

# Circumstances of Injuries to Cyclists

## Resulting in Emergency Department Visits in Toronto & Vancouver

SM Friedman<sup>1</sup> JR Brubacher<sup>2</sup> D Chisholm<sup>1</sup> GS Hunte<sup>2</sup> T Frendo<sup>2</sup> M Winters<sup>2</sup> S Babul<sup>2</sup> ML Chipman<sup>1</sup> PA Crompton<sup>2</sup> MD Cusimano<sup>1</sup>  
MA Harris<sup>2</sup> M Monro<sup>2</sup> CCO Reynolds<sup>2</sup> L Vernich<sup>1</sup> K Teschke<sup>2</sup> (<sup>1</sup> University of Toronto <sup>2</sup> University of British Columbia)

### Introduction

Cycling is sustainable mode of transportation that has many individual and population health benefits: increases in physical fitness; declines in body weight; lower risks of associated diseases; and reductions in air, noise, and water pollution.

Unfortunately, the risk of injuries discourages people from cycling. In addition, injuries result in trauma and costs at both the individual and societal levels.

To identify ways to prevent injury events, we are conducting a multicentre case-crossover study focusing on "Bicyclists' Injuries and the Cycling Environment" (the BICE Study).

### Methods

Adult cyclists who lived and were injured in either Vancouver or Toronto and visited the emergency departments of Toronto General, Toronto Western, St. Michael's, Vancouver General or St. Paul's Hospitals were screened for eligibility and recruited to participate in an in-person interview about their injury trip and circumstances.

Here we report on the circumstances of the first 300 eligible injury events, 150 in each city (May to December 2008).

We summarize descriptive data about the cyclists (age, sex), the trip (purpose, prior use of drugs and alcohol, city), the injury event (crash vs. fall and sub-classifications of these, and whether a motor vehicle was involved or not) and the injury (Canadian Trauma Acuity Score (CTAS) and hospitalization).

Analytical comparisons were made using chi<sup>2</sup> (e.g., comparisons of cyclist and trip characteristics between cities) and by calculating odds ratios (e.g., comparisons of injury circumstances by cyclist and trip characteristics). Adjusted analyses were conducted using multiple logistic regression, with two models, one for each of the following dependent variables: 1) crash vs. fall, and 2) motor vehicle involved vs. not.

### Results

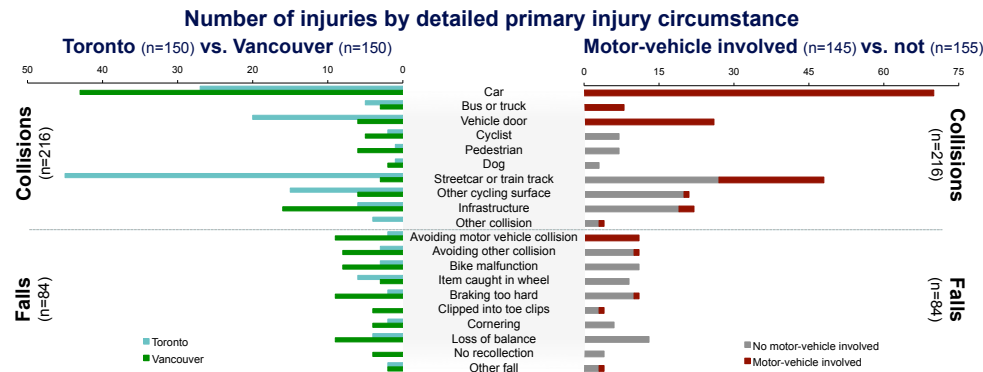
The median CTAS was 3 (inter-quartile range: 3-4). Of the 300 cyclists studied, 27 (9.0%; 95% Confidence Interval: 5.8-12.2%) had injuries severe enough that they were admitted to hospital.

Injury circumstances were broadly classified as

- collisions (216 cases; 72%; 95% CI: 66.9-77.1%) or falls (84 cases; 28%; 95% CI: 22.9-33.1%) and
- involving motor-vehicles (145 cases; 48%; 95% CI: 42.4-53.7%) or not (155 cases; 52%; 95% CI: 45.3-56.7%).

There were no differences in CTAS or hospital admissions by either of the broad classifications of injury circumstances ( $p > 0.10$ ).

In comparisons between cities, the age and sex distributions of injured cyclists did not differ significantly, nor did their use of drugs or medications. The Toronto hospitals served the downtown core, and more of the injury trips were during commutes to work or school than in Vancouver, where the hospitals served recreational and commuting routes ( $p < 0.05$ ).



