

Bicycling, helmets, & ethics in injury prevention

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Photo: Ken Ohrn



A little history

1956, Pete Snell, a car racer, dies of head injuries, despite helmet



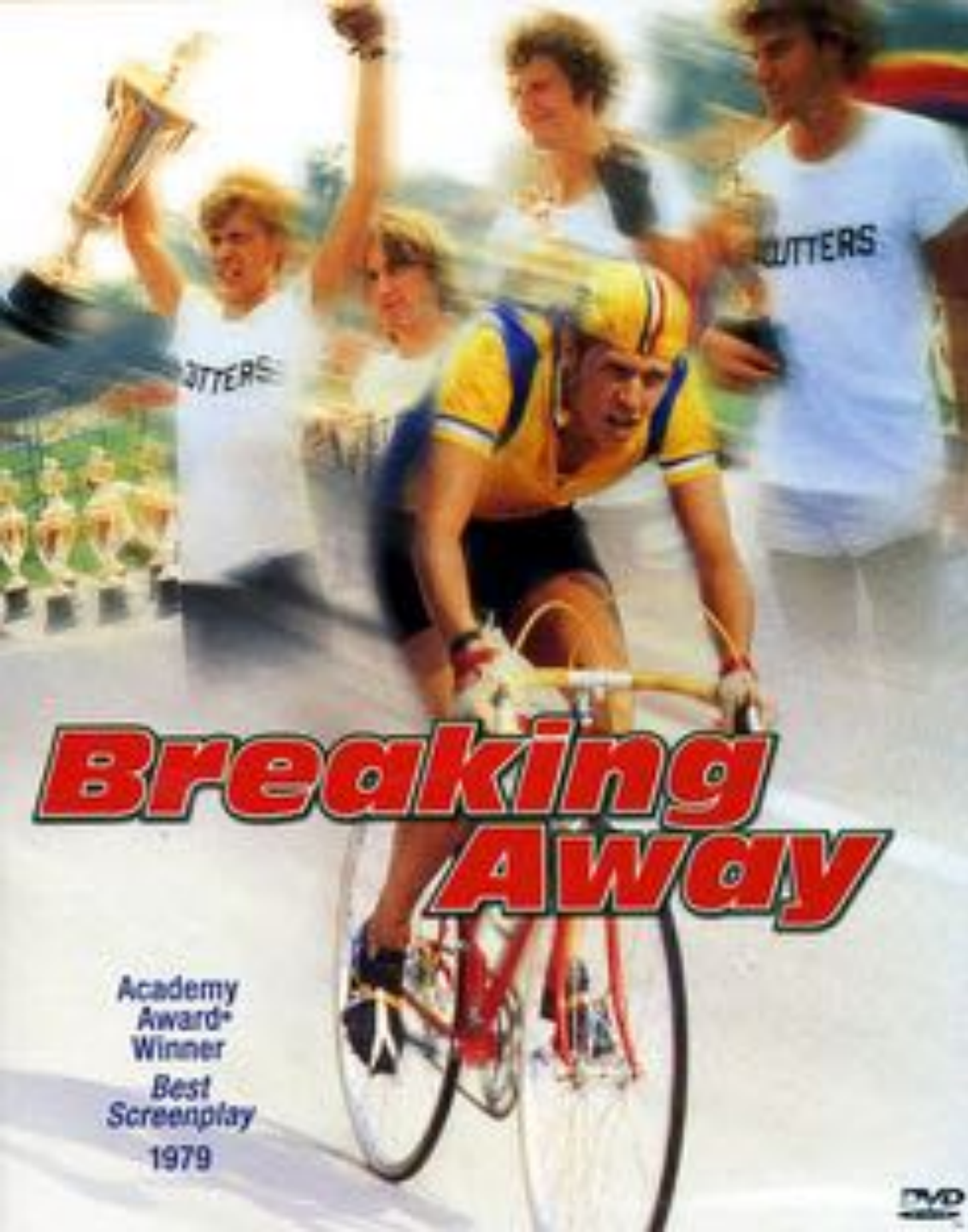
Snell Foundation to improve helmet design and set standards



Helmets sometimes used by bike racers too, mainly leather to start

Bell designed polystyrene cycling helmets in 1975

Snell created bike helmet standard in 1985



Late 1960s and 1970s
bicycling boom

switch away from cruiser
or city style bikes

amateurs start buying
“10-speed” racing bikes

Effectiveness of Bicycle Safety Helmets in Preventing Head Injuries

A Case-Control Study

Diane C. Thompson, MS; Frederick P. Rivara, MD, MPH; Robert S. Thompson, MD

Objectives.—To examine the protective effectiveness of bicycle helmets in 4 different age groups of bicyclists, in crashes involving motor vehicles, and by helmet type and certification standards.

