BUILT FOR WALKING: SAFE ENVIRONMENTS FOR ACTIVE TRANSPORTATION

Ontario Road Safety Forum March 6, 2018

Andrew Howard, MD, FRCSC, MSc

Linda Rothman, BScOT, PhD

Child Health Evaluative Sciences, Hospital for Sick Children

OVERVIEW

- **Introduction**
- **Background**
- **Methodological Overview**
  - Cross Sectional Studies
  - Case Control Studies
  - Quasi – Experimental Studies (Natural Experiments)
- **Further School-Based Studies**
  - Parent Perceptions
  - Driver Behaviour
  - Vision Zero Intervention Project
- **Further City Wide Studies**
  - Social inequities and the BE
  - Child Active Transportation Safety and the Environment (CHASE)
- **Conclusions and Discussion**

WHO WE ARE

- Dr. Andrew Howard- *Senior Scientist, Orthopaedic Surgeon, Hospital for Sick Children, Toronto, ON*
- Dr. Linda Rothman – *Senior Research Associate, Epidemiologist, Hospital for Sick Children, Toronto, ON*
- Dr. Colin Macarthur-*Senior Scientist, Clinical Research, Epidemiologist, Hospital for Sick Children, Toronto, ON*
- Dr. Alison Macpherson- *Professor, Epidemiologist, York University, Toronto, ON*
- Dr. Ron Buliung- *Professor, Geographer, University of Toronto, Mississauga, ON*
- Dr. Marie Soleil Cloutier – *Professor, Geographer, Institut national de la recherche scientifique (INRS), Montreal, QC*

WHAT WE DO

- Children's injury prevention research since the late 1990s
  - Playground
  - Hockey
  - Orthopaedic injuries
  - Motor vehicle occupants
  - Vulnerable road users and active transportation
- Data
  - Trauma, emergency room surveillance, hospital discharge, coroner's, police data, municipal, school board, census, surveys, City of Toronto

COLLABORATORS, PARTNERS, KNOWLEDGE USERS, STAKEHOLDERS

- Universities
- Hospitals
- Municipalities (Public Health, Policy, Transportation)
- Provincial government (Transportation, Metrolinx),
- School boards
- Coroners
- Parachute
- Green Communities Canada
- Toronto Police Services
- CAA

Preventive Medicine 60 (2014) 10–15

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Influence of social and built environment features on children walking to school: An observational study☆

Linda Rothman [a,b,*], Teresa To [a], Ron Buliung [c], Colin Macarthur [a], Andrew Howard [a]

ARTICLE

Motor Vehicle-Pedestrian Collisions and Walking to School: The Role of the Built Environment

PEDIATRICS Volume 133, Number 5, May 2014

AUTHORS: Linda Rothman, BScOT, MHSC, PhD,[a,b] Colin Macarthur, MBChB, PhD,[a,c,d] Teresa To, PhD,[a,b,d,e] Ron Buliung, PhD,[f] and Andrew Howard, MD, MSC, FRCSC[a,d,g,h]

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Sarah A. Richmond [a,*], Linda Rothman [a,c,1], Ron Buliung [d], Naomi Schwartz [a,b,2], Kristian Larsen [d], Andrew Howard [a,e,f,g,3]

Rothman et al. BMC Public Health (2015) 15:774
DOI 10.1186/s12889-015-2116-4

BMC Public Health

RESEARCH ARTICLE Open Access

Installation of speed humps and pedestrian-motor vehicle collisions in Toronto, Canada: a quasi-experimental study

Linda Rothman[1,2*], Alison Macpherson[2], Ron Buliung[3], Colin Macarthur[4], Teresa To[1], Kristian Larsen[1,3] and Andrew Howard[5]

Journal of Transport & Health

Volume 3, Issue 4, December 2016, Pages 523-528

Examining the impact of cycle lanes on cyclist-motor vehicle collisions in the city of Toronto

Deepit Bhatia [a, c], Sarah A. Richmond [a], C.K. Jennifer Loo [c], Linda Rothman [b], Colin Macarthur [d], Andrew Howard [a]

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RESEARCH ARTICLE Open Access

Do school crossing guards make crossing roads safer? A quasi-experimental study of pedestrian-motor vehicle collisions in Toronto, Canada

Linda Rothman[1,3*], Daniel Perry[2,4], Ron Buliung[5], Colin Macarthur[1,6,8], Teresa To[1,8,9], Alison Macpherson[1,2,7,8], Kristian Larsen[1,3] and Andrew Howard[1,2,7,8]

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[b] Child Health Evaluative Sciences, The Hospital for Sick Children, 555 University Ave., Toronto M5G 1X8, Canada
[c] Department of Geography, University of Toronto Mississauga, 3359 Mississauga Road, SB3104, Mississauga, ON L5L 1C6, Canada

Traffic Injury Prevention

ISSN: 1538-9588 (Print) 1538-957X (Online) Journal homepage: http://www.tandfonline.com/loi/gcpi20

Dangerous student car drop-off behaviours and child pedestrian-motor vehicle collisions: an observational study

Linda Rothman MHSCPhD , Andrew Howard MSCFRCSC , Ron Buliung PhD, Colin Macarthur MBChBPhD & Alison Macpherson PhD

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Injury Prevention

An international peer-reviewed journal for health professionals and others in injury prevention

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Home > Volume 20, Issue 3 > Article

Inj Prev 2014;**20**:155-158 doi:10.1136/injuryprev-2012-040717

Original article

The impact of pedestrian countdown signals on pedestrian-motor vehicle collisions: a reanalysis of data from a quasi-experimental study

OPEN ACCESS

Sarah A Richmond[1], Andrew R Willan[1,2], Linda Rothman[1], Andi Camden[1], Ron Buliung[3], Colin Macarthur[1,4], Andrew Howard[1,5,6,7]

Travel Behaviour and Society

journal homepage: www.elsevier.com/locate/tbs

The school environment and student car drop-off at elementary schools

Linda Rothman [a,b,*], Ron Buliung [c], Andrew Howard [b,d], Colin Macarthur [b], Alison Macpherson [a]

thestar.com

GTA

News / GTA

Kids' rates of walking to school not linked to crashes: study

The proportion of kids who walk to school is not linked to the number of crashes in a neighbourhood. Instead the "built environment" is responsible, a new study shows.

Walking the walk: How cities can make it safe for kids en route to school

ADRIANA BARTON
The Globe and Mail
Published Tuesday, Apr. 08 2014, 3:10 PM EDT
Last updated Tuesday, Apr. 08 2014, 11:57 PM EDT

thestar.com

St. Clair streetcar line has made pedestrians safer: study

Hospital for Sick Children research concludes that pedestrian-vehicle collisions were reduced by half after the separated streetcar line was built.

660News ALL NEWS RADIO

Ad

A child crossing the street at a crosswalk

THINKSTOCK PHOTO

Study recommends kids walk to school

News Staff *Apr 7, 2014 06:47:09 AM*

As more cities embrace countdown signals at intersections, Toronto study casts doubt on their safety

CityNews LOCAL VIDEO NEWS TIPS

School drop-offs more dangerous than parents think: study

BY NEWS STAFF
POSTED JAN 21, 2016 10:31 AM EST

LIFE

thestar.com

News / GTA

Toronto countdown crosswalks have led to increase in pedestrian collisions, study finds

A fresh look at old data finds a 26 per cent rise in people being struck in intersections. But timing tweaks could change that.

Driving your kids to school puts other children at risk, new study finds

Dangerous driving a problem at over 100 Toronto-area elementary schools

CBC News Posted: Jan 21, 2016 4:54 PM ET | Last Updated: Jan 21, 2016 4:54 PM ET

Using police data, researchers at the University of Toronto, York University and Sick Kids Hospital found that 411 children were involved in vehicle collisions near 118 elementary schools over a 12-year period from 2000-2011. (Flickr)

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Parents' dangerous driving at drop-off areas puts students at risk, study finds

Study finds increased chance of injury in and around schools in the morning rush as drivers break all the rules.

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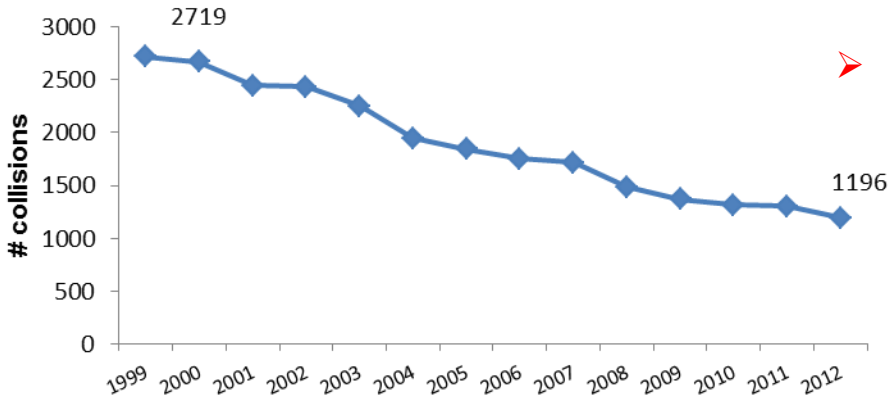
MELISSA RENWICK / TORONTO STAR Order this photo

Safety of walking to school for children related to features of the environment

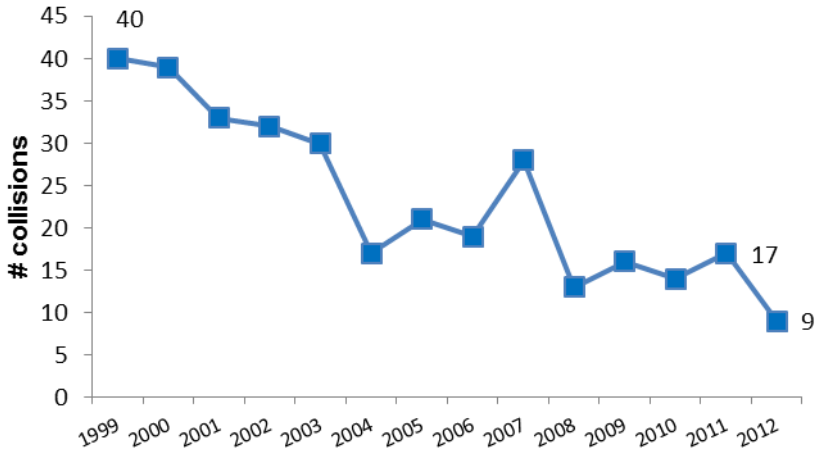
April 7, 2014 / *Author:* Tara Haelle / *Reviewed by:* Robert Carlson, M.D Beth Bolt, RPh

National Pedestrian Collisions Resulting In Any Injury (0-14)[1]



- 44% reduction

National Pedestrian Fatalities (0-14)[1]



- 57% reduction

[1]Transport Canada, Canadian Motor Vehicle Traffic Collision Statistics: 2013

thestar.com

News · Deadly Streets

New numbers reveal 2016 was Toronto's deadliest year for pedestrians in at least a decade

thestar.com

News · GTA

Four pedestrians die in Scarborough within 24 hours

Safety advocate says speed limits over 50 km/h contributed to the deaths.

1,600 collisions involved pedestrians in Toronto this year, police say

36 collisions resulted in fatal injuries with many involving jay-walkers or seniors

CBC News Posted: Dec 22, 2017 2:28 PM ET | Last Updated: Dec 22, 2017 3:32 PM ET

CBC

Pedestrian deaths prompt councillor's motion to speed up street safety plan

Coun. Kristyn Wong-Tam wants to fast-track Vision Zero, a plan to prevent pedestrian deaths

pressreader

Pedestrian deaths plague Toronto

Mayor Tory joins cities across North America and in Europe in adopting Vision Zero

Annex Post 1 Nov 2017 KAREN STINTZ

THE GLOBE AND Fatal crossings: Where and how pedestrians die in Toronto

FATAL CROSSINGS

The number of pedestrian deaths in Toronto has leapt 15 per cent over past five years – and yet public attention and political reaction continu fall short. **Oliver Moore** and **Michael Pereira** analyzed five years of d and found an increasingly urgent public safety matter

WHAT IS TRANSPORTATION HEALTH?

- Road Traffic Injury Prevention
- Health promotion through active transportation (walking, cycling, public transit)
- Same population, built environment, same denominators
- Need to be considered together

TORONTO TRAUMA PATIENTS, 2015

	All	ISS12+
Occupant	42	14
Pedestrian	30	10
Cyclist	15	7

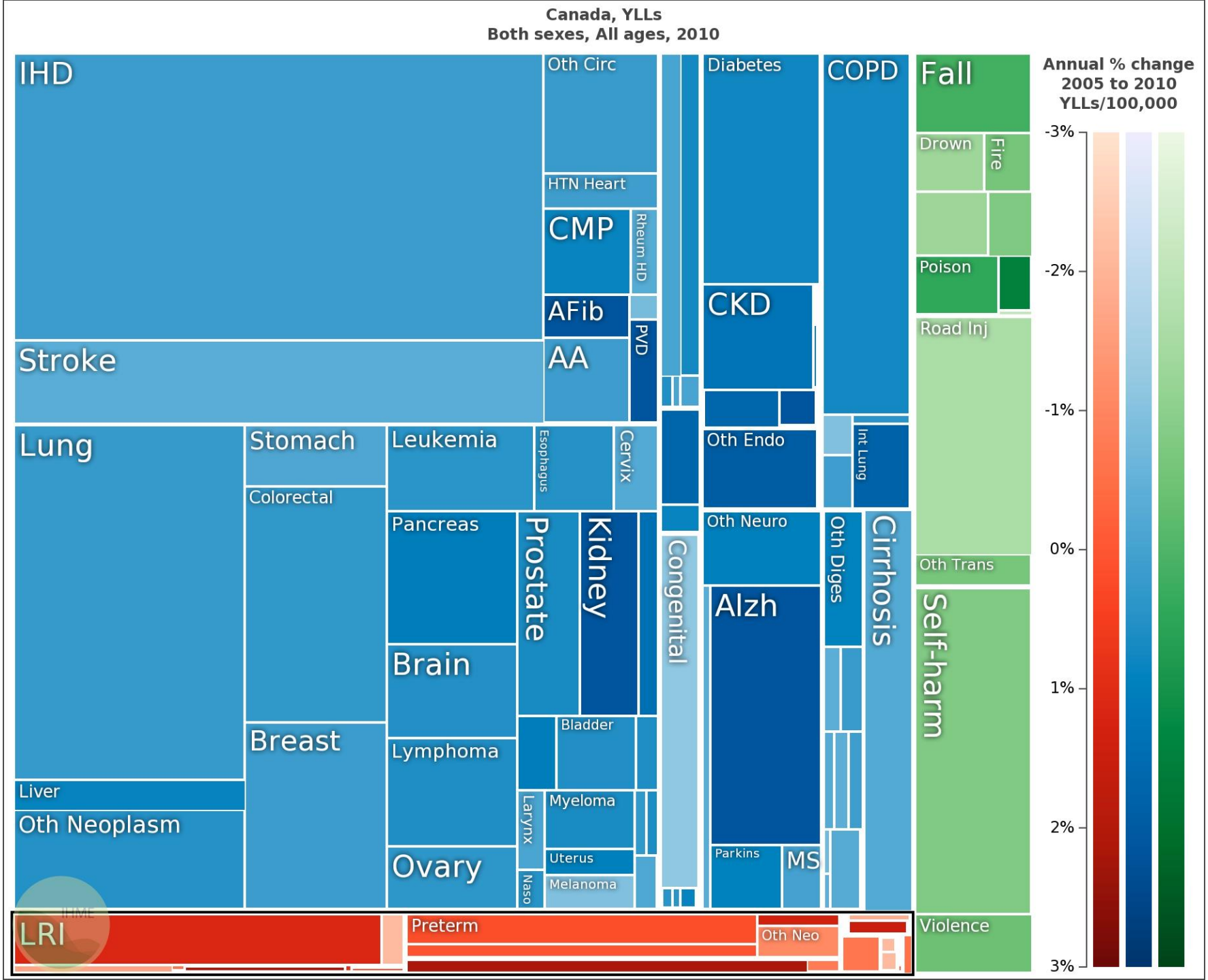
Canada, YLLs
Both sexes, 5-14 years, 2010

