Safe cycling: How do risk perceptions compare with actual risk?

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University of British Columbia, University of Toronto, Toronto General Hospital, Toronto Western Hospital, St. Michael’s Hospital, St. Paul’s Hospital, Vancouver General Hospital
Fatality & injury rates – per distance travelled

differences in cycling injury rates - Europe & NA

[Data sources: International - Pucher & Buehler Transport Reviews 2008;28:495-528
safety is a deterrent (Winters et al, 2010)

- Metro Vancouver, 1,400 current and potential cyclists

“How does the following factor influence your decision to cycle?” (73 factors)

Top 10 deterrents
- route is icy or snowy
- street has a lot of car, bus, & truck traffic
- vehicles drive faster than 50 km/hr
- route has glass or debris
- risk from motorists who don't know how to drive safely near bikes
- risk of injury from car-bike collisions
- raining
- route has surfaces that can be slick when wet or icy when cold
- route is not well lit after dark
- need to carry bulky or heavy items
risk perceptions of different modes (Noland et al, 1995)

- Philidelphia, n=506 responses from general population + bicycle clubs, commute mode: 14% by bicycle, 65% by car, 7% walk, 14% by transit.

- “rate how likely YOU think it is for you to be in an accident, during the next five years, if you used [mode] for commuting to or from work or school”

<table>
<thead>
<tr>
<th>Mode</th>
<th>Likelihood</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle</td>
<td>4.16</td>
<td>~50% chance of having an accident</td>
</tr>
<tr>
<td>Auto</td>
<td>2.92</td>
<td>~ somewhat unlikely</td>
</tr>
<tr>
<td>Walking</td>
<td>2.85</td>
<td>~ very unlikely to have an accident</td>
</tr>
<tr>
<td>Transit</td>
<td>2.34</td>
<td></td>
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- even the cyclists rated cycling as the highest risk
why focus on perceptions?

• decisions to cycle may be guided more by perceptions than injury data

• risk perceptions are influenced by:
  • the probability of an adverse event (e.g., the risk of a crash)
  • and the magnitude of the consequences (e.g., the severity of the injury)

• perceived reductions in risk may have greater than proportional effects on encouraging or discouraging cycling

• discordance between what is safe based on empirical evidence versus public perception, suggests that even if protective infrastructure is built people may choose not to cycle

• goal: to compare the perceived and observed injury risk of route types
Bicyclists’ Injuries & the Cycling Environment
participating cities

Toronto
  • 2.5 million people, 1% of trips by bike
  • snow in winter, heat in summer
  • 3 participating hospitals

Vancouver
  • 0.6 million people, 4% of trips by bike
  • rain in winter, temperate summer
  • 2 participating hospitals
study overview

- Cyclist to emergency department
- Interview
- Site observations
- Data analysis
interview to map route & choose control sites
observed relative risk

injury site

control site 1

control site 2

SITE OBSERVATION FORM

1. Instructions & Site ID

2. Description of the scene to be described:

3. Site study:

4. Site observations:

5. Site conditions:

6. Site limitations:

7. Site recommendations:

8. Site conclusions:

9. Site additional notes:

control site 1

control site 2
perceptions of risk

“how safe do you think this site was for cyclists on that trip?”
- very safe (1)
- somewhat safe (0.5)
- neither safe nor dangerous (0)
- somewhat dangerous (-0.5)
- very dangerous (-1)

n=1380 control sites
study results
participants & trips

- Toronto 273
- Vancouver 417

- male 59%
- 19 to 39 years old 62%
- income > $50,000 56%
- cycle > 52 times/year 88%
- trip < 5 km 68%
- weekday, daylight 77%