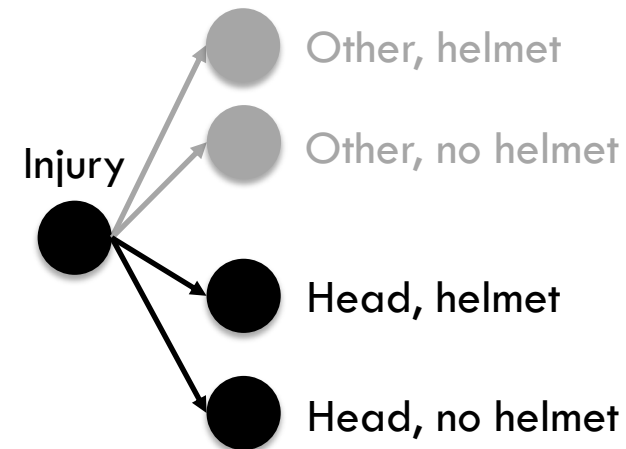
Research Design.—Prospective case-control study

Setting.—Emergency departments (EDs) in 7 Seattle, Wash, area hospitals between March 1, 1992, and August 31, 1994.

Participants.—Case subjects were all bicyclists treated in EDs for head injuries, all who were hospitalized, and all who died at the scene. Control subjects were bicyclists treated for nonhead injuries.

Main Results.—There were 3390 injured bicyclists in the study; 29% of cases and 56% of controls were helmeted. Risk of head injury in helmeted vs unhelmeted cyclists adjusted for age and motor vehicle involvement indicate a protective effect of 69% to 74% for helmets for 3 different categories of head injury: any head injury (odds ratio [OR], 0.31; 95% confidence interval [CI], 0.26-0.37), brain injury (OR, 0.35; 95% CI, 0.25-0.48), or severe brain injury (OR, 0.26; 95% CI, 0.14-0.48). Adjusted ORs for each of 4 age groups (<6 y, 6-12 y, 13-19 y, and ≥20 years) indicate similar levels of helmet protection by age (OR range, 0.27-0.40). Helmets were equally effective in crashes involving motor vehicles (OR, 0.31; 95% CI, 0.20-0.48) and those not involving motor vehicles (OR, 0.32; 95% CI, 0.20-0.39). There was no effect modification by age or motor vehicle involvement ($P=.7$ and $P=.3$). No significant differences were found for the protective effect of hard-shell, thin-shell, or no-shell helmets ($P=.5$).

Conclusions.—Bicycle helmets, regardless of type, provide substantial protection against head injuries for cyclists of all ages involved in crashes, including crashes involving motor vehicles.



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Estimated 65 to 74% protective effect for head, brain, severe brain injuries

Many, many similar style studies since ...

and 56% of controls were helmeted. Risk of head injury in helmeted vs unhelmeted cyclists adjusted for age and motor vehicle involvement indicate a protective effect of 69% to 74% for helmets for 3 different categories of head injury: any head injury (odds ratio [OR], 0.31; 95% confidence interval [CI], 0.26-0.37), brain injury (OR, 0.35; 95% CI, 0.25-0.48), or severe brain injury (OR, 0.26; 95% CI, 0.14-0.48). Adjusted ORs for each of 4 age groups (<6 y, 6-12 y, 13-19 y, and \geq 20 years) indicate similar levels of helmet protection by age (OR range, 0.27-0.40). Helmets were equally effective in crashes involving motor vehicles (OR, 0.31; 95% CI, 0.20-0.48) and those not involving motor vehicles (OR, 0.32; 95% CI, 0.20-0.39). There was no effect modification by age or motor vehicle involvement ($P=.7$ and $P=.3$). No significant differences were found for the protective effect of hard-shell, thin-shell, or no-shell helmets ($P=.5$).

Conclusions.—Bicycle helmets, regardless of type, provide substantial protection against head injuries for cyclists of all ages involved in crashes, including crashes involving motor vehicles.