IHD
Stroke
Oth Circ
CMP
Drugs
Diabetes
CKD
COPD
Asthma
Oth Endo
Liver
Leukemia
Congenital
Oth Neoplasm
Brain
Kidney
Oth Neuro
Oth Diges
Epilepsy
Alzh
Hodgkin's
Lymphoma
LRI
Meningitis
Whooping
HIV
Oth Inf
Drown
Fire
Oth Unintent
Mech Force
Poison
Road Inj

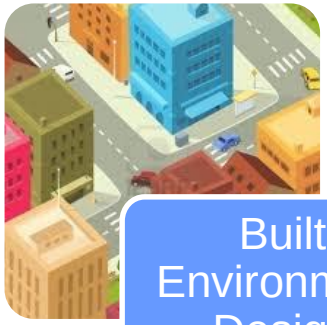
Oth Trans
Self-harm
Violence

Annual % change
2005 to 2010
YLLs/100,000

-3%
-2%
-1%
0%
1%
2%
3%


Canada, YLLs
Both sexes, All ages, 2010
IHD
Stroke
Oth Circ
HTN Heart
CMP
Rheum HD
AFib
PVD
AA
Diabetes
CKD
Oth Endo
COPD
Int Lung
Fall
Drown
Fire
Poison
Road Inj
Oth Trans
Self-harm
Violence
Annual % change
2005 to 2010
YLLs/100,000
-3%
-2%
-1%
0%
1%
2%
3%
Lung
Liver
Oth Neoplasm
Stomach
Colorectal
Breast
Leukemia
Esophagus
Cervix
Pancreas
Brain
Lymphoma
Ovary
Prostate
Kidney
Bladder
Larynx
Myeloma
Uterus
Naso
Melanoma
Congenital
Oth Neuro
Alzh
Parkins
MS
Oth Diges
Cirrhosis
LRI
Preterm
Oth Neo

Walking to School



Built Environment Design (BE)

Potential Health Benefits

Potential Risk of Pedestrian-Motor Vehicle Collisions (PMVCs)

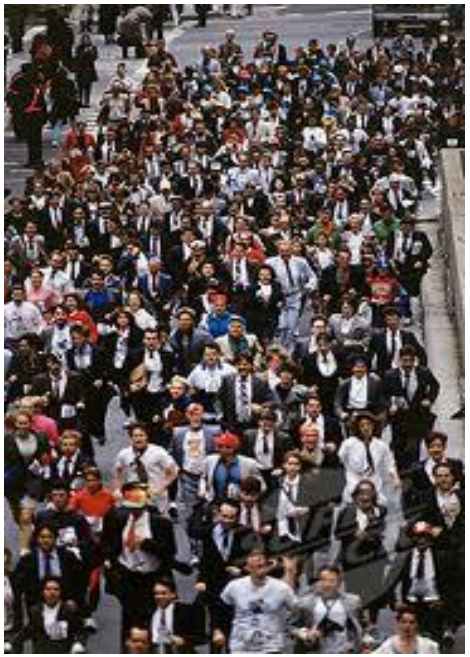
BALANCE

Haddon's Matrix - Pedestrian Injury

	Person	Equipment	Environment
Pre Event	Driver Training, Distraction, pedestrian visibility	Pedestrian warning systems	Road design, raised crosswalks, speed camera, crossing guards, signals, lighting, etc…….
Event		Bumper, hood, windshield design	
Post Event	Access to health care	Collision Notification	ATLS system

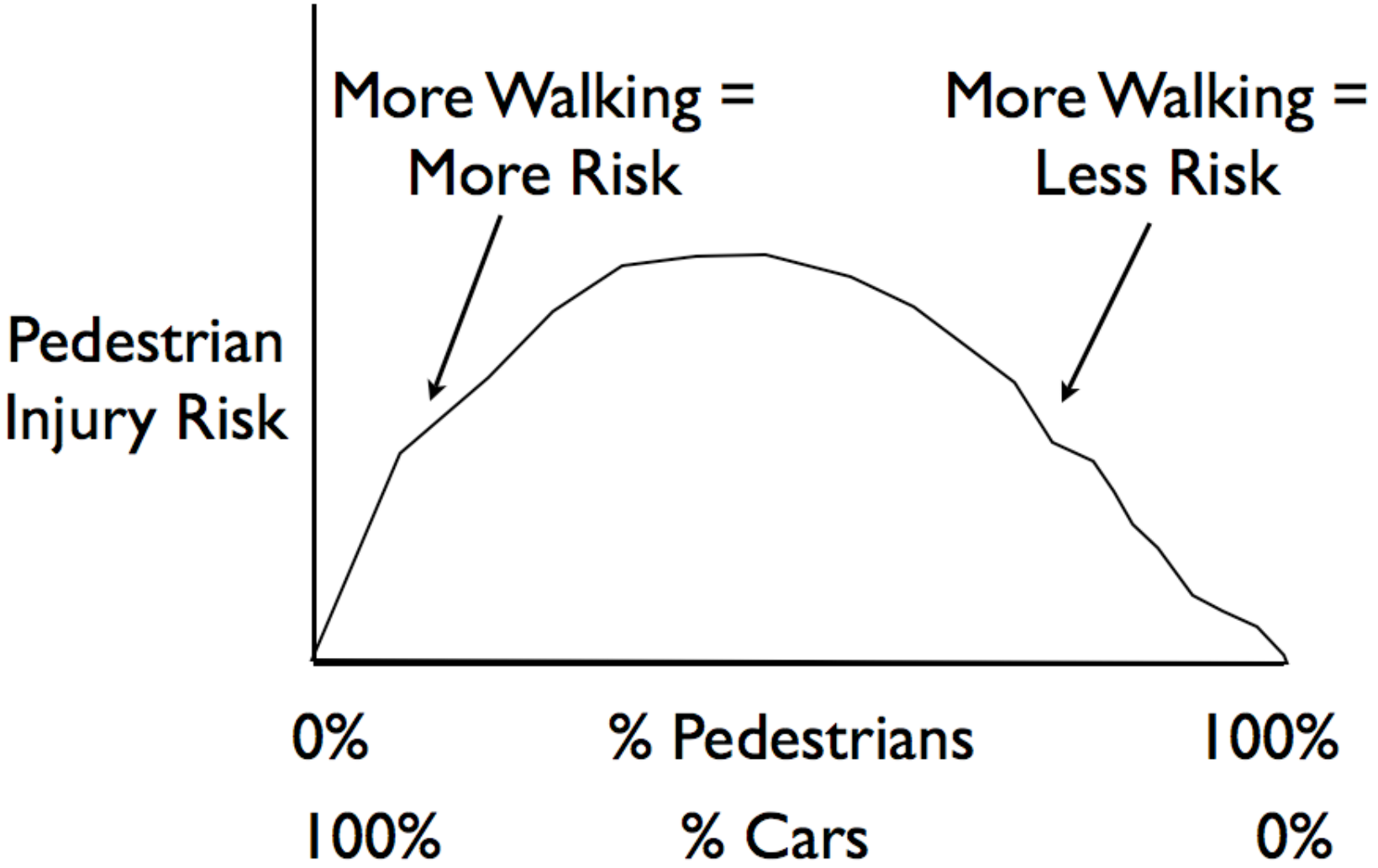
Safety in numbers?[1]

OR



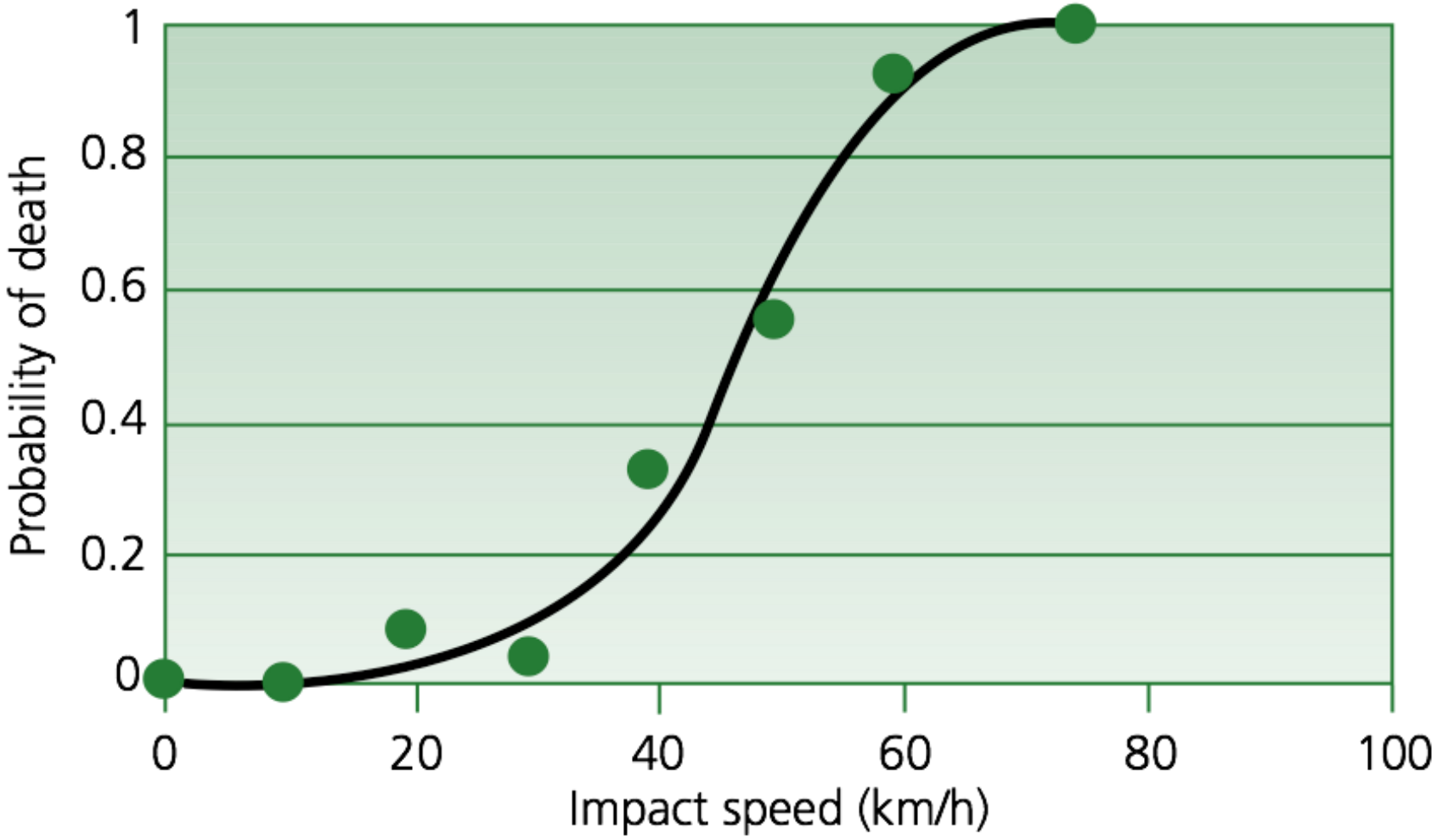
Increased walking exposure = increased risk?[2,3,4]

1 Jacobsen PL, *Inj Prev.* 2003;**9**:205-209.
2 Macpherson, A. *Am J Public Health.* 1998;**88**:1840-1843.
3 Rao, *Bull N.Y. Acad Med.* 1997;**74**:65-80.
4 Gropp *Inj Prev.* 2013;**19**:64-67



Risk of Pedestrian Injury Varies by Transport Mix

Pedestrian fatality risk as a function of the impact speed of a car



WALKING, SAFETY AND THE BUILT ENVIRONMENT

- Systematic review of built environment correlates of both walking and child pedestrian injury[1]
- Ten electronic databases,1980-Feb, 2012, urban, ages 4-12, highly motorized countries
- Associations between BE and walking or injury
- 35 child pedestrian injury, 50 walking papers

Systematic review

Walking and child pedestrian injury: a systematic review of built environment correlates of safe walking

Linda Rothman,[1,2] Ron Buliung,[3] Colin Macarthur,[1,4,5] Teresa To,[1,2,5,6] Andrew Howard[1,5,7,8]

METHODOLOGIC OVERVIEW

- Cross Sectional Studies
- Case Control Studies
- Quasi – Experimental Studies (Natural Experiments)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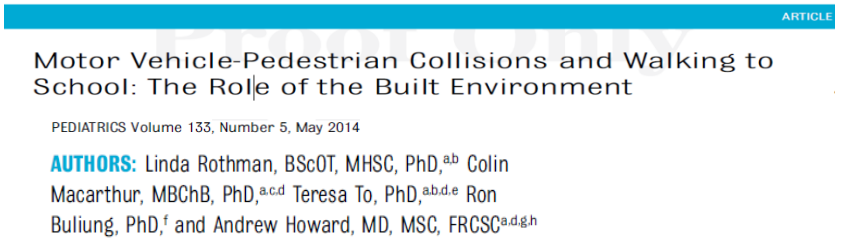

ARTICLE

Motor Vehicle-Pedestrian Collisions and Walking to School: The Role of the Built Environment

PEDIATRICS Volume 133, Number 5, May 2014

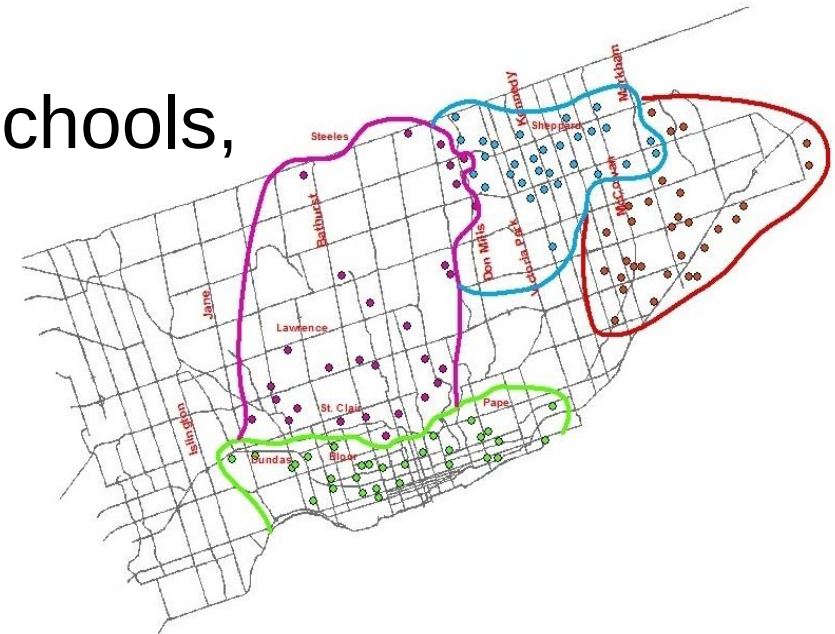
AUTHORS: Linda Rothman, BScOT, MHSC, PhD,[a,b] Colin Macarthur, MBChB, PhD,[a,c,d] Teresa To, PhD,[a,b,d,e] Ron Buliung, PhD,[f] and Andrew Howard, MD, MSC, FRCSC[a,d,g,h]

OBSERVATIONAL STUDY

- What is the relationship between increased walking to school and child PMVC?
- Can walking/injury relationship be modified through the built environment?

