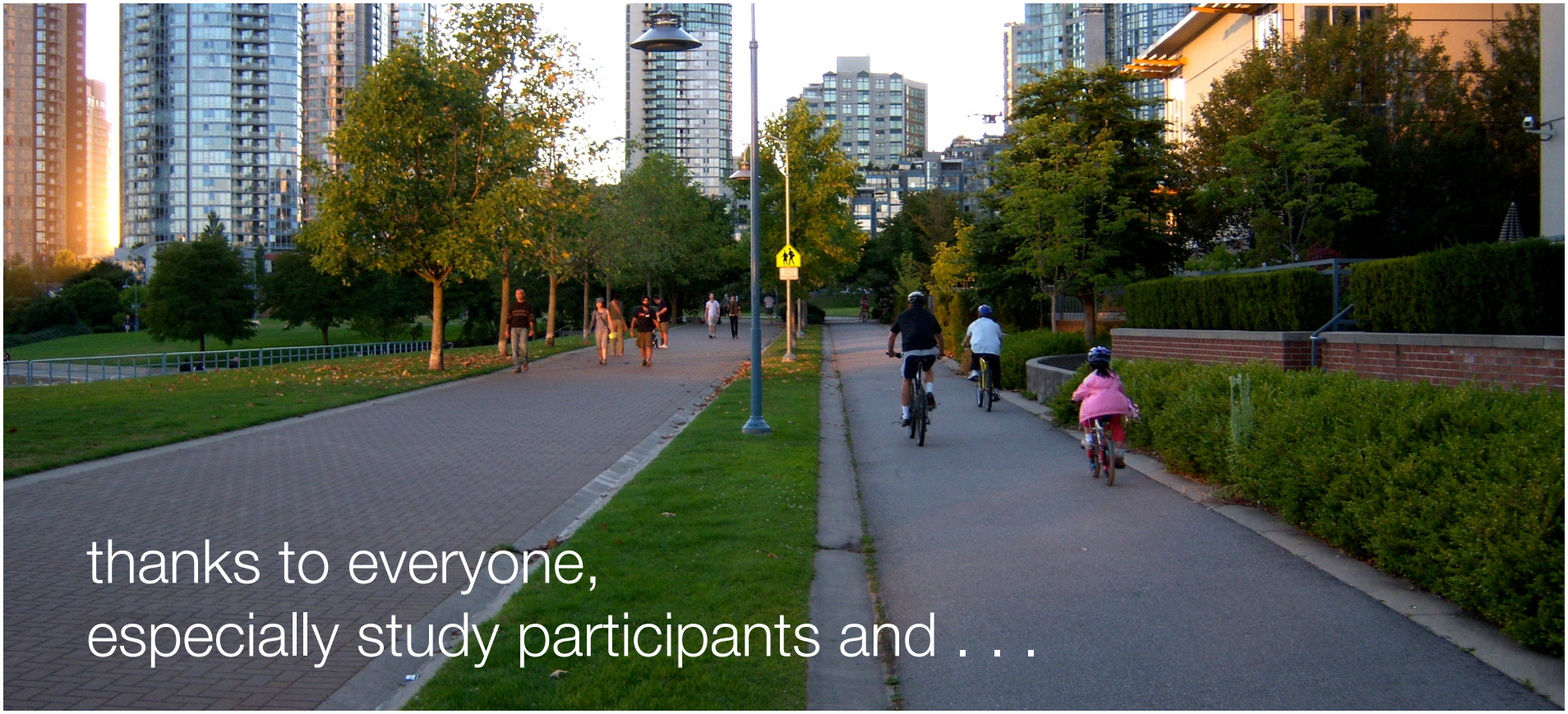
Cycling injuries vs. health

transportation & illness



risks vs. benefits of cycling

authors	location	benefits & risks taken into account	ratio of benefit : risk
British Medical Association, 1992	United Kingdom	↑ physical activity ↑ traffic crashes	20 : 1 lives saved vs. lost
Woodcock et al., 2009	London, England	↑ physical activity ↓ population air pollution ↑ traffic crashes	49 : 1 lives saved vs. lost 15 : 1 DALYs saved vs. lost
Johan de Hartog et al., 2010	Netherlands	↑ physical activity ↑ traffic crashes ↑ individual air pollution	9 : 1 lives saved vs. lost
Rojas-Rueda et al., 2011	Barcelona, Spain	↑ physical activity ↑ traffic crashes ↑ individual air pollution	96 : 1 lives saved vs. lost
Rabl & de Nazelle, 2012	Europe	↑ physical activity ↓ population air pollution ↑ traffic crashes ↑ individual air pollution	19 : 1 Euros saved vs. lost



thanks to everyone, especially study participants and . . .

Vancouver study team

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Funders

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