Photo: Ken Ohrn

Now several summaries of the evidence in systematic reviews & meta-analyses

Consistent evidence helmets reduce odds of head injury after a crash

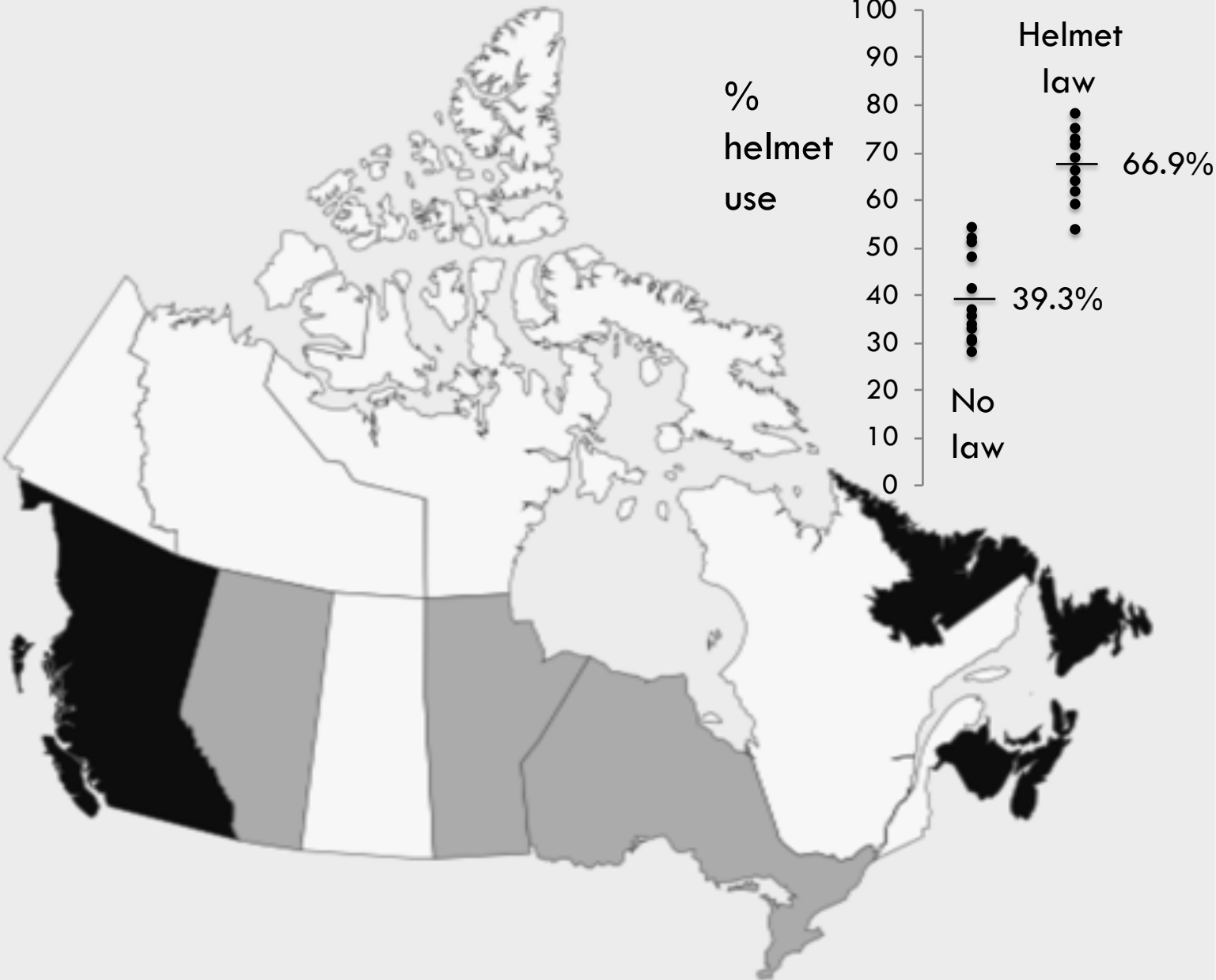
- Attewell et al., 2001 0.40 (0.29, 0.55)
- Elvik, 2013 0.50 (0.39, 0.65)
- Olivier et al., 2016 0.49 (0.42, 0.57)

8 provinces adopted helmet laws from 1995 to 2015

- No helmet law
- Child only law
- All ages law



Helmet laws result in increased helmet use



A public health success story,
right?

Diversion of attention from
other injury prevention issues

The attention of researchers ...

Topic	Attention (Number of Researchers)
Head injuries	943
Helmets	895
Other injuries	395
Bike lanes	82

943 on head injuries

895 on helmets

395 on other injuries

82 on bike lanes

“The major safety measure for bicyclists is to wear a helmet that meets safety standards.”

Road Safety in Canada, 2011, Transport Canada

The attention of safety professionals ...



GUIDELINES

Preventing child cycling injuries



GUIDELINES

Helmet fitting guide



The London Police Service reminds you...

Always wear a helmet when riding a bicycle.

#SafetyFirst



What about injuries that aren't mitigated by helmets?