METHODS

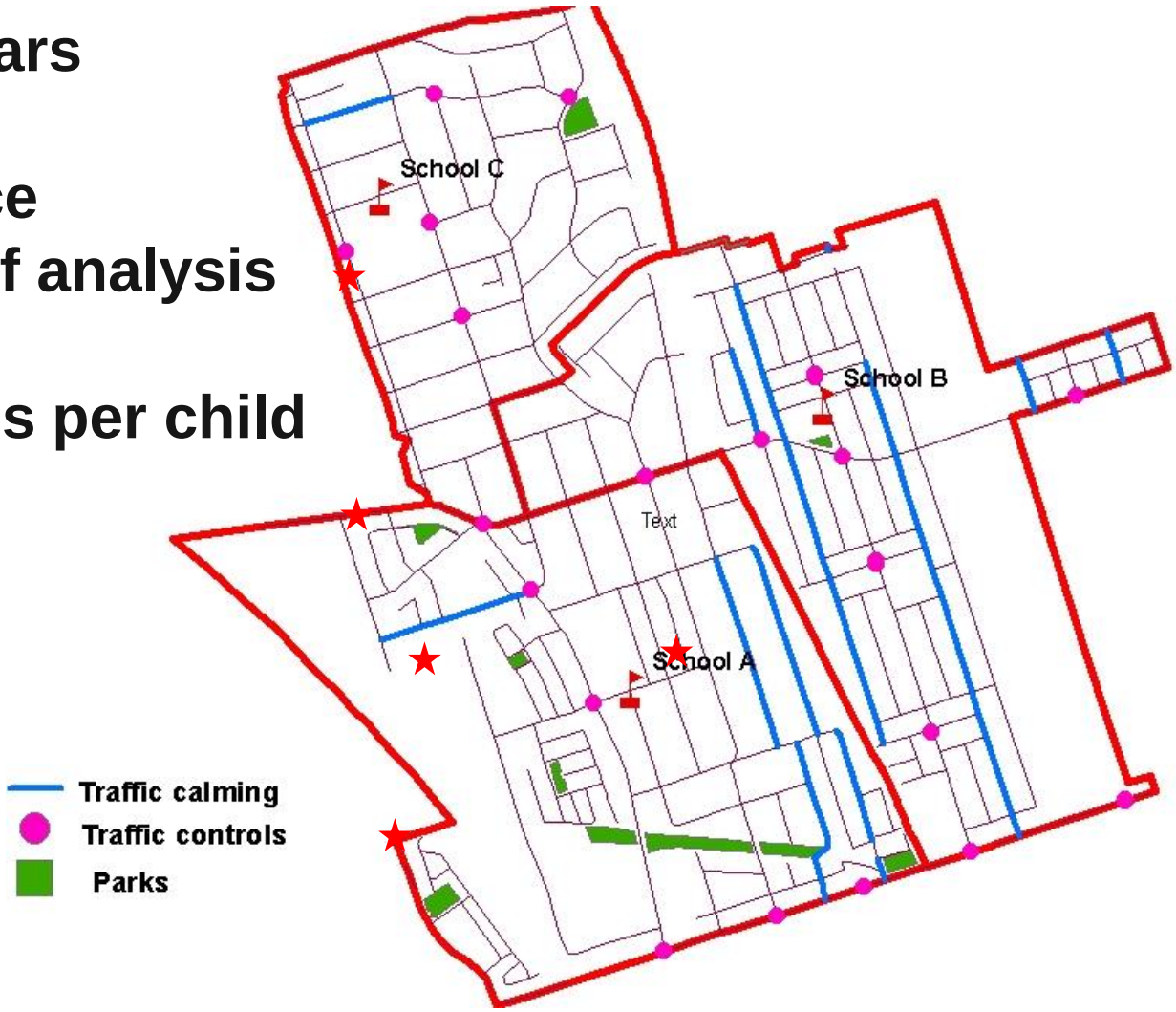
- Observational counts, Toronto
- Spring 2011, Grades JK – 6 elementary schools
- Proportion of children living within walking distance
- Total number of children counted: **23,157**
- 12 observers, 4 teams sent to different areas of the city
- Parent questionnaire in 20 schools, grades 4-6



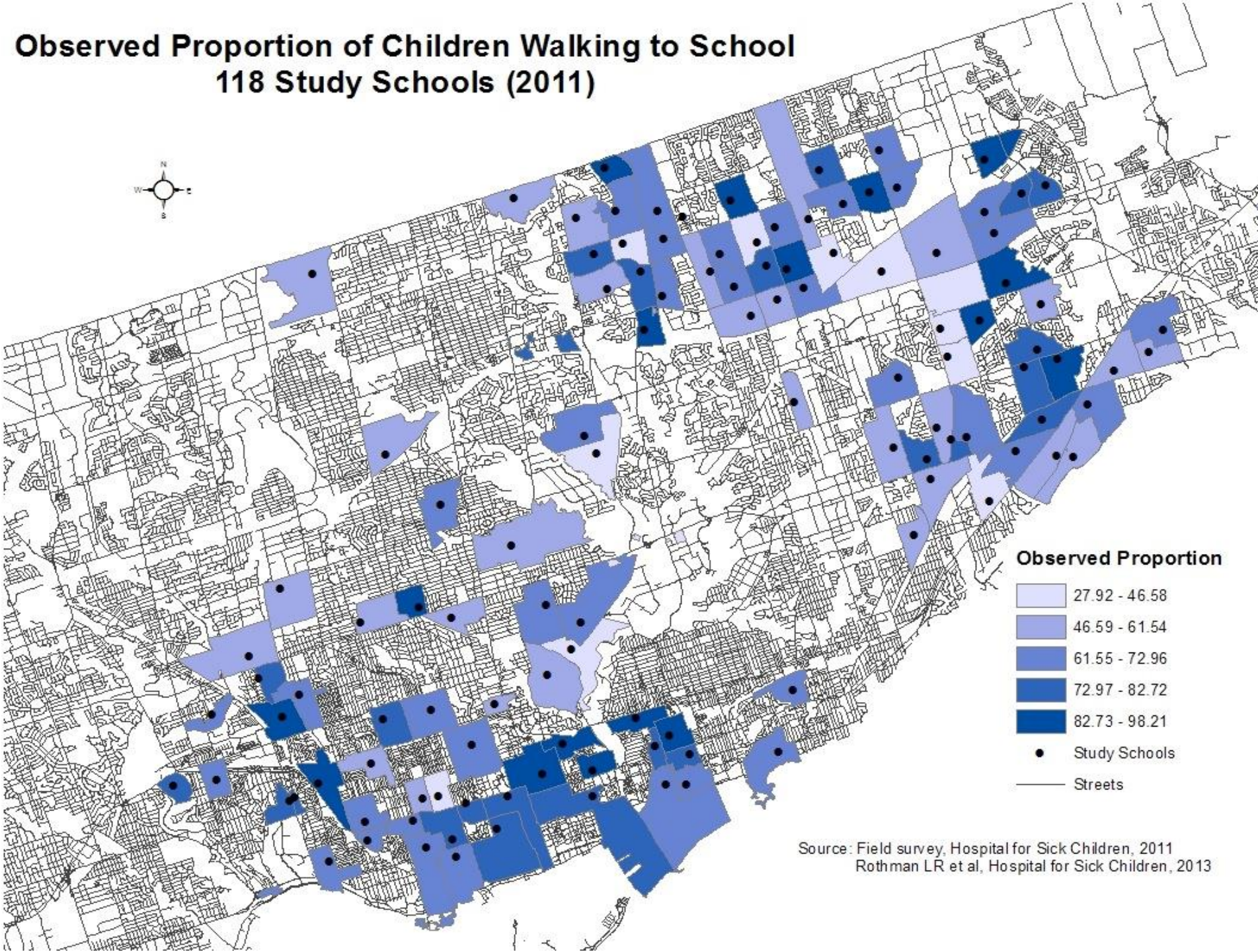
Built Environment **Density** **Census**	Child population Total population Males, 4 to 12	Multi-dwelling
Diversity **MPAC, City of Toronto**	Mixed land use (entropy) Commercial land use Industrial Institutional	Residential Vacant land Recreational Park land
Design **City of Toronto, Census**	Crossing guards Dead end Flashing lights Intersection Road Local road Collector road Major road Minor road	One way streets Old houses (pre 1946) Sidewalks missing (both, one) Traffic calming Traffic lights Trails Urban Route directness (Inter/inter+dead end) Other TDSB and Catholic schools
Field Survey	School crossing guard Mean speed> 5 km over speed limit Any dangerous crossing Double parking Cars parked blocking	Cars appear to be driving fast Traffic congestion Any dangerous intersection Dropping opposite side School vehicle volume
Social Environment **TDSB, Census**	School LOI (Social disadvantage) School population Children grades 4 - 6 at school Males at school	Below ATLICO by school DA New immigrants at school School age (years) English not first language

MAPPING

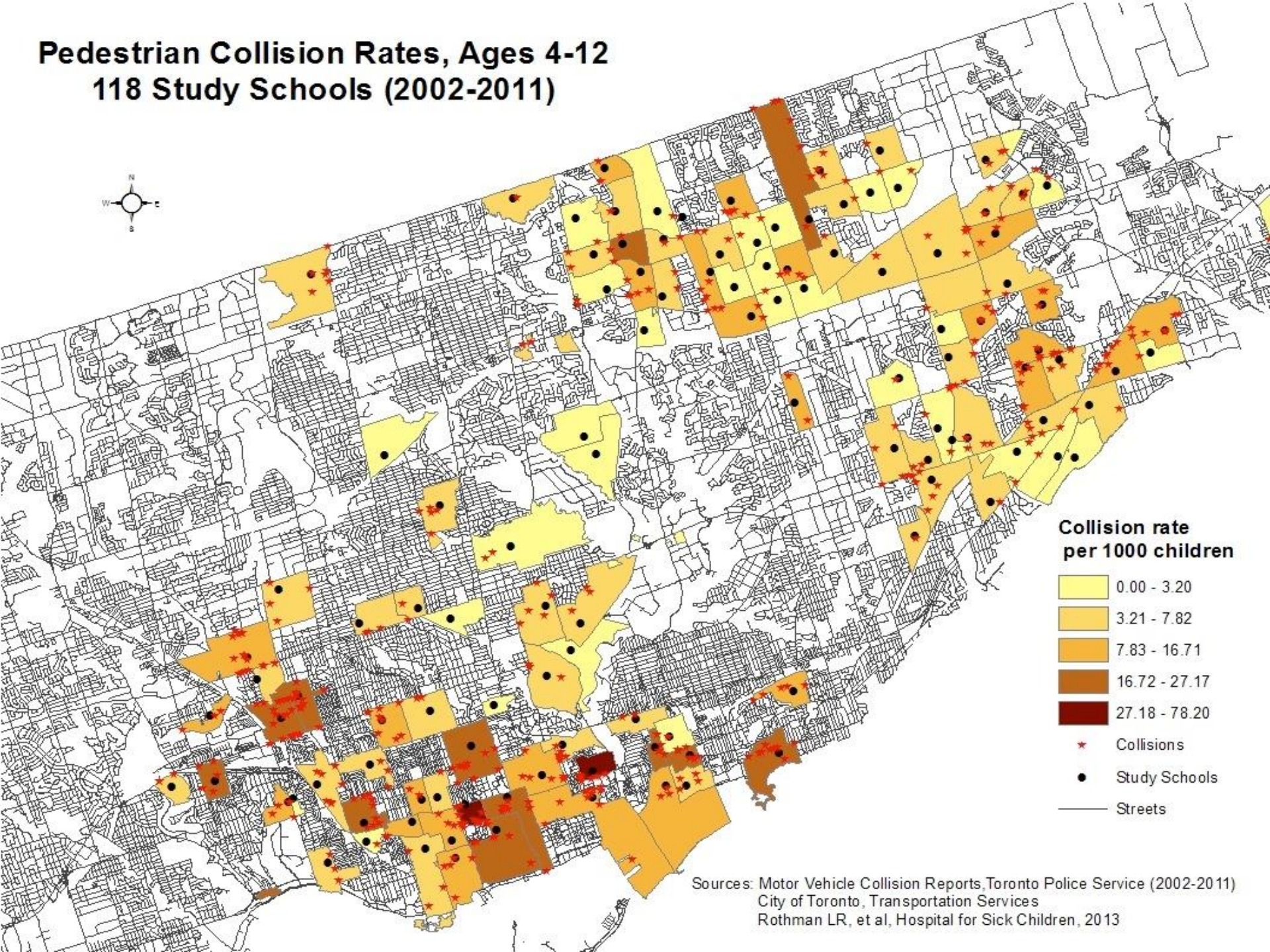
- **Police-reported child PMVCs 2002-2011, 4-12 years**
  - **School attendance boundaries: Unit of analysis**
  - **Rates of collisions per child population**



Observed Proportion of Children Walking to School
118 Study Schools (2011)



Pedestrian Collision Rates, Ages 4-12
118 Study Schools (2002-2011)



Sources: Motor Vehicle Collision Reports,Toronto Police Service (2002-2011)
City of Toronto, Transportation Services
Rothman LR, et al, Hospital for Sick Children, 2013

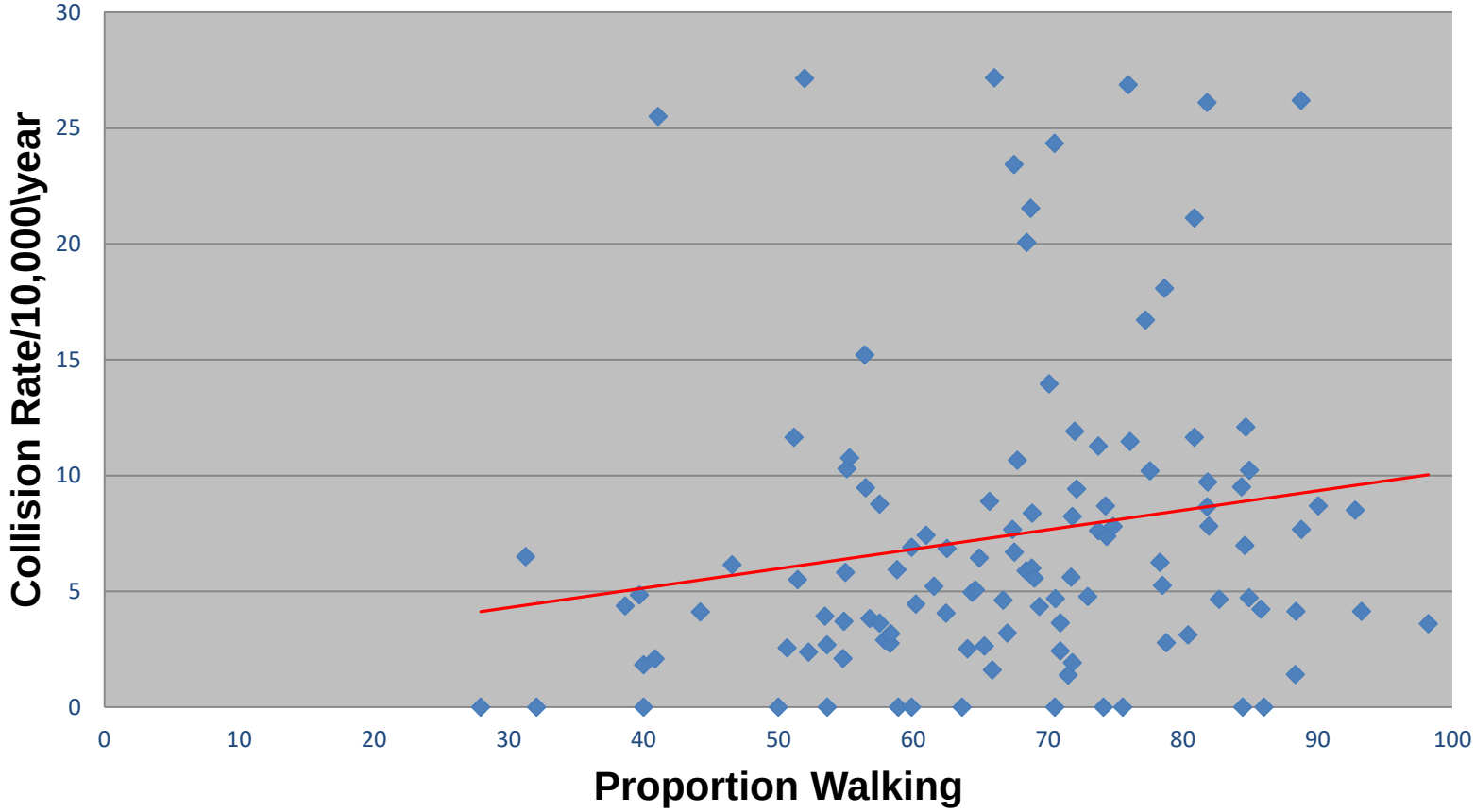
CHILD PMVC, 2002-2011 (10 years)