} 690
perceived risk

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<tr>
<th>Route type</th>
<th># Sites</th>
<th>Mean Perceived risk</th>
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<td>Major street with shared lane &amp; no parked cars</td>
<td>19</td>
<td>-0.21</td>
</tr>
<tr>
<td>Major street, with parked cars</td>
<td>265</td>
<td>-0.07</td>
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<td>Major street, with no parked cars</td>
<td>232</td>
<td>0</td>
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<tr>
<td>Major street with shared lane &amp; parked cars</td>
<td>11</td>
<td>0.09</td>
</tr>
<tr>
<td>Sidewalk</td>
<td>82</td>
<td>0.1</td>
</tr>
<tr>
<td>Cycle track</td>
<td>19</td>
<td>0.18</td>
</tr>
<tr>
<td>Major street with bike lane &amp; parked cars</td>
<td>54</td>
<td>0.23</td>
</tr>
<tr>
<td>Residential street designated bike route</td>
<td>100</td>
<td>0.25</td>
</tr>
<tr>
<td>Major street with bike lane &amp; no parked cars</td>
<td>109</td>
<td>0.26</td>
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<tr>
<td>Multiuse paths, paved</td>
<td>89</td>
<td>0.36</td>
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<tr>
<td>Residential street designated bike route, with traffic calming</td>
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<tr>
<td>Bike only path</td>
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Response frequency: How safe is this site? From 1: very safe; -1: very dangerous.
### Perceived Risk

**Route type**

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*# Sites* reflects the number of sites evaluated for each route type. The *Mean Perceived Risk* is calculated from 1: very safe; -1: very dangerous.
perceived risk

Route type | Response frequency: How safe is this site? | # Sites | Mean Perceived risk
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Major street with shared lane & no parked cars | | 19 | -0.21
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Residential street | | 222 | 0.44
Multiuse paths, unpaved | | 22 | 0.66

Increasing perceived risk

Very dangerous | Somewhat dangerous | Neither safe nor dangerous | Somewhat safe | Very safe
perceived risk

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Increasing perceived risk

Response frequency: How safe is this site?

# Sites: Number of sites for each route type.

Mean Perceived risk:
- 1: very safe;
- 1: very dangerous
observed risk (relative risks) by route type

Major streets with parked cars
- no bike infrastructure
- shared lane
- bike lane

Major streets, no parked cars
- no bike infrastructure
- shared lane
- bike lane

Local streets
- no bike infrastructure
- bike route
- bike route with traffic diverters
- bike route with traffic slowing

Separated from traffic
- sidewalk
- multiuse path, paved
- multiuse path, unpaved
- bike only path
- cycle track
are safe routes *perceived* as safe?
observed risk vs. perceived risk

- High observed and perceived risks
- Low observed and perceived risks
- Higher observed than perceived risk
- Lower observed than perceived risk

Legend:
- High observed/low perceived
- Low observed/high perceived
- Higher observed than perceived
- Lower observed than perceived

Graph showing observed relative risk vs. perceived risk with different risk categories and their respective locations on the graph.
discrepancies
perceived risk higher than observed risk

people overestimate the risk….

observed risk (OR = 0.12) – nearly 1/10th the risk of major streets with no cycling infrastructure

perceived risk – moderate (0.18) – “neither safe nor dangerous”

unfamiliarity?
cycle tracks are relatively rare in North America
discrepancies
perceived risk lower than observed risk

people underestimate the risk….

observed risk-unpaved OR = 0.63
-paved OR = 0.75
(compared to major streets with no cycling infrastructure)

perceived risk
-unpaved - the safest type (0.66)
-paved “somewhat safe” (0.36)

safety considerations focused on motor vehicles?
- not taking into account crashes with pedestrians, other cyclists, animals, or from slippery surfaces or infrastructure?
limitations

severity of injury
• perceived “risk of any injury” versus “risk of severe injury”
• all injured had attended emergency department within 24 hours
• evidence elsewhere that the most severe injuries and fatalities result from crashes with motor vehicles

safety of “the site”
• responses interpreted as related to route infrastructure
• cannot know if the response reflected other factors (e.g., traffic speed, volume, weather)
• does not address safety related to personal crime, bicycle theft, or health risk from air pollution exposure
conclusions

generally good alignment between perceptions and observed safety
• separated routes > residential routes > major streets

misconceptions around some separated routes
• perceived risk for cycle tracks overestimated observed risk
• perceived risk for multiuse paths underestimated observed risk

education and media may be useful tools to align public opinion with evidence on observed risk
thanks to everyone

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• David Tomlinson
• Barbara Wentworth

study funders

BICE Study

• Canadian Institutes of Health Research
• Heart and Stroke Foundation

Photos by BICE Study, Cycling Embassy of Denmark, Martin De, Calvin Ge, Imelda Wong, Glenys Webster, Dave Bryson (The Tyee)