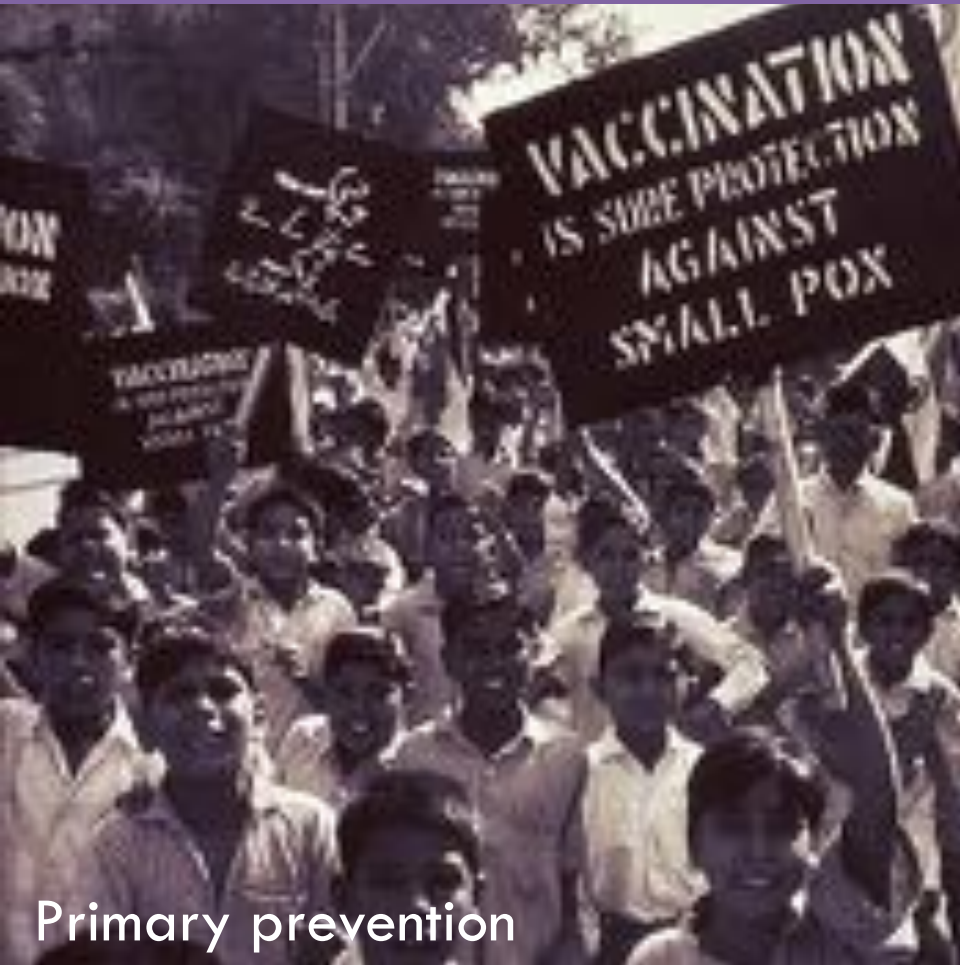
Bicycling
hospitalizations
in Canada:

~4,100 per year

87% involve body
sites other than
head



What about the type of prevention?



Primary prevention



Secondary prevention



Photo: Google Streetview

What about primary prevention of crashes?

Cycle track alongside busy street ... ~90% safer



Quiet street bikeway with traffic diversion ... ~55% safer



Off street bike path ... ~40% safer



Lower speed limits: London, 50% fewer child deaths & serious injuries



Many major cities adopting lower city speed limits ...

*Edinburgh, Paris, Barcelona, New York City
Denmark, the Netherlands, Germany*



Photo: Pat Martel CBC

Running lights on bikes reduce collision risk ~ 50%

Not taking potential cycling
benefits into consideration



Photo: Ken Ohrn

Lower death & chronic disease risk with physical activity

physical activity (150 minutes/week)...

- + 4 years life expectancy at age 30
- 19-50% lower all cause, cancer, & heart disease mortality risk
- greatest benefit among currently least active



Photo: Ken Ohrn

Deaths from chronic diseases vs. traffic injuries

Deaths in Canada, 2015

Heart disease	51,500
Cerebrovascular diseases	13,800
Diabetes	7,200
Dementia	6,600
Breast & colon cancers	14,300
Traffic deaths	1,900