- 481 collisions within 105 school boundaries*
- No collisions in 13 school boundaries

• No Injury:	24 (5%)
• Minimal Injury:	191 (40%)
• Minor Injury (seen in ED):	236 (49%)
• Major Injury (admitted):	30 (6%)
• Fatality:	1 (<1%)

- 214 (44%) were school travel time collisions

COLLISION RATE AND PROPORTION WALKING TO SCHOOL



•13% increase in collision rate with every 10% increase walking

RESULTS: COLLISIONS MODELLED (NEG BINOM)

	Variable	IRR (95% CI)
Exposure	**Walking to School**	**0.84 (0.29, 2.46)**
Built Environment Density	Multi-dwelling density # /1000m^2	0.84 (0.73, 0.96)
Design	Traffic lights/km roads	3.20 (1.89, 5.41)
	One way streets/10 km roads	1.19 (1.03, 1.36)
	Traffic calming/10 km roads	1.31 (1.06, 1.63)
	School crossing guard	1.45 (1.09, 1.91)
Non-built environment	Lower school SES	2.36 (1.39, 3.99)

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[a] Faculty of Health-School of Kinesiology & Health Science York University, Norman Bethune College, 4700 Keele St., Room 337 Toronto, ON M3J 1P3, Canada
[b] Child Health Evaluative Sciences, The Hospital for Sick Children, 555 University Ave., Toronto M5G 1X8, Canada
[c] Department of Geography, University of Toronto Mississauga, 3359 Mississauga Road, SB3104, Mississauga, ON L5L 1C6, Canada

REPEAT (2015): CASE/CONTROL (Log Reg)

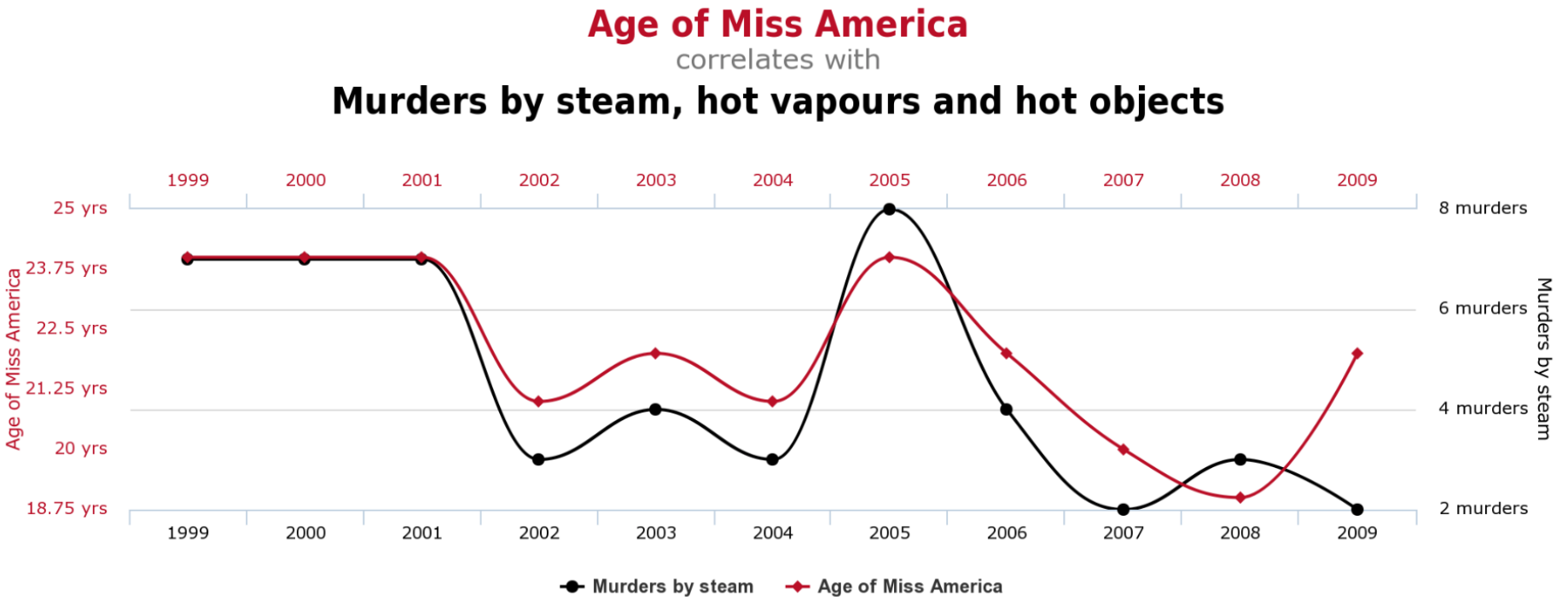
	Variable	Odds (95% CI) of being a higher collision school
Exposure	**Walking to School**	**0.49 (0.02, 13.72)**
Built Environment Density	Residential Land Use $km^2/10km^2$	0.56 (0.37, 0.86)
Design	Traffic lights/km roads	1.59 (1.17, 2.15)
	One way streets/10 km roads	4.00 (1.76, 9.08)
	Traffic calming/10 km roads	3.56 (1.03, 12.26)
	School crossing guard	3.65 (1.10, 12.20)
Non-built environment	Lower school SES	1.37 (1.11, 1.70)

PROBLEMS WITH CROSS-SECTIONAL STUDIES

- Associated with higher collision rates ??
  - School crossing guard
  - More traffic calming

- Traffic calming may have not been present when collision occurred
- Pre-post studies

CORRELATION OR CAUSATION ?



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GENERAL METHODS

- Quasi-experimental, pre-post repeated measures
  - Repeated measure by traffic feature
  - Limited by lack of exposure data – design uses time as the denominator
- Regression analyses for count data
  - Incidence rate ratios with 95% CI
- Mapping
  - Locate collisions and assign to traffic features
  - Map features of the built environment
  - Conduct **spatial analysis** of collisions pre/post installation

SPEED HUMPS

Rothman et al. BMC Public Health (2015) 15:774
DOI 10.1186/s12889-015-2116-4

BMC Public Health

RESEARCH ARTICLE Open Access

Installation of speed humps and pedestrian-motor vehicle collisions in Toronto, Canada: a quasi-experimental study

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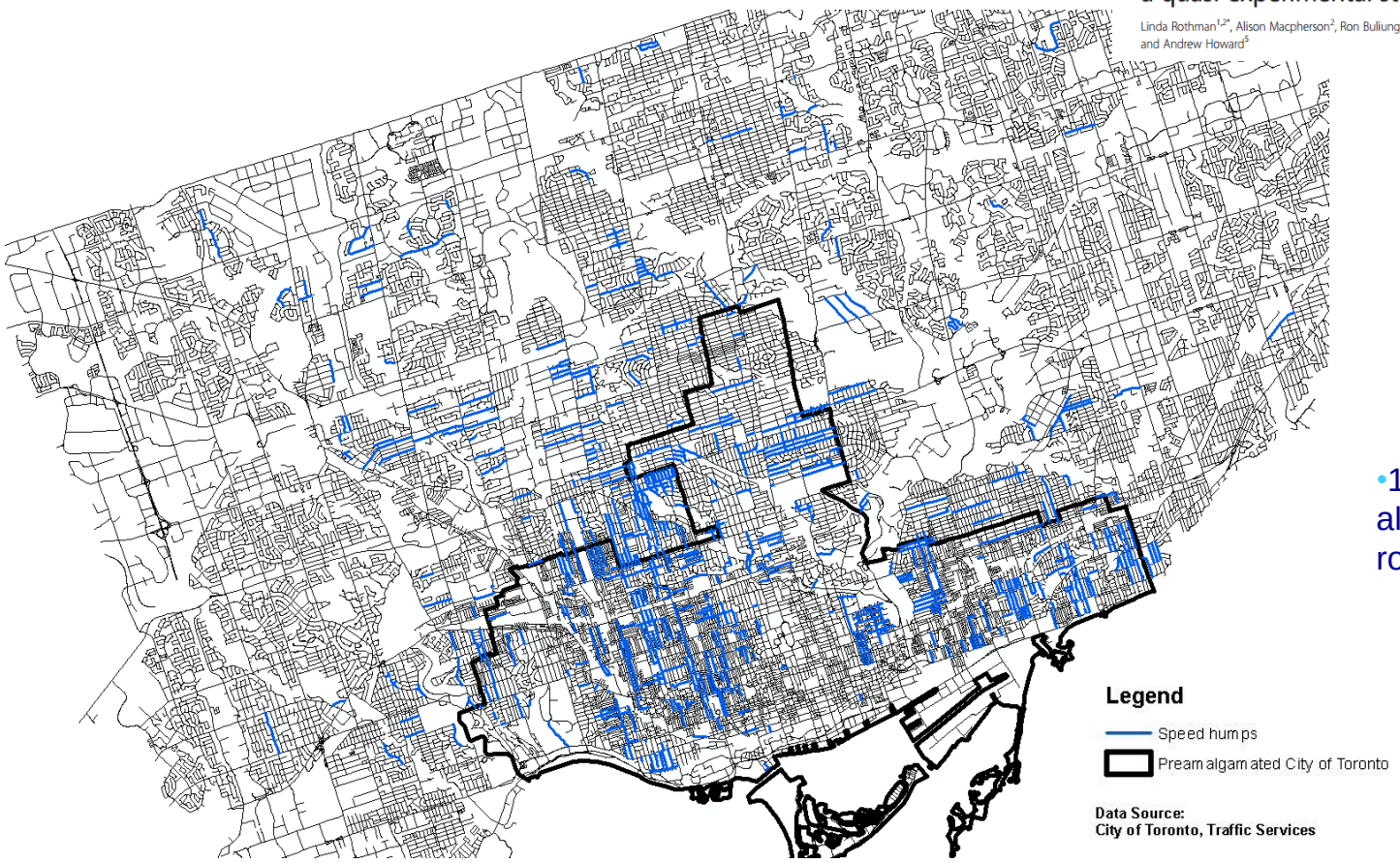
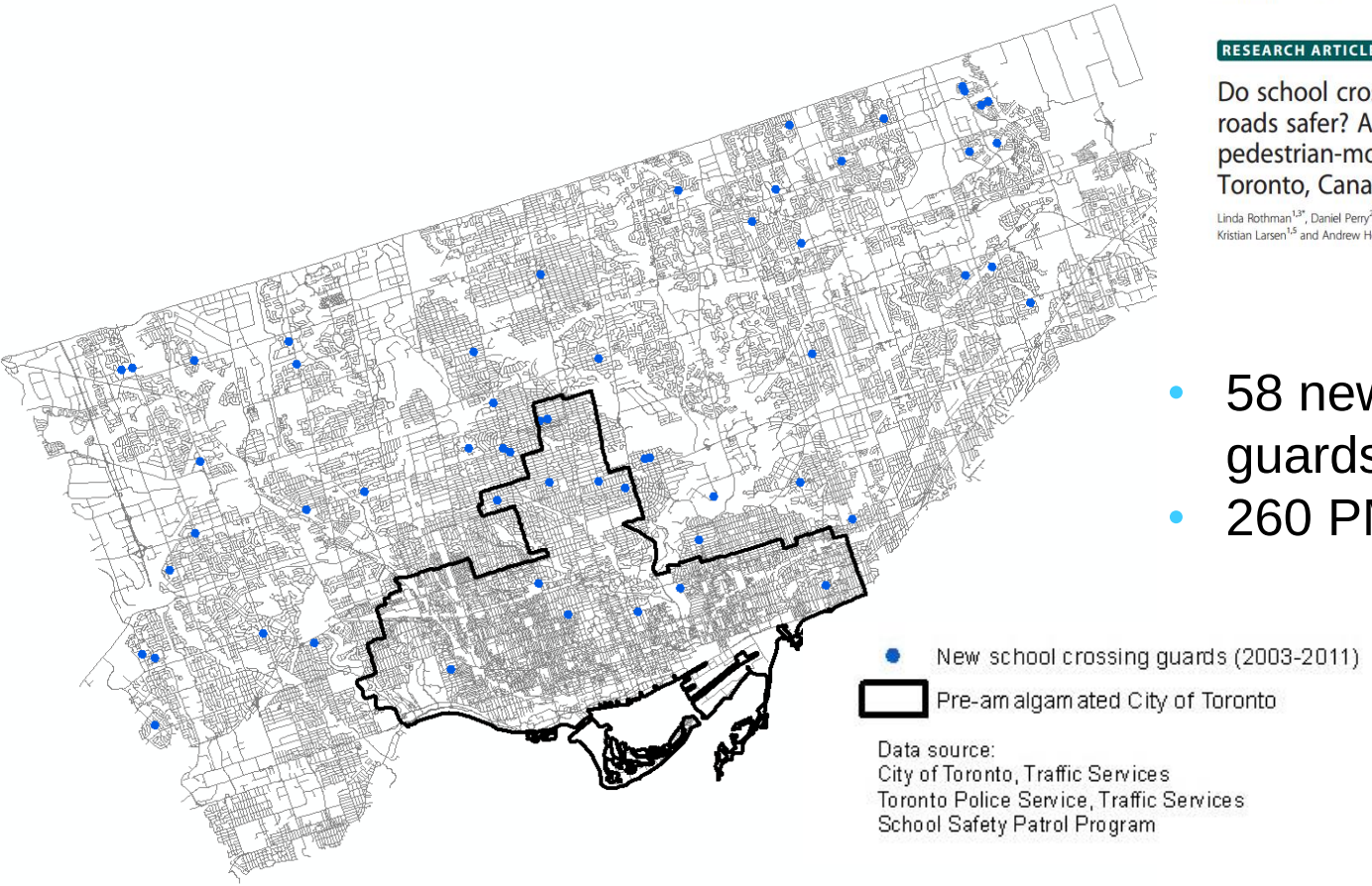


Central City of Toronto

- 1,344 collisions along speed hump roadways

- Installation associated with a 22% decrease overall (296 PMVCs prevented) and 45% decrease in collision rates in children

SCHOOL CROSSING GUARDS



Rothman et al. BMC Public Health (2015) 15:732
DOI 10.1186/s12889-015-2065-y

BMC Public Health

RESEARCH ARTICLE Open Access

Do school crossing guards make crossing roads safer? A quasi-experimental study of pedestrian-motor vehicle collisions in Toronto, Canada

Linda Rothman[1,3*], Daniel Perry[2,4], Ron Buliung[5], Colin Macarthur[1,6,8], Teresa To[1,8,9], Alison Macpherson[3], Kristian Larsen[1,5] and Andrew Howard[1,2,7,8]

- 58 newly implemented guards
- 260 PMVCs

- Collision rates unchanged after implementation
- ?? More children walking at these locations, future study
- Guards are a simple roadway modification to increase walking to school without detrimental safety effects

City Wide Guards: 568

Proportion of collisions (n = 1850) occurring at a guard location

	Non-school travel time			School travel time			
	N	SCG location	Not at SCG location	N	SCG location	Not at SCG location	Chi-square P-value
Children (4 – 12)	1155 (62%)	138 (12%)	1017 (88%)	695 (38%)	95 (13.7%)	600 (86.3%)	0.28

- High burden of child PMVC outside school travel times and not at crossing guard locations