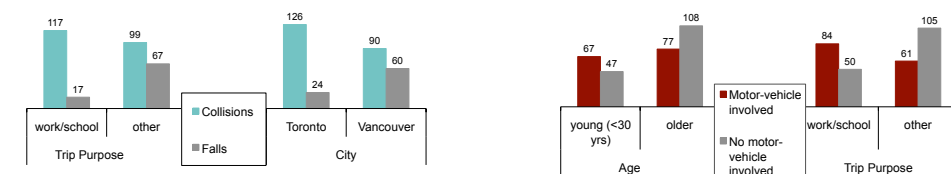
### Crude associations between injury circumstances and characteristics of cyclists, trips, & locations

	Collision	Fall	Total	Odds Ratio collision vs. fall	95% CI Lower Upper
<b>Gender *</b>					
male	111	54	165	0.59	0.35 0.99
female	104	30	134	ref	
<b>Age *</b>					
< 30 years	89	25	114	1.67	0.97 2.86
≥ 30	126	59	185	ref	
<b>Substance use</b>					
alcohol or drugs	26	16	42	0.58	0.29 1.16
medications	21	7	28	1.08	0.44 2.66
none	178	64	242	ref	
<b>Trip Purpose *</b>					
work/school	117	17	134	4.66	2.57 8.45
other	99	67	166	ref	
<b>City *</b>					
Toronto	126	24	150	3.50	2.03 6.04
Vancouver	90	60	150	ref	

\*offered in multiple logistic regression model

	Motor vehicle involved	No motor vehicle	Total	Odds Ratio vehicle vs. not	95% CI Lower Upper
<b>Gender</b>					
male	77	88	165	0.88	0.55 1.38
female	67	67	134	ref	
<b>Age *</b>					
< 30 years	67	47	114	2.00	1.25 3.21
≥ 30	77	108	185	ref	
<b>Substance use</b>					
alcohol or drugs	15	27	42	0.56	0.28 1.10
medications	14	14	28	1.00	0.45 2.19
none	121	121	242	ref	
<b>Trip Purpose *</b>					
work/school	84	50	134	2.89	1.81 4.63
other	61	105	166	ref	
<b>City</b>					
Toronto	78	72	150	1.34	0.85 2.11
Vancouver	67	83	150	ref	

### Characteristics significantly ( $p < 0.05$ ) related to injury circumstances in logistic regression models



### Results

Differences in detailed primary injury circumstances between cities (figure upper left)

- proportions of injuries involving motor vehicles (cars, buses, trucks, dooring) were almost identical in the two cities
- odds of a collision involving vehicle door were higher in Toronto (OR: 2.83; 95% CI: 1.13-7.02)
- odds of a collision involving streetcar tracks were higher in Toronto (OR: 19.6; 5.9-65.0)
- odds of a collision involving pedestrians or cyclists were lower in Toronto (OR: 0.33; 95% CI: 0.13-0.83)

Motor vehicle involvement and detailed primary injury circumstances (figure upper right)

Motor vehicles were involved in many injury events beyond direct crashes. For example, nearly half of crashes involving streetcar tracks involved maneuvers to avoid double-parked cars or cars moving in or out of parking spots.

Crude analyses of injury circumstances (tables)

Injured cyclists who used drugs or alcohol prior to their trip more commonly had falls not involving motor vehicles, but these associations were not statistically significant. All other variables (age, sex, trip purpose, city) were significant in at least one analysis and were offered to the relevant logistic regression model.

Multiple logistic regression models

Comparing the odds of a crash being a collision vs. a fall, collisions were more common

- in Toronto (OR: 2.86; 95% CI: 1.62-5.07) than Vancouver, and
- on trips to work or school (OR: 4.42; 95% CI: 2.38-8.23) than trips for other purposes.

Comparing the odds of a crash involving motor-vehicles vs. not, those involving motor vehicles were more common

- among injured cyclists less than 30 years old (OR: 2.02; 95% CI: 1.24-3.30) than those who were older, and
- on trips to work or school (OR: 2.88; 95% CI: 1.79-4.65) than for other purposes.

### Implications & Limitations

The injury circumstances and the differences between cities suggest that transportation infrastructure and interactions with motorized and non-motorized traffic are important factors in cycling injuries, ones that could be modified for injury prevention in the future.

The current analysis did not correct for cyclists' "exposure to risk," for example, there are more streetcar tracks in Toronto than in Vancouver. Analyses of the full dataset will use the case-crossover method to compare route characteristics of injury sites to control sites. This will correct for differences in use of various types of infrastructure, to allow "risk of injury" estimates, rather than the simple "frequency of injury" estimates provided here.

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