← Bicycling deaths = 50



Photo: Ken Ohrn

Health benefits consistently outweigh injury risk

Benefit to risk ratios in 5 studies in UK, USA, Spain

6 to 1

8 to 1

15 to 1

33 to 1

362 to 1

Not reflecting on contrary
evidence about injury risk
& its implications



United States

5.5
deaths/100
billion km

Denmark
1.5

Netherlands
1.1

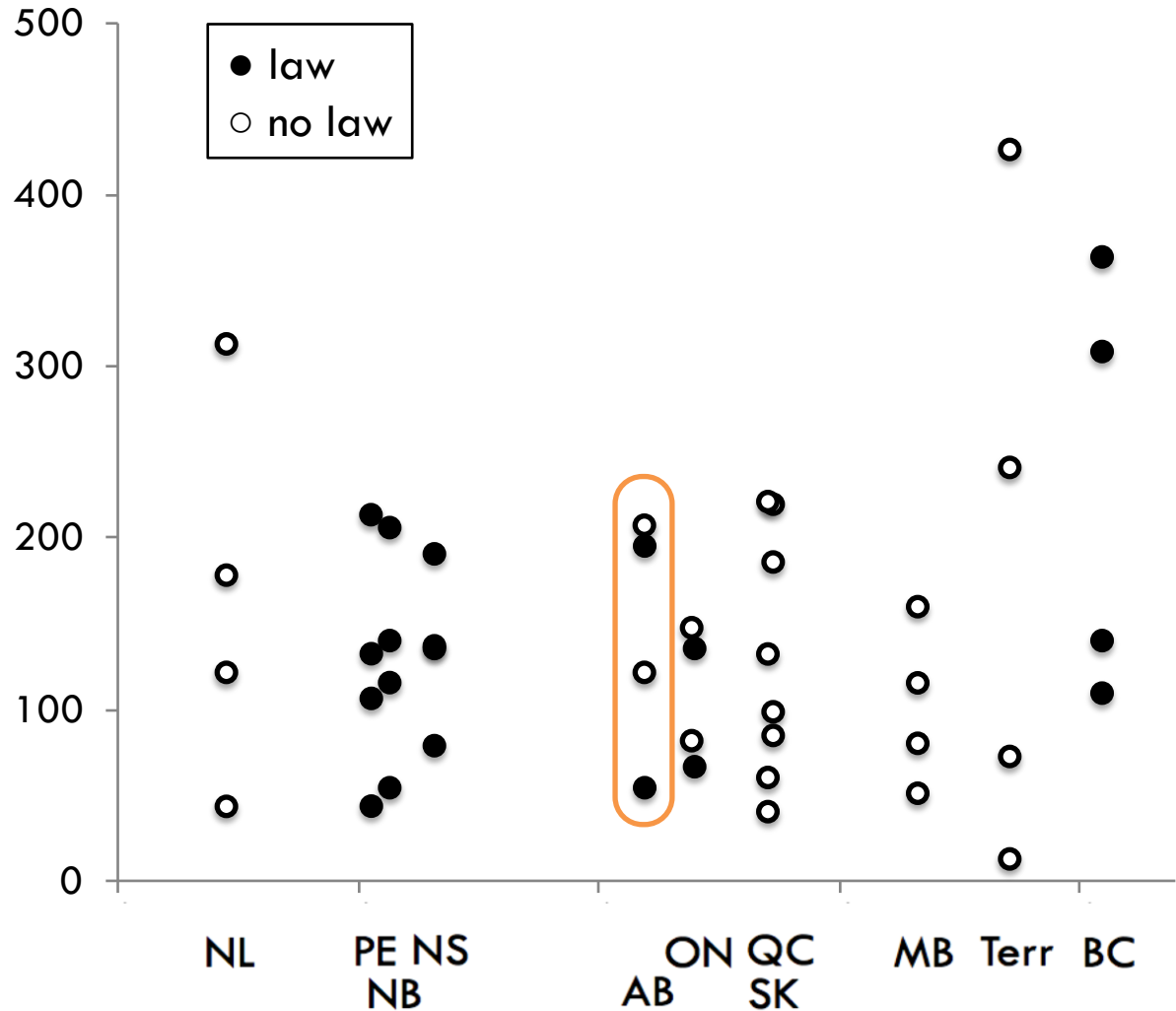
Buehler & Pucher, 2012

Fatality rates lower in countries where helmet use rare, but separation of people on bikes from MV is common