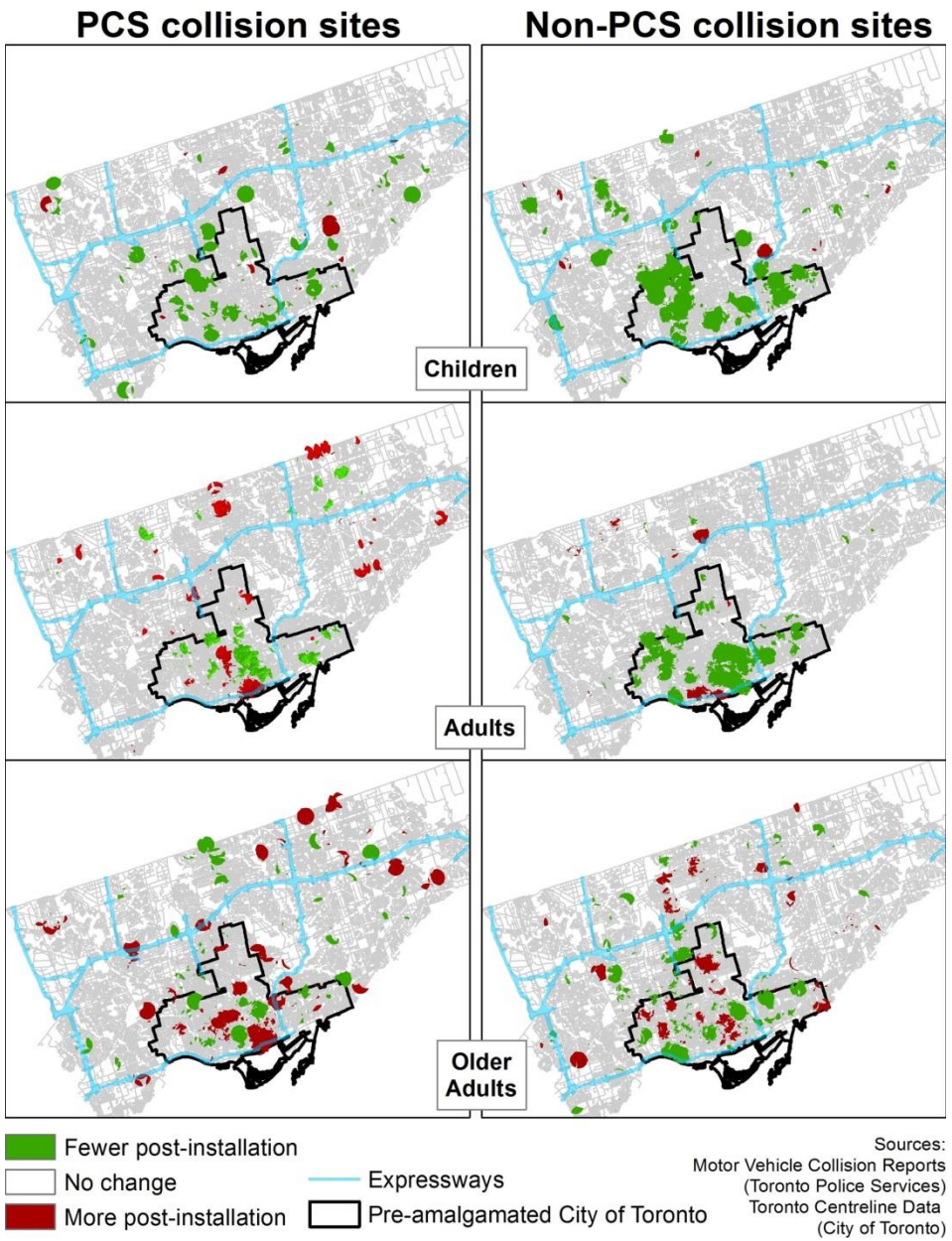
PEDESTRIAN COUNTDOWN SIGNALS

- Spatial pre-post study of pedestrian countdown timers at 1965 traffic light controlled intersections

Table 1 Frequency and incidence rate ratios of all collisions by pedestrian countdown signal (PCS) (pre, post) and by season (summer, winter)

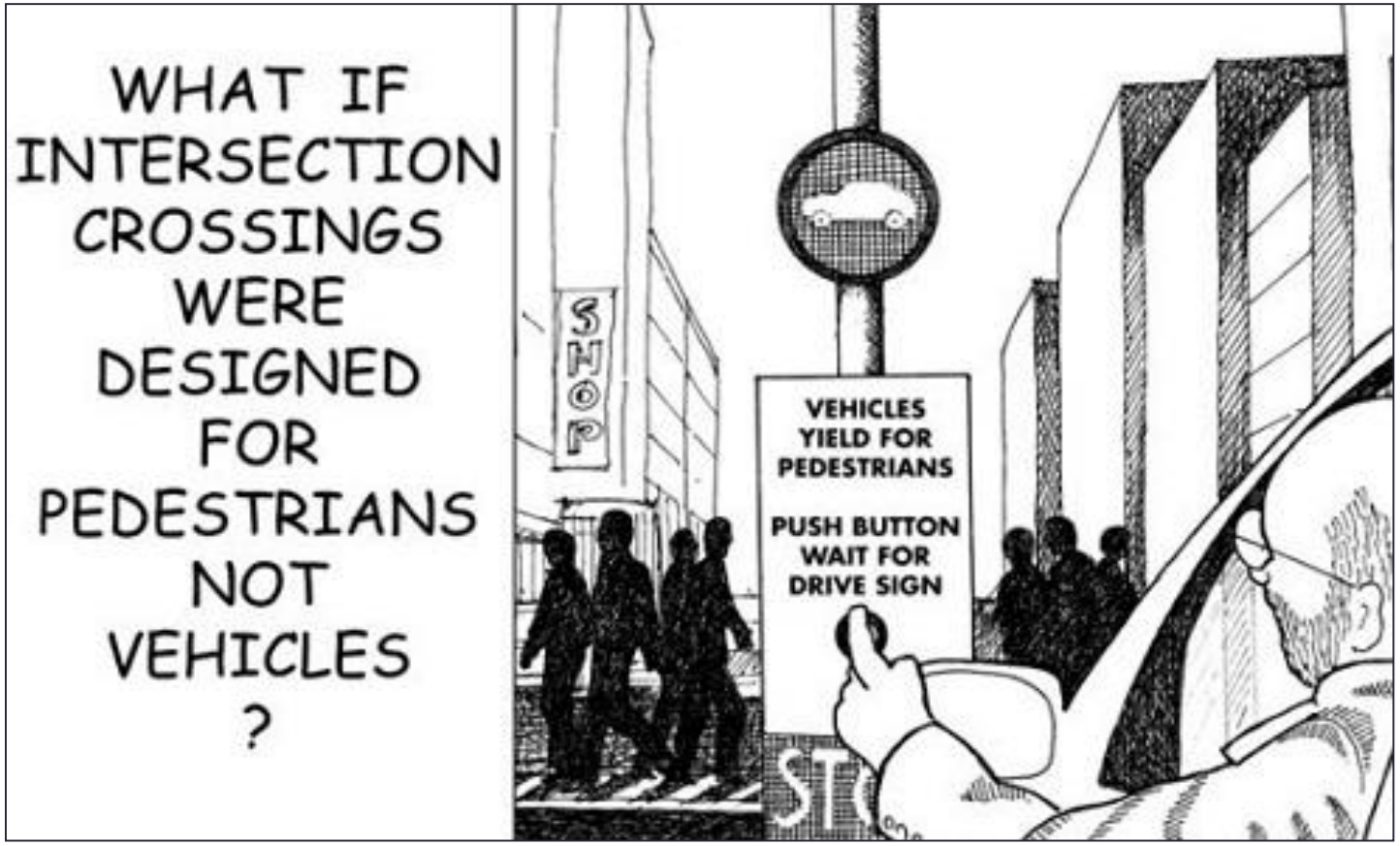
Collision type	Total I-M[a]	I-M (≥1 collision)	# of collisions	IRR[b] (95% CI)[†] (adjusted for covariates)[††]	p-value
All collisions					
Pre PCS	42904	935	1023	1	
Post PCS	29619	1548	1737	1.26 (1.11 – 1.42)	<0.001
Summer	36406	1041	1142	1	
Winter	36117	1442	1618	1.19 (1.09 – 1.31)	<0.001

Spatial Analysis



- Effects varied by age and location
- Installation may result in increased PMVC; non-PCS locations showed more consistent reductions
- Effectiveness varies within a city, therefore, likely to vary across cities
- Pedestrians may misuse the information to cross quickly, rather than to cross safely

➢ **Could changes in signal timing, or vehicle turning restrictions, yield desired safety benefits?**



Source: http://shadeparadenashville.blogspot.ca/2015_08_01_archive.html

STREETCAR RIGHT OF WAY

TABLE 1. Incidence rates and incidence rate ratios, comparing pre and post right- of-way on pedestrian motor vehicle collisions

	Collisions (pre)	Collisions (post)	IR[a] (pre)	IR (post)	IRR[b] (95%CI)[c]
St. Clair	100	53	113.7	60.2	0.52 (0.37 – 0.74)
Age (years)					
Child (0-15)	23	3	26.2	3.40	0.13 (0.04 – 0.44)
Adult (16-59)	59	34	67.1	38.6	0.61 (0.38 – 0.97)
Older adult (60+)	16	12	18.2	13.6	0.75 (0.34 – 1.64)
Injury status					
No injury	3	2	3.4	2.3	0.67 (0.11 – 3.98)
Minor injury	87	49	98.9	55.6	0.56 (0.40 – 0.80)
Major injury	9	2	10.2	2.3	0.23 (0.05 – 1.15)
Fatal injury	1	0	1.1	0	-[d]

SPATIAL ANALYSIS

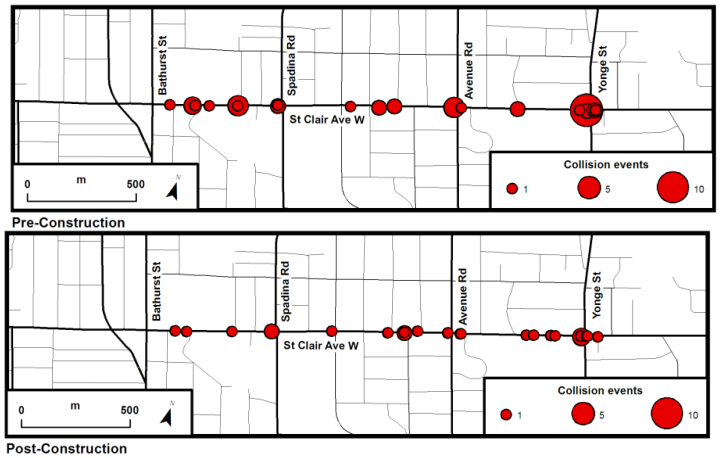
Contents lists available at ScienceDirect

Accident Analysis and Prevention

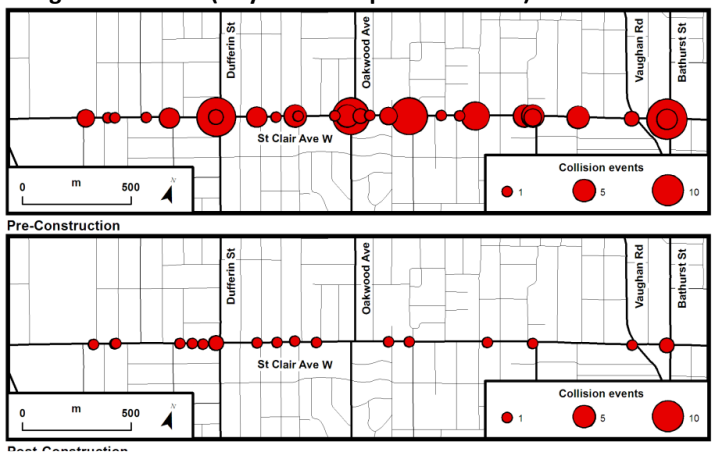
journal homepage: www.elsevier.com/locate/aap

Exploring the impact of a dedicated streetcar right-of-way on pedestrian motor vehicle collisions: A quasi experimental design

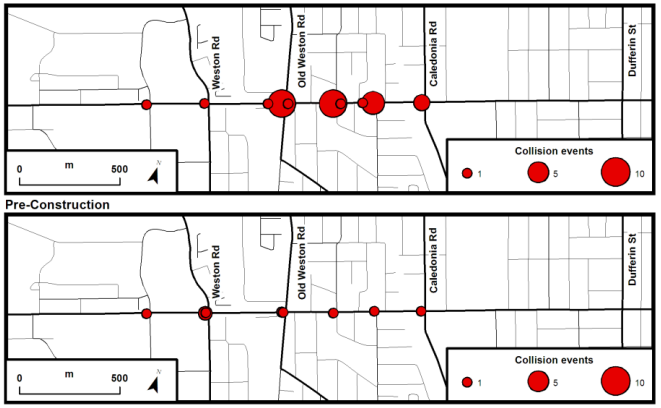
Sarah A. Richmond[a,*], Linda Rothman[a,c,1], Ron Buliung[d], Naomi Schwartz[a,b,2], Kristian Larsen[d], Andrew Howard[a,e,f,g,3]



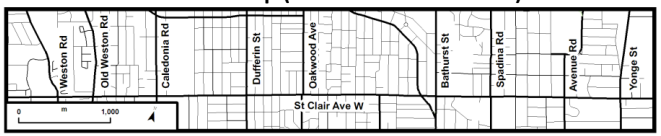
Yonge to Bathurst (July 2005 - September 2007)



Bathurst to Lansdowne (June 2006 - December 2009)



Lansdowne to Gunn's Loop (June 2006 - June 2010)



- Increased dispersion of collision events post installation

BIKE LANES

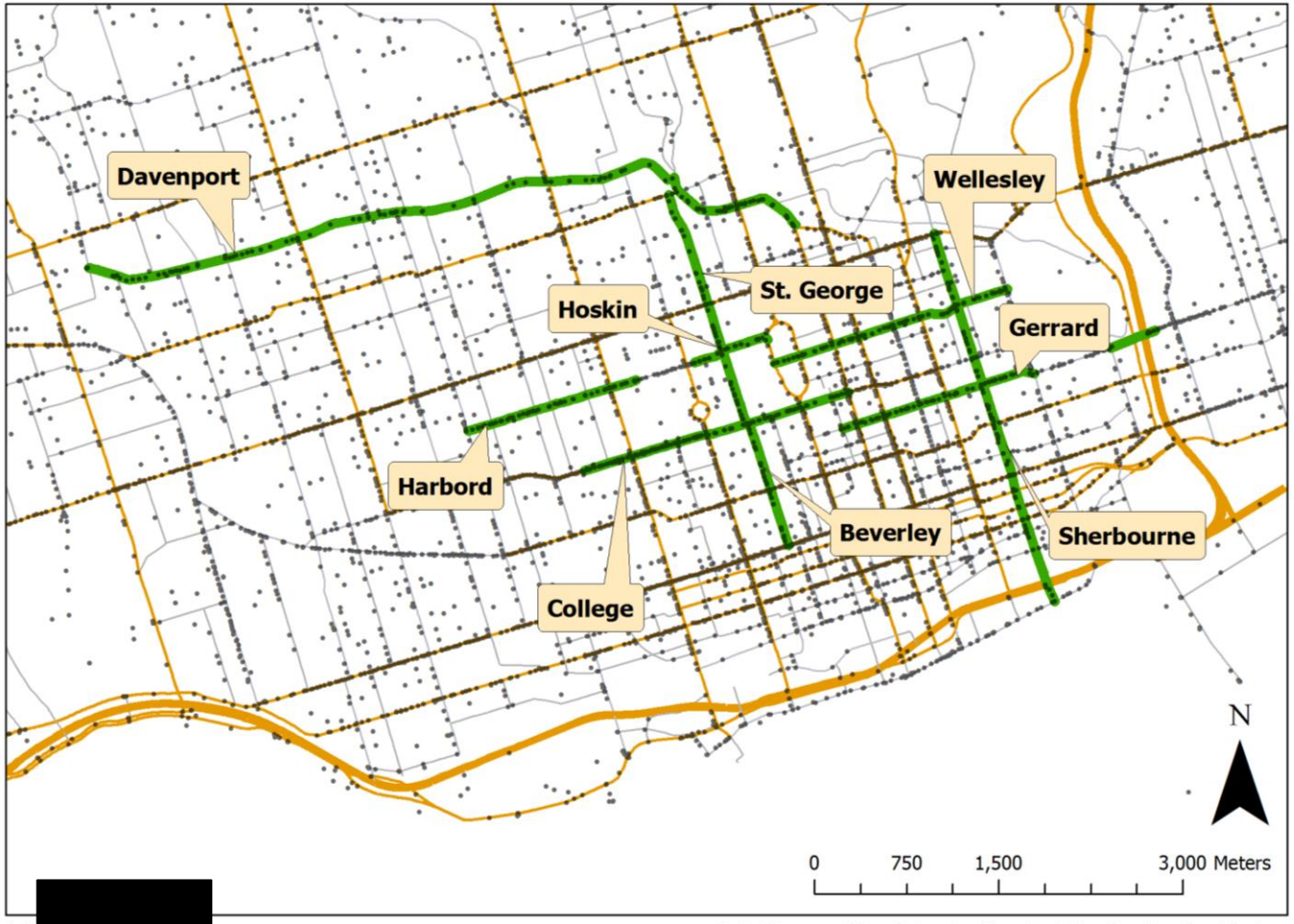
Journal of Transport & Health
Volume 3, Issue 4, December 2016, Pages 523-528