Injury hospitalization rates the same in provinces with & without helmet laws

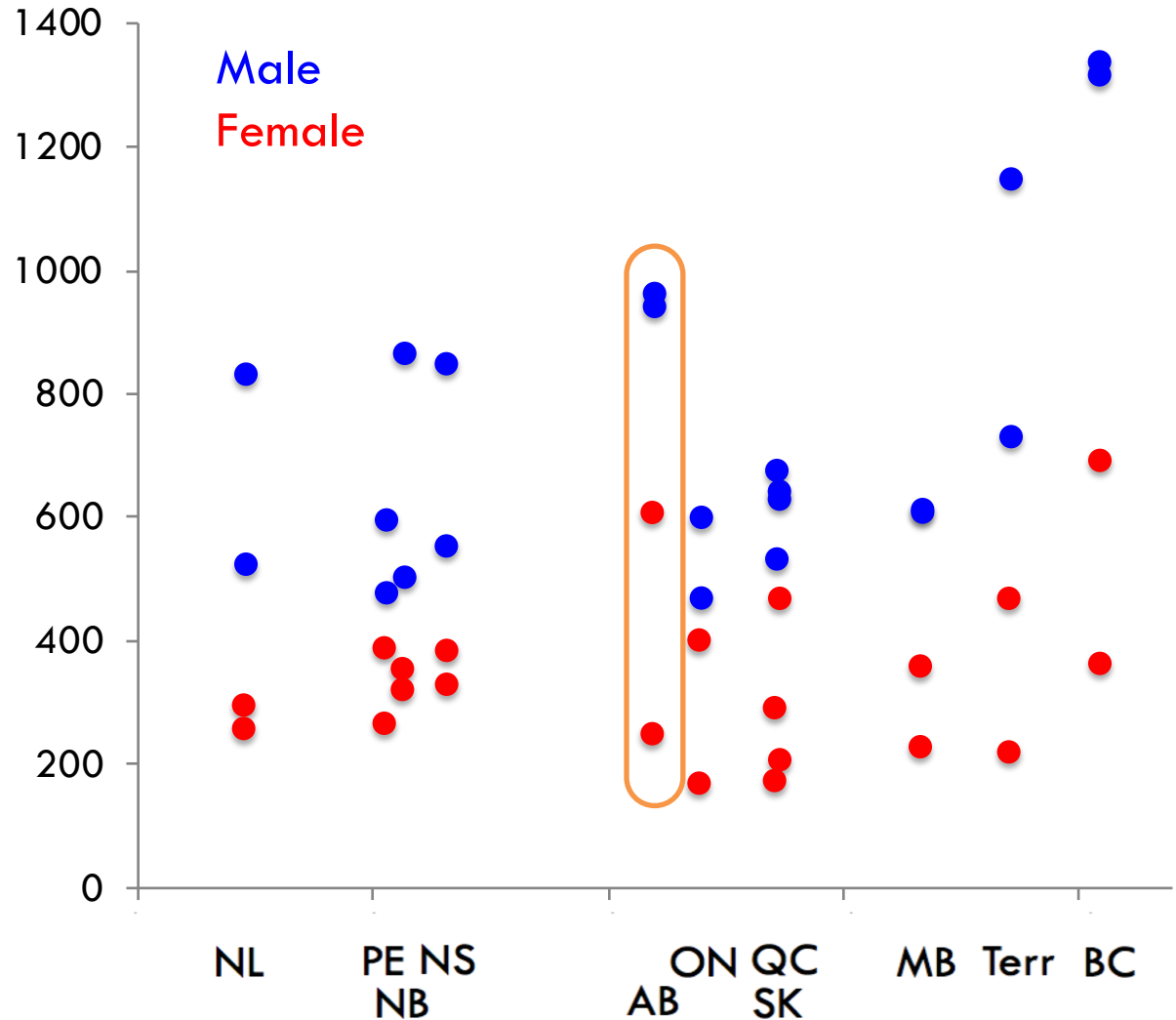
**Brain, head, scalp,
skull, face injuries**
Hospitalizations per
100 million trips

2006-2011



BUT ...injury rates consistently lower for females than males

All injuries
Hospitalizations per
100 million trips
2006-2011



Less helmet use on bike share bikes ... yet $\sim\frac{1}{2}$ the serious injury & fatality rate



Photo: Mumanumu Trip Advisor

Goodman et al., 2014; Woodcock et al., 2014; Fishman & Schepers, 2015; Elliot et al., 2016

Potential explanations of contrary evidence?

Best case scenario ...

- Factors other than helmets much more important for reducing injury risk
 - separated bike routes, other route design factors
 - lower speeds – bikes & motor vehicles
 - bike lights

Worst case scenario ...

- Potential helmet harms?