Examining the impact of cycle lanes on cyclist-motor vehicle collisions in the city of Toronto

Deepit Bhatia [a, c], Sarah A. Richmond [a], C.K. Jennifer Loo [c], Linda Rothman [b], Colin Macarthur [d], Andrew Howard [a]

Show more

Downtown Toronto cycle lanes and CMVCs (1991-2010) (n=23,959)



Changes in collision frequency pre- and post-installation

	IR per 100 segment-months (pre)	IR per 100 segment-months (post)	Model IRR	
All lanes	65.22	53.99	0.8109 (0.65, 1.01)	
Beverley-St. George	91.7	62.5	**Change in collision freq. per 100 months:**	-16 (-34, 2.0)
Sherbourne	61.7	63.3		-13 (-27, 1.0)
Davenport	85.8	64.2		-16 (-34, 12)
Harbord-Hoskin	33.3	28.3		-6.0 (-13, 1.0)
Wellesley	58.3	33.3		-10 (-21, 1.0)
College	179.2	145.8		-32 (-66, 2.0)
Gerrard	31.25	29.2		-6.0 (-13, 1)
No injury	1.087	5.435	5.00 (1.44, 17.28)	
Minimal/minor	24.28	20.29	0.84 (0.58, 1.20)	
Major/fatal	28.98	21.74	0.72 (0.51, 1.01)	

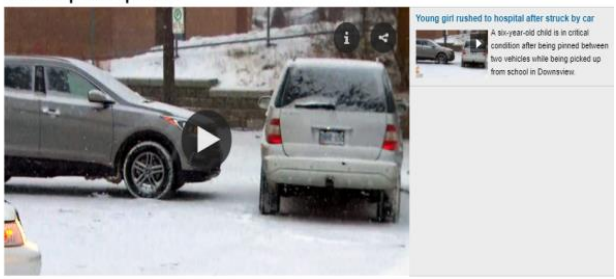
QUASI-EXPERIMENTAL STUDIES

- **Limitations**
  - Collisions are rare
  - Lack of traffic and pedestrian exposure data
  - Lack of traffic speed data
  - Non-randomized
  - Police-reported data
  - Small numbers
- **Strengths**
  - Pre-post design allows for control of non-time dependent covariates, temporal and seasonal effects
  - Study generalizability
  - Multidisciplinary collaborations
  - Active involvement of stakeholders
  - Real-world policy implications

EMPHASIS AREA 2: SCHOOL CHILDREN

A child is seriously injured or killed every 17 weeks on their way to or from school on Toronto's roads.

5-year-old girl dead after becoming pinned between two vehicles in school pick-up area



CRIME September 3, 2013 12:30 pm Updated: September 3, 2013 5:19 pm

Teenage girl struck and killed by truck in Toronto's west-end

By David Shum and James Armstrong Global News

Rachael D'Amore, CTV Toronto
Published Friday, April 21, 2017 3:53PM EDT
Last Updated Friday, April 21, 2017 6:59PM EDT

Boy, 6, struck and killed by vehicle was on his way home from Scarborough school

MOTOR VEHICLE COLLISION February 13, 2018 9:42 am Updated: February 14, 2018 4:49 pm

8-year-old boy dies after being hit by vehicle on St. Anne's Road

By Logan Caswell and Tamara Forlanski Global News

Google

children hit by car near school

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About 46,500,000 results (0.54 seconds)

Toronto girl, 5, struck and killed by unoccupied vehicle was cancer ...
https://globalnews.ca/news/3967252/school-mourns-death-of-girl/
Jan 16, 2018 - A 5-**year-old girl** fatally **struck** by an empty SUV that police say somehow rolled away and pinned her against another **vehicle outside** a **school** in Toronto's north end had previously survived a cancer diagnosis, a family friend told Global News. Ana Paula Carrera said she has known the little **girl's** mother for ...

17-year-old girl hit by car near Sir John A. Macdonald Secondary School
www.cbc.ca/.../17-year-old-girl-hit-by-car-near-sir-john-a-macdonald-secondary-school...
A **girl**, a 17-**year-old** student, was **hit** by a **car** early Wednesday morning, police say, **outside** Sir John A. Macdonald Secondary **School** in Hamilton. ... CBC News Posted: Nov 08, 2017 10:09 AM ET Last Updated: Nov 08, 2017 **12**:36 PM ET. A female student has been injured after she was **hit**, police say, by a **car near** Sir ...

Toronto police to examine SUV, seek witnesses after girl pinned ...
www.cbc.ca/.../fatal-collision-girl-killed-five-makeshift-memorial-witnesses-1.4489110
Jan 16, 2018 - Toronto police will examine an SUV and are seeking witnesses to a collision **outside** a **school** on Monday in which a five-**year-old girl** was pinned between two ... Child **struck by vehicle near** Keele and Wilson. A police spokesperson said 'the **vehicle** that was set in motion **struck** the man and the child.

11-year-old girl hit by car, seriously injured near Auburn school | KOMO
komonews.com/.../12-year-old-girl-airlifted-after-being-hit-by-car-near-auburn-schoo...
AUBURN, Wash. - An 11-**year-old girl** was airlifted to the hospital with life-threatening injuries Wednesday morning after she was **hit** by a minivan **near** an Auburn elementary **school**, emergency officials report.Police and medics responded to the scene, **near** Ca.

Child, woman hit by car near Bill Williams Elementary - turnto23.com ...
https://www.turnto23.com/.../child-woman-hit-by-car-near-bill-williams-elementary
Dec 6, 2017 - UPDATE (**12**/7/17 8:22 a.m.): The Kern County Coroner's Office has identified the 5-**year-old hit** and **killed** on Wednesday as Emily Guillen-Casillas.

12-year-old girl hit by minivan near Auburn school in critical condition ...
https://www.seattletimes.com/.../12-year-old-girl-struck-by-car-near-school-in-auburn/
Sep 14, 2016 - Authorities say a **12-year-old girl** was seriously injured and airlifted to Harborview Medical Center in Seattle.

12-year-old girl 'critical' after being hit by a car in Leeds - Yorkshire Post

FURTHER SCHOOL BASED STUDIES

- Parent Perceptions of Traffic Danger
- Risky Driver Behaviour
- Vision Zero Intervention Project

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Associations between parents' perception of traffic danger, the built environment and walking to school

Linda Rothman[a,b,*], Ron Buliung[c], Teresa To[a], Colin Macarthur[a], Alison Macpherson[b], Andrew Howard[a]

PARENT PERCEPTIONS OF TRAFFIC DANGER

1. Are parent perceptions of traffic danger *en route* to school and/or at the *school site* during morning drop-off related to walking to school?
2. What are the relationships between features of the built environment and parent-perceived traffic danger?

- Caregiver questionnaire
- 20 schools subsample
- Grades 4-6
- 733 surveys returned

Contents lists available at ScienceDirect

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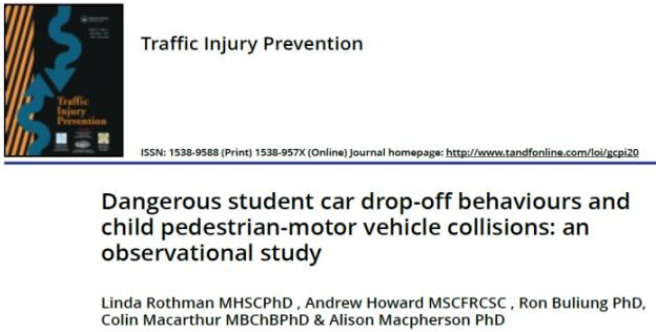
Linda Rothman [a,b,*], Ron Buliung [c], Teresa To [a], Colin Macarthur [a], Alison Macpherson [b], Andrew Howard [a]

- **High route danger perception** was related to:
  - Less frequent walking
  - Dangerous midblock crossing
  - Higher speed roadways
  - But **not** actual collision rates

➢ To influence walking, the ***safety of the route*** must be considered, however, must also address safety directly around school sites

FURTHER SCHOOL-BASED STUDIES

- Parent Perceptions of Traffic Danger
- Risky Driver and Pedestrian Behaviours
- Vision Zero Intervention Project



Traffic Injury Prevention

ISSN: 1538-9588 (Print) 1538-957X (Online) Journal homepage: http://www.tandfonline.com/loi/gcpi20

Dangerous student car drop-off behaviours and child pedestrian-motor vehicle collisions: an observational study

Linda Rothman MHSCPhD , Andrew Howard MSCFRCSC , Ron Buliung PhD, Colin Macarthur MBChBPhD & Alison Macpherson PhD

Travel Behaviour and Society

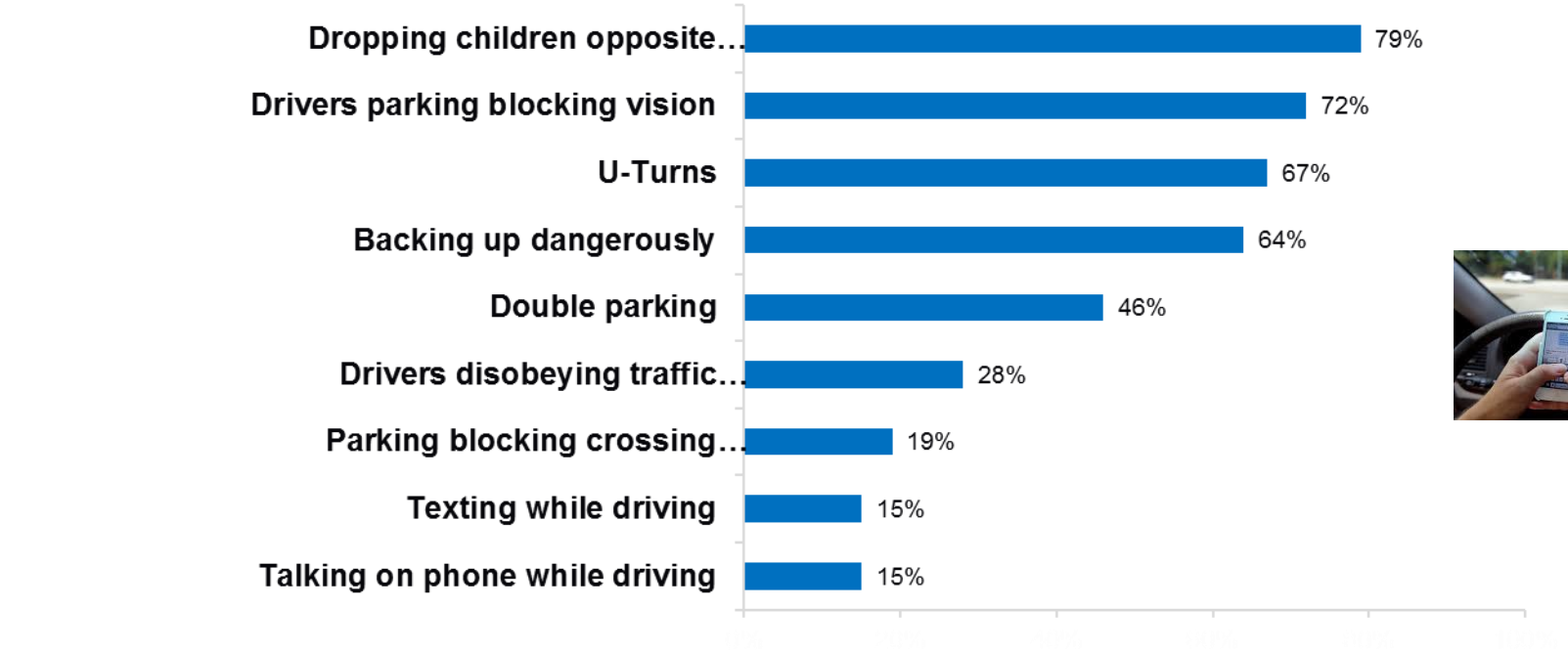
journal homepage: www.elsevier.com/locate/tbs

The school environment and student car drop-off at elementary schools

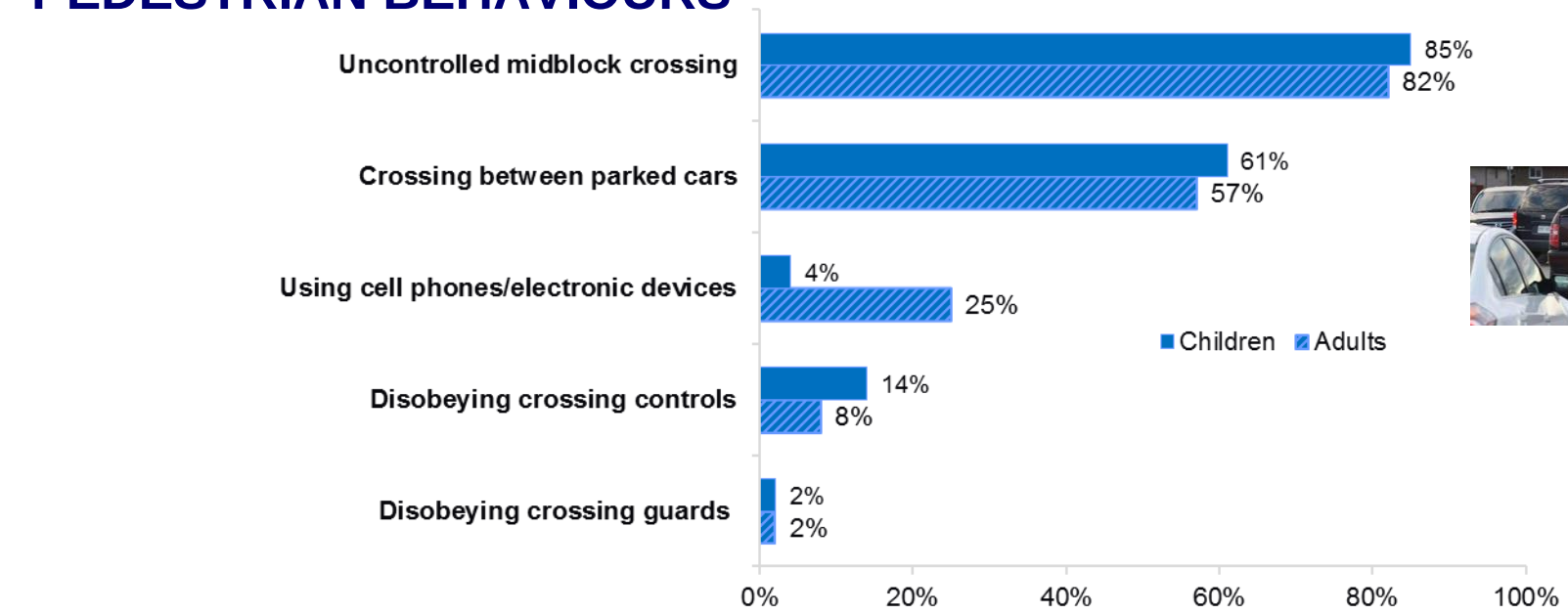
Linda Rothman [a,b,*], Ron Buliung [c], Andrew Howard [b,d], Colin Macarthur [b], Alison Macpherson [a]

DRIVING BEHAVIOURS

2015



PEDESTRIAN BEHAVIOURS



Risky driving behaviours and child PMVC (200 m) during school travel times (n =45)

	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)
Total dangerous driving behaviours	1.36 (1.04, 1.80)	1.45 (1.02, 2.07)
Major and minor arterials	1.29 (1.14, 1.46)	1.27 (1.13, 1.44)
LOI (social disadvantage)	4.19 (1.36, 12.92)	2.99 (1.03, 8.68)

- **Traffic congestion –*risk***
- **Designated drop off areas-*protective***
- **School crossing guards-*protective***

- Last day of observational data collection, 2015
- In front of a school at 8:10 a.m.