Disbelief that there
might be policy harms

Surveys of cycling over time periods covering law change

- 74% drop in bike to school commuting (1985-2004) Australia
- 31% drop in bike to school commute share (1986-1996) Toronto
- 25% drop in bike to work commuting (1991-96) New Zealand
- 18% drop in commuter cycling in Manitoba (2011-2016)
- 4-5% drop in youth cycling, US states with child laws
- 9%-21% drop in youth cycling in PEI, no change in adults (2001-3)
- 27-56% drop in child & youth cycling in Alberta (2000-6)
- no drop in commuter cycling in NS (1996-2001), PEI (2001-6), Nfld (2011-2016)

TinTin et al., 2009; Lewis et al., 2007; Buliung et al., 2009; Carpenter & Stehr, 2011; Karkhaneh, 2011; Dennis et al., 2010

Helmet laws reduce some cycling – survey evidence



Changes in non-head injuries after helmet law introduced

- 22-40% drop in other injuries, Victoria Australia
- 14% drop in other injuries, Victoria Australia
- 19% drop in other injuries, NSW Australia
- unquantified drop in other injuries, New Zealand
- 14% (Ontario), 16% (NB), 24% (BC) drops in other injuries
- 14% drop in other injuries, California
- 9% drop in non-head injuries, 16 US states
- no drop in other injuries (AB)

Vulcan 1992; Cameron et al., 1994; Olivier et al., 2013; Scuffham et al., 2000; MacPherson et al., 2002; Karkhaneh et al., 2013; Lee et al., 2005; Markowitz & Chatterjee, 2013

Helmet laws reduce some cycling – "other injury" evidence

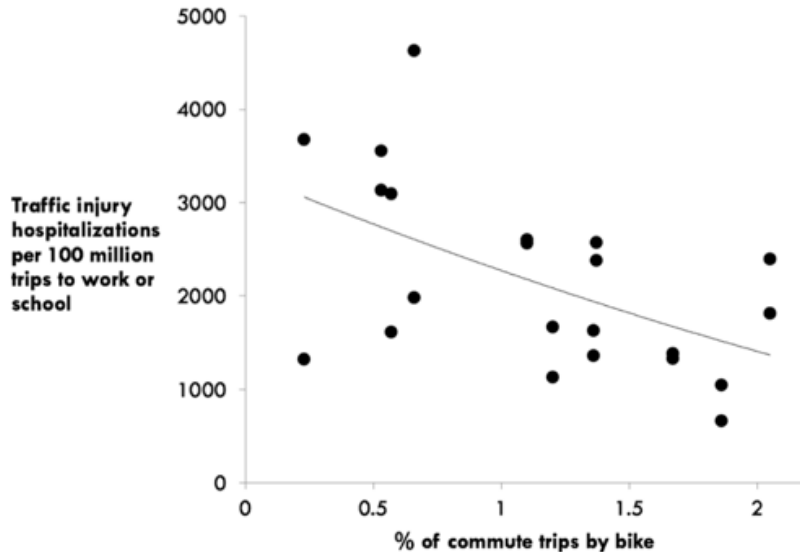




Photo: Ken Ohrn

Missed physical activity benefits

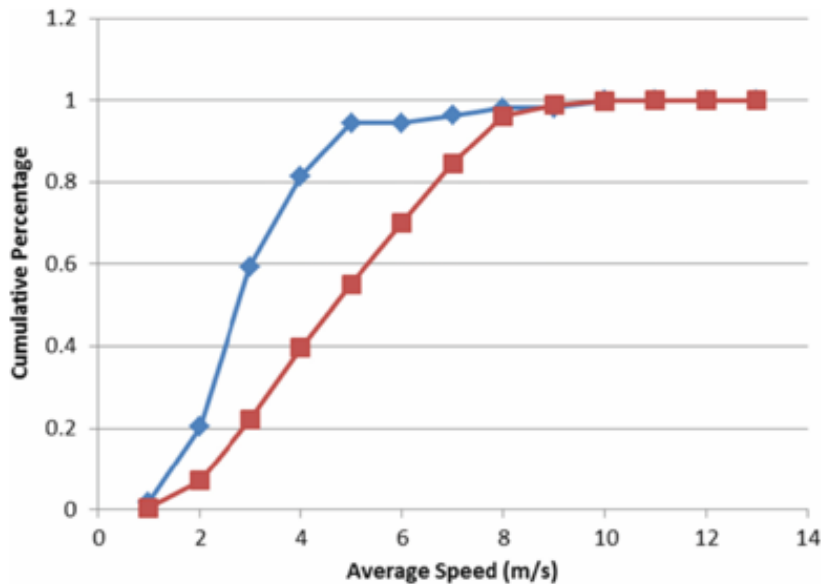
Two effects of reduced cycling



“Safety in numbers” lost

Risk compensation ...

- helmet wearers ride faster



- ◆— No helmet, average speed 11 km/h
- Helmet, average speed 17 km/h

Helmets may increase risk of being in a crash

Zaki et al., 2013; Messiah et al., 2012; Phillips et al., 2011; Walker et al., 2014; Palmer et al., 2014



Photo: Amo la bicicleta

Risk compensation ...