SCHOOLS' RESPONSE….

Knowledge users:

- Parent council
- School staff
- School advisory council
- Crossing guard
- Community liaise officer
- Toronto public health
- Caretaker
- School superintendent
- Caring and safe schools committee
- Toronto Police Services
- School newsletter

Actions taken:

- Developed a pedestrian/parking safety committee
- New crosswalk installed
- Used info for establishment of Kiss' N Ride
- Used for proposal to City of Toronto for new crossing guard
- Walking school bus implemented
- Contacted police re: excessive speeding
- Assigned more staff to monitor drop off
- "No stopping, buses only" signs posted along curb
- Started Walking Wednesdays
- New lines painted on driveway
- Purchased bike rack
- Planned 3 walk to school days
- Registered on the Safe Routes to School website
- Changed bus loading, legal parking and drop-off zones
- Investigated changes to speed limit and signage (e.g. curve ahead)
- Invited Manager of Traffic Operations for City of Toronto to do student talk about traffic safety
- Traffic safety incorporated into health class discussions
- Established walking goals for school

FURTHER SCHOOL-BASED STUDIES

- Parent Perceptions of Traffic Danger
- Risky Driver Behaviour
- Vision Zero Intervention Project

- School safety zones: physical environment changes, enforcement activities, education and school traffic facilitators
- Evidence-based and data-driven

- **Our Project**
  - Policy makers and academics working together to develop appropriate evaluation strategies
  - Developing step-up pre-post evaluation

PARTICIPATING SCHOOLS

- Priority setting exercise
  - Weighted score of school

1/3

- # of collisions involving killed/severely injured children
- # of other collisions
- % of children living within walking distance of the school (i.e. 1.6 km)

TORONTO'S ROAD SAFETY PLAN
VISIONZERO

PROJECT 1: SCHOOL ZONE (150 M)

- To examine the impact of Vision Zero built environment interventions related to the school safety zone strategy
  - Primary Outcomes
    - Active School Transport (surrogate health outcome)
    - Vehicle Speeds (surrogate safety)
    - PMVC as rare outcomes
  - Secondary Outcomes
    - Traffic Volume
    - Risky Driving and Pedestrian Behaviour

TORONTO'S ROAD SAFETY PLAN
VISION ZERO

PROJECT 2: SCHOOL ROUTES

- Process evaluation, introduction of road safety improvements along specified routes at **two** schools
- Bloomberg, Partnership for Healthy Cities

- Outcomes
  - Facilitators and the barriers to implementation
  - Parent's perceptions of traffic dangers before and after the interventions (survey)
  - Change of walking routes
  - Feasibility/usefulness of measuring the proposed outcomes

TORONTO'S ROAD SAFETY PLAN
VISIONZERO

BUILT ENVIRONMENT INTERVENTIONS

Speed

- Traffic calming
- Speed signage reductions
- Radar speed boards

Time

- Traffic signals (including installation of and leading pedestrian intervals)

Midblock crossings

- School crossing guards

Space

- Signs/pavement
- Designated drop- off areas

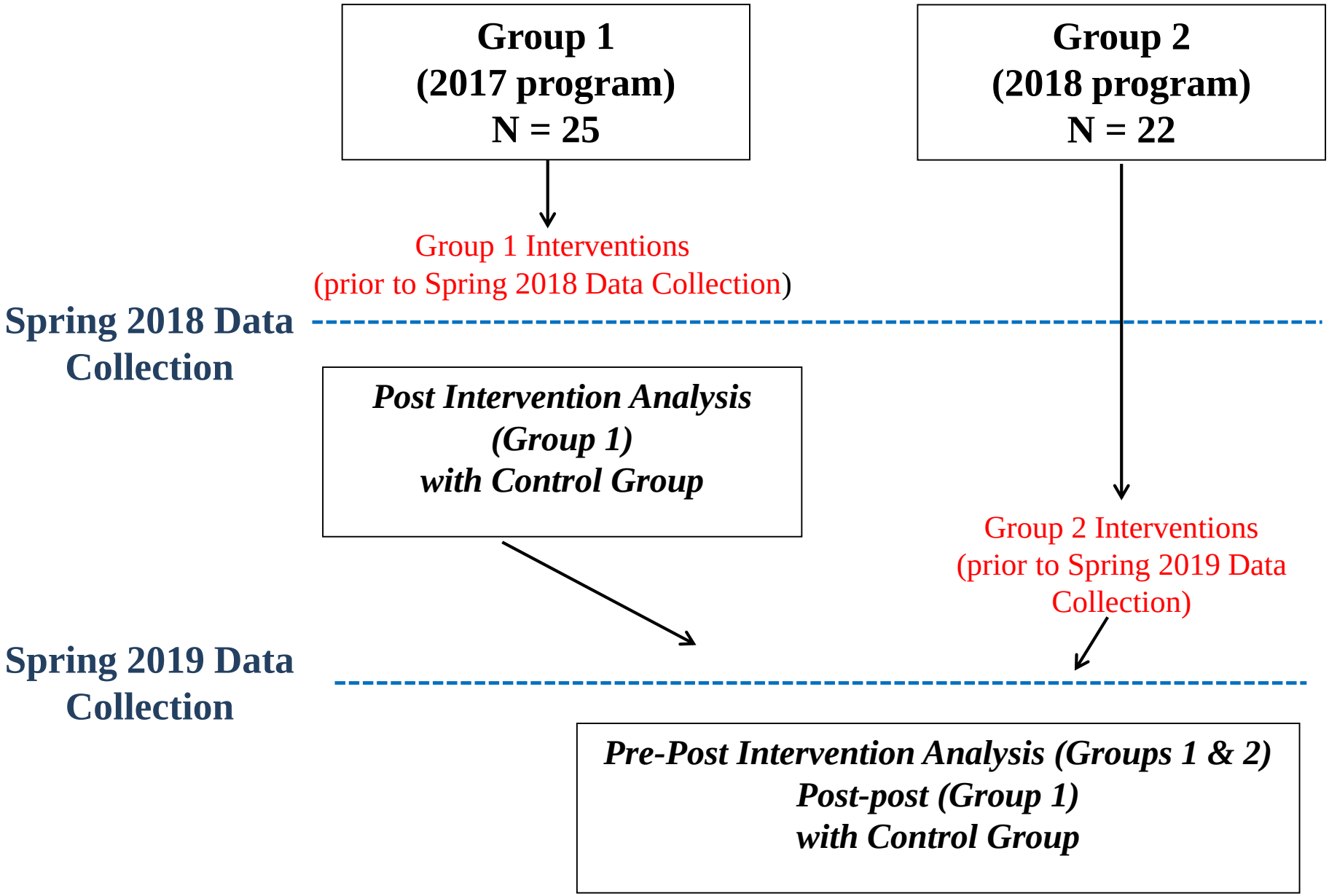
Pedestrian Visibility

- Increased lighting

Personnel/Programming

- School traffic management coordinator
- School travel planning

PROJECT 1

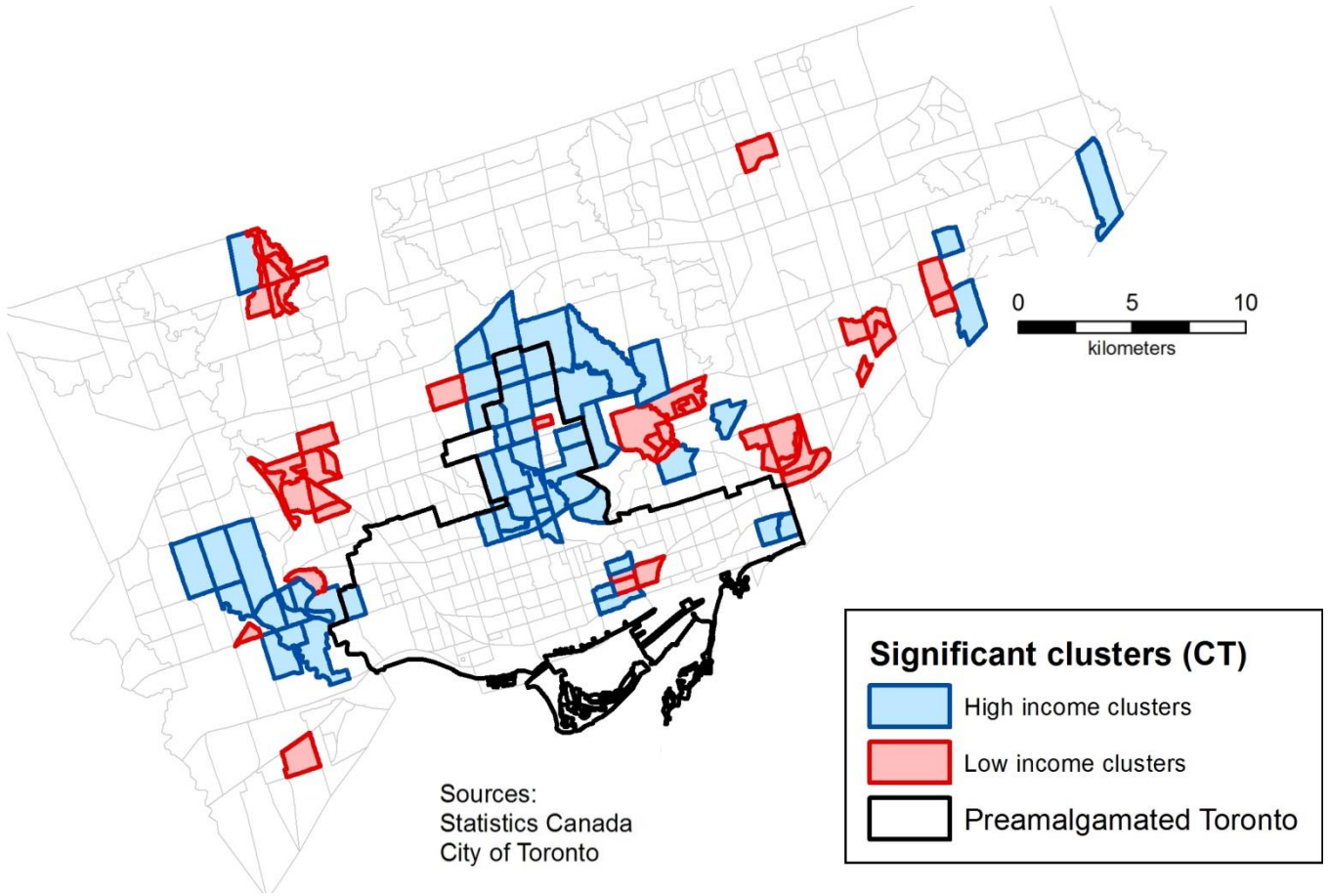

Group 1
(2017 program)
N = 25
Group 2
(2018 program)
N = 22
Group 1 Interventions
(prior to Spring 2018 Data Collection)
Spring 2018 Data Collection
Post Intervention Analysis
(Group 1)
with Control Group
Group 2 Interventions
(prior to Spring 2019 Data Collection)
Spring 2019 Data Collection
Pre-Post Intervention Analysis (Groups 1 & 2)
Post-post (Group 1)
with Control Group

FURTHER CITY WIDE STUDIES

- Social Inequities in the Roadway BE
- Child Active Transportation Safety and the Environment (CHASE) study

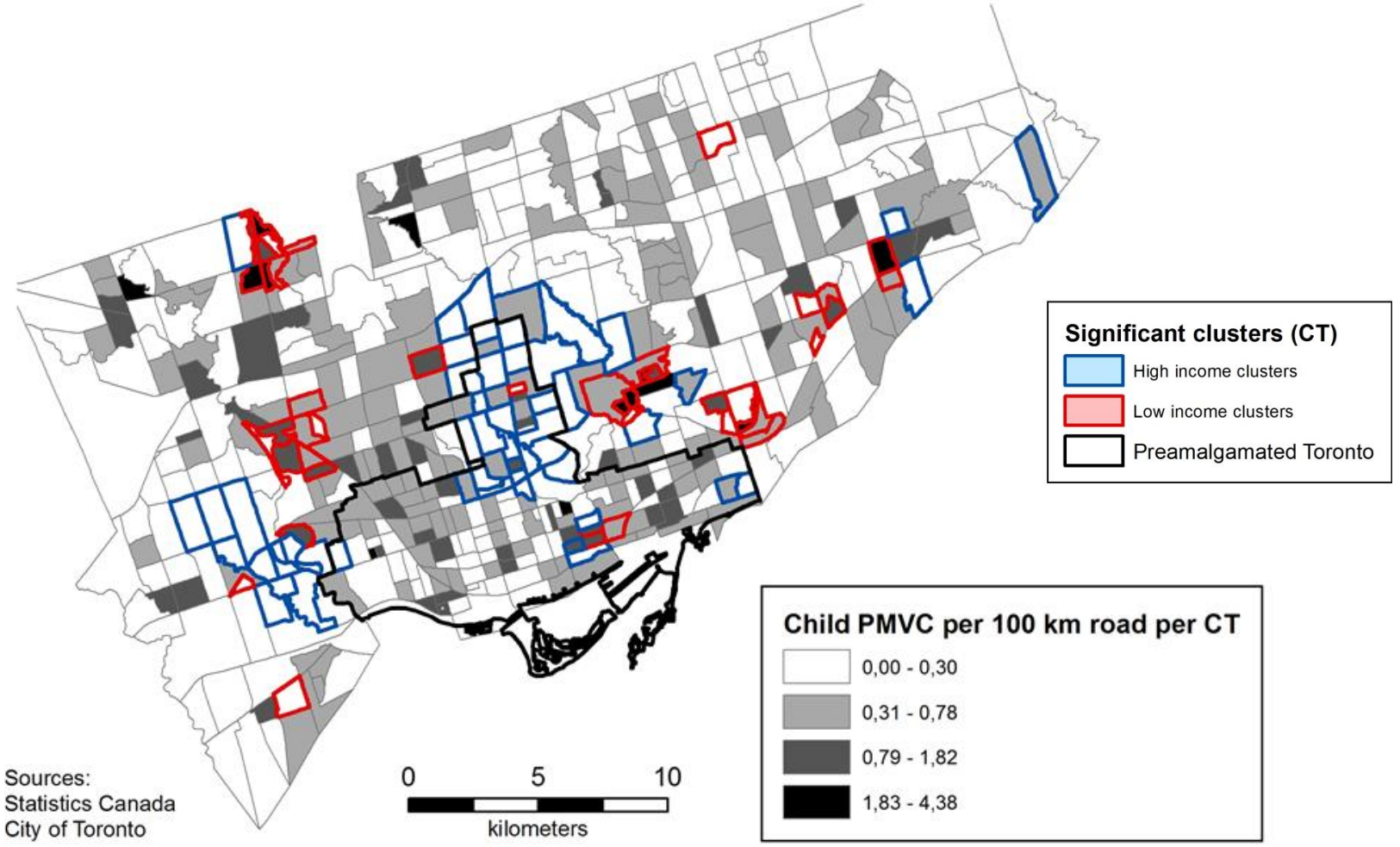
Greater School Social Disadvantage (2011, 2015)

- Higher collision rates
- Higher density multifamily housing
- Fewer crossing guards
- Higher speed roadways
- Less traffic calming
- More traffic congestion



- 524 census tracts
  - 58 (11%) high, 44 (8%) significant low income clusters (2006 Census)

Spatial distribution of child (5-14) PMVC/per 100 km per CT, 2001-2010

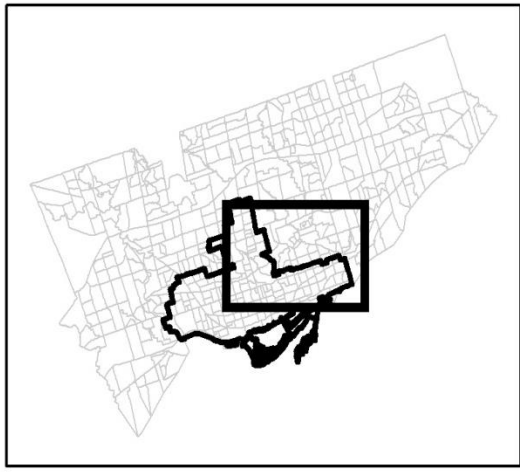


- Collision rates almost 6 times higher in low income clusters

Multivariate analysis: Odds (95% CI) of being in a low income cluster

Roadway Environment	Adjusted Odds Ratios (95% CI)
Speed humps	0.35 (0.15, 0.80)
Local road	0.62 (0.47, 0.82)
Crossing guard	1.43 (1.03, 1.99)

Spatial Distribution of Speed Humps



Significant clusters (CT)

- High income
- Low income
- Speed humps

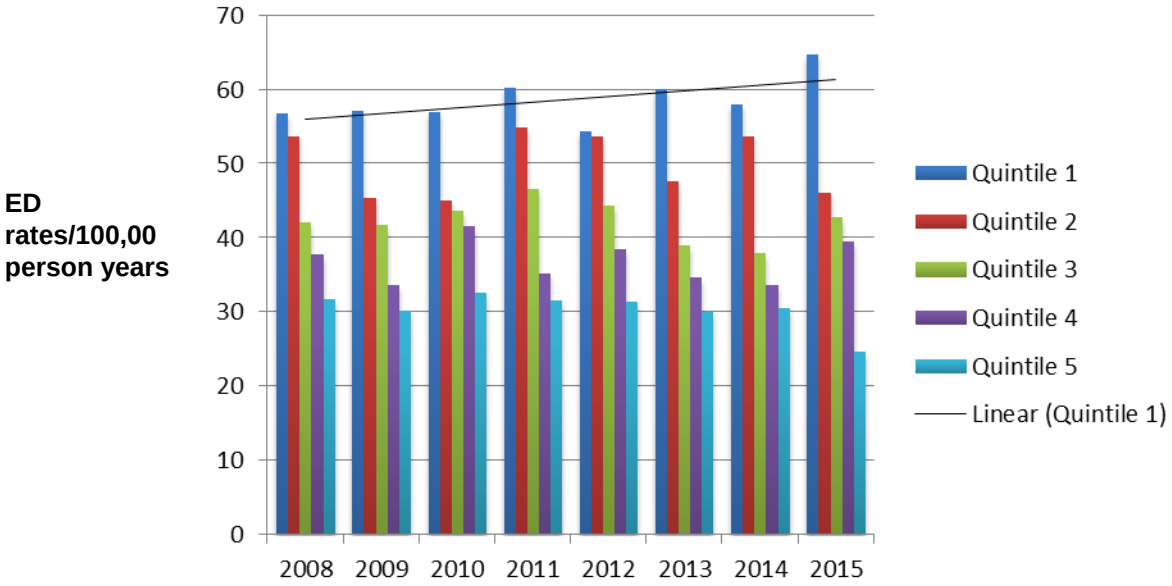
0 2 4

kilometers

Sources:
Statistics Canada
City of Toronto

TRENDS IN CHILD PMVC EMERGENCY DEPARTMENT VISITS AND SES

- 0-19 years (2008-2015), Ontario
- 2015 socioeconomic quintiles (1 = lowest, 5 = highest)



- Rates 2 times higher in lowest versus highest SES quintile; differential increasing over time

FURTHER CITY WIDE STUDIES

- Social Inequities in the Roadway BE
- Child Active Transportation Safety and the Environment (CHASE) study

CHILD ACTIVE TRANSPORTATION SAFETY AND THE ENVIRONMENT (CHASE)

- 5 year (2017-21)Intersectoral Research Grant from CIHR
- To examine within and across large Canadian urban centres the built environment and
  - Child and adolescent active school transportation
  - Pedestrian and cycling injuries
- To identify implementation strategies for BE change at the municipal level to encourage AT

CIHR IRSC
Canadian Institutes of Health Research
Instituts de recherche en santé du Canada

CHILD ACTIVE TRANSPORTATION SAFETY AND THE ENVIRONMENT (CHASE)

Brent E. Hagel[1], Andrew Howard[2], Alison Macpherson[3] Pamela Fuselli[4]
[1]University of Calgary, [2]University of Toronto, [3]York University, [4]Parachute

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Jacky Kennedy, Green Communities Canada**;**
Tracey Ma, Ministry of Transportation of Ontario (Toronto)
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Liz Owens, Alberta Transportation
Dr. Ian Pike, University of British Columbia;
Dr. Juan Torres Michel, Université de Montréal
Dr. Donald Voaklander, University of Alberta;
Dr. Meghan Winters, Simon Fraser University (Burnaby, British Columbia)

UNIVERSITY OF CALGARY
SickKids
YORK UNIVERSITÉ UNIVERSITY
Parachute
PREVENTING INJURIES. SAVING LIVES.

COLLABORATORS

- City of Montreal, Transportation Safety
- City of Toronto, Traffic Safety Unit
- City of Edmonton, Office of Traffic Safety
- The City of Calgary, Traffic Safety Roads
- Canadian Cancer Society, Quebec Division
- Vélo Quebec, Research
- Canadian Association for Road Safety Professionals
- Green Communities Canada
- Metrolinx, Planning and Policy
- University of British Columbia, School of Population and Public Health
- Hub for Active School Travel (HASTE)
- Alberta Health Services, Office of the Medical Officer
- Transport Canada, Road Safety Directorate
- Region of Peel, Sustainable Transportation
- Alberta Health Services, Pediatric Emergency Medicine
- Hospital for Sick Children, Pediatric Emergency Medicine
- University of British Columbia, Pediatric Emergency Medicine
- Alberta Children's Hospital (Calgary), Emergency Medicine.
- Alberta Health Services, Office of the Medical Officer
- Eco-Counter

CHASE: STUDY ACTIVITIES (2017-21)

- ***School observational data collection***
- ***Geographic analyses*** to examine space-time distribution of collisions city-wide
- ***Pre-post quasi-experimental studies*** to estimate effects of BE traffic features
- ***Case-crossover study*** to compare BE characteristics of cyclist injury site and random sites along route
- ***Literature reviews, focus groups, national survey*** to identify facilitators and barriers for implementing BE change at municipal level
- ***BE implementation toolkit***

FURTHER QUESTIONS….

- What are our next ‘natural experiments’ from your perspective
- How do we get exposure data?
- The ‘big picture’ is healthy transportation – but the effective interventions are built environment

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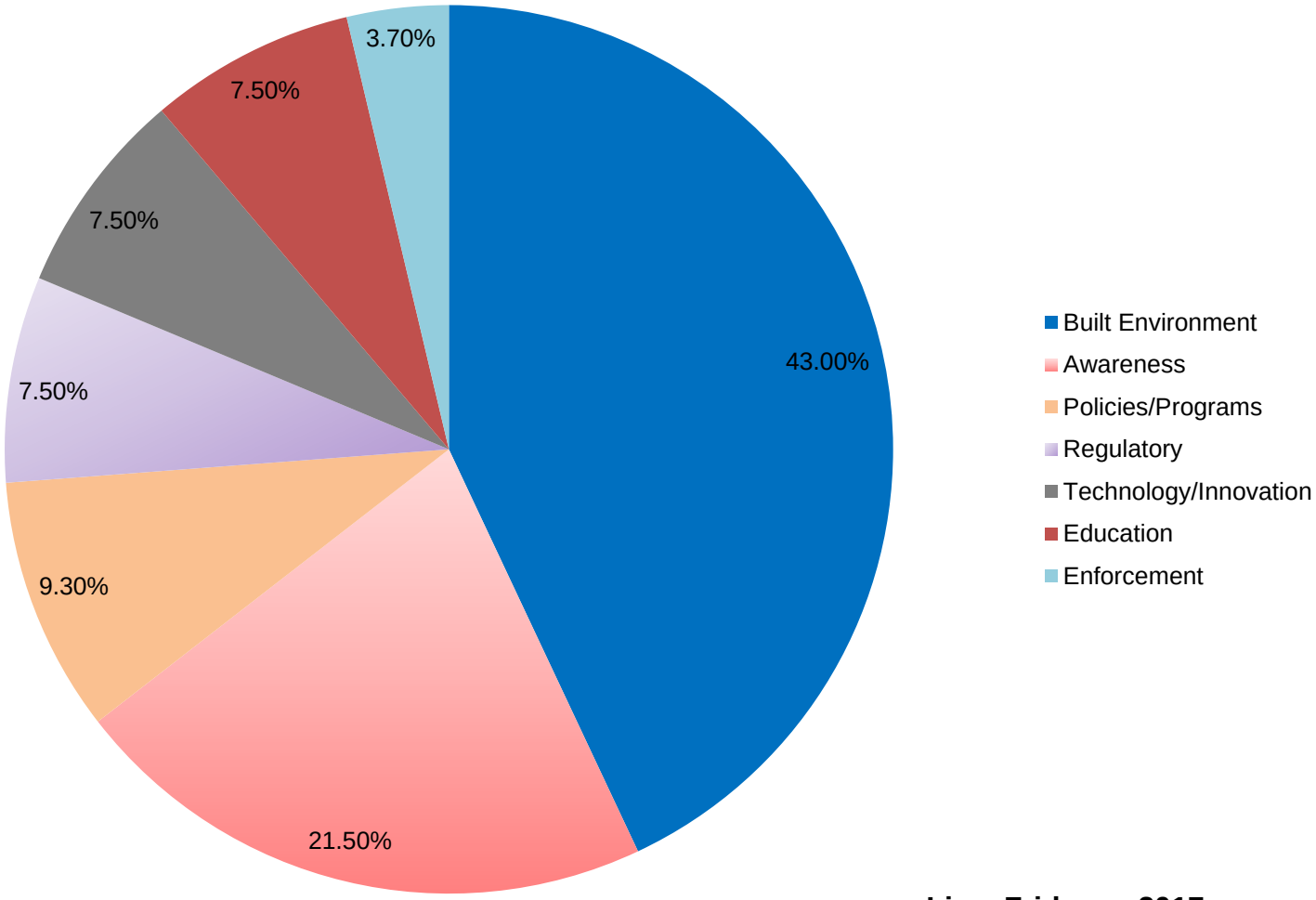
CONCLUSION AND DISCUSSION

- More walking does not have to result in more collisions.
- Safety **must** be considered with the promotion of children's active transportation
- We need to get the built environment right!

Extra slides

Breakdown of Intervention Types outlined in Road Traffic Policy Documents in Toronto



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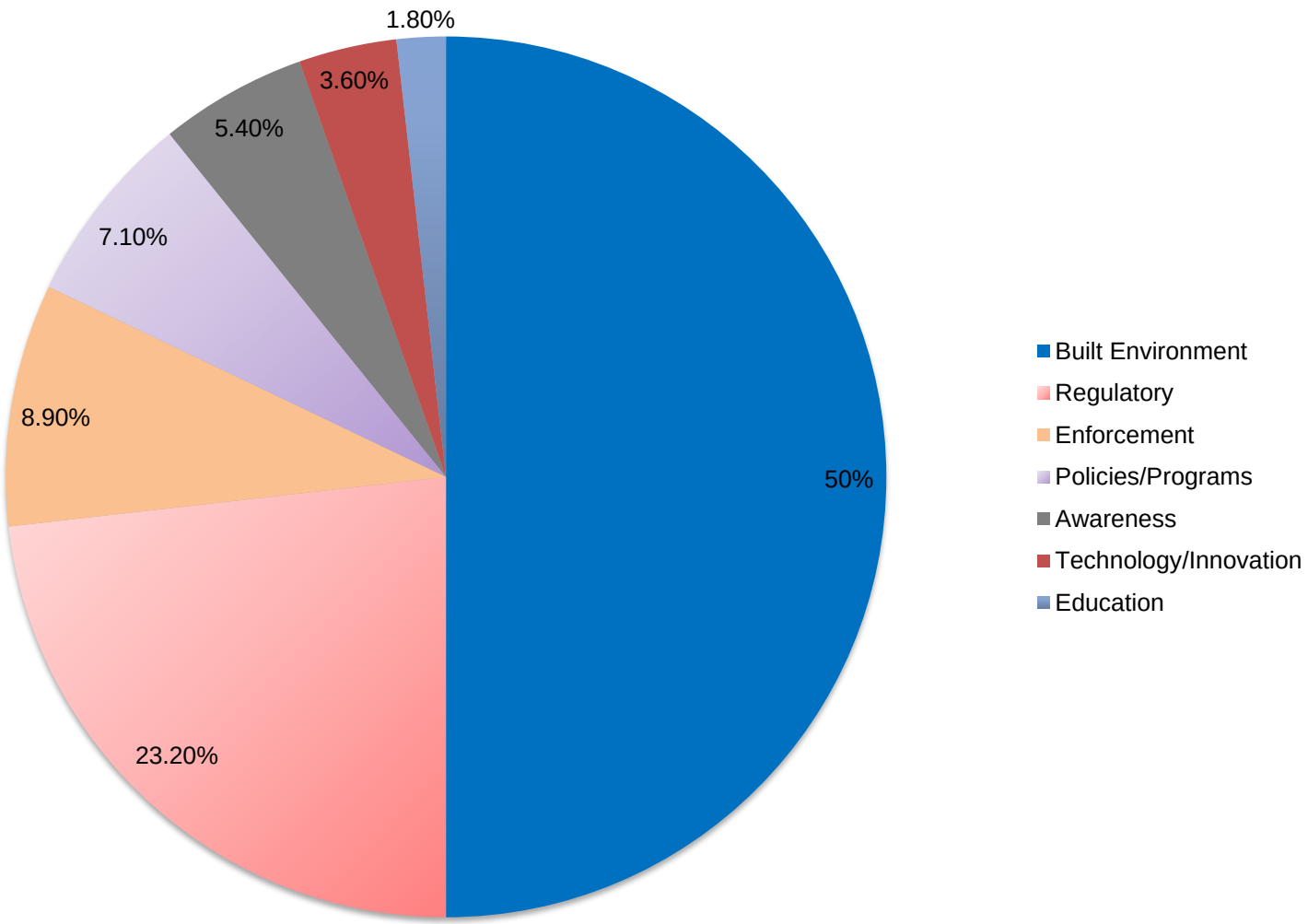
Breakdown of Intervention Types outlined in Road Traffic Policy Documents in Peel



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