- drivers pass closer to helmet wearers

Helmets may increase risk of being in a crash

Zaki et al., 2013; Messiah et al., 2012;
Phillips et al., 2011; Walker et al.,
2014; Palmer et al., 2014



- Risk compensation ...
- mountain biking has higher injury risk ($\sim 4x$)

Helmets may increase risk of being in a crash



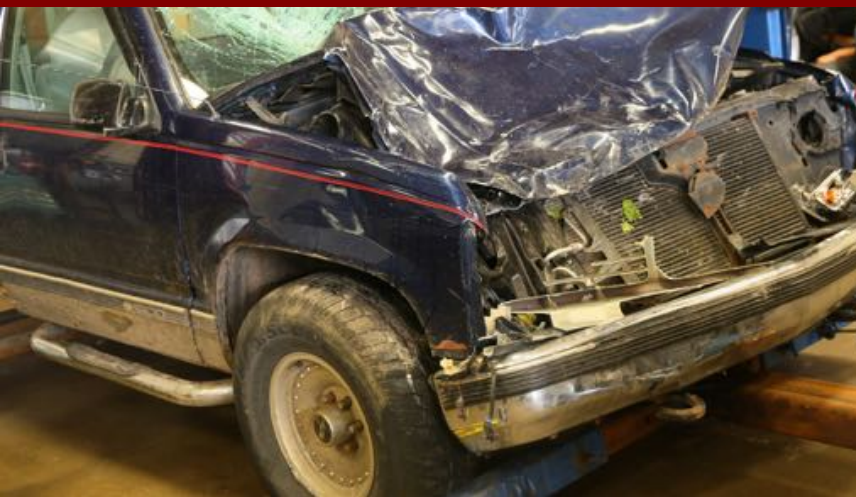
Photo: Velosurance

Zaki et al., 2013; Messiah et al., 2012;
Phillips et al., 2011; Walker et al.,
2014; Palmer et al., 2014

Photos: Mark Bugnaski, Mlive, AP



Over-selling injury mitigation potential of helmets?





Very different approaches to "highway" riding



Helmet law choices

← helmet law choices →



If in a crash,
odds of head
injury

active

quiet

no air emissions

negligible injury
risk to others

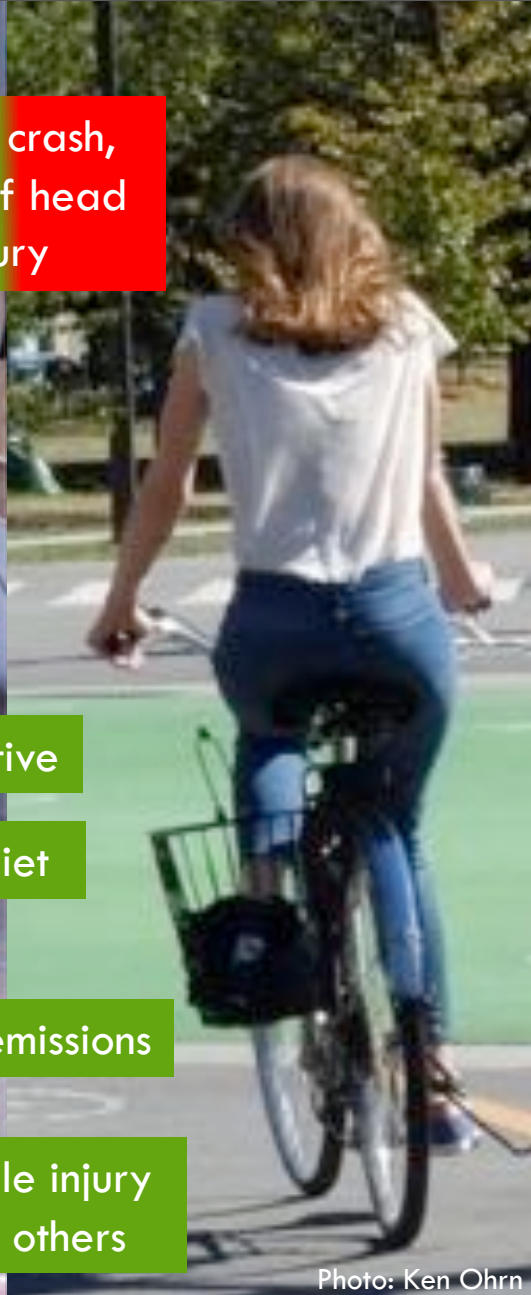


Photo: Ken Ohrn



sitting

noise

air pollution

greenhouse gases

injury risk to
other road users

many other factors affect injury risk



If in a crash, odds
of head injury

All injury risk
street / bike lane

All injury risk
fast / slow riding



A public health success story?

Only one of these is illegal in BC & the maritimes ...



... only one is good for your health & public health