

Evidence *reviews*

RESEARCHING AND PREVENTING DISEASES CAUSED
BY HAZARDS IN OUTDOOR & INDOOR ENVIRONMENTS.

The impact of transportation infrastructure on bicycling injuries & crashes: a review of the evidence

Conor Reynolds, Anne Harris, Kay Teschke, Peter Cripton and Meghan Winters

Background

Bicycling has the potential to improve fitness, diminish obesity, and reduce noise, air pollution, and greenhouse gases associated with motor vehicle travel. However, bicyclists have a greater risk of crashes and injuries requiring hospitalization than do motor vehicle occupants. In addition, concerns about safety have been shown to influence people's willingness to choose cycling for transportation. We believe that if bicycling could be made safer, more people would bicycle and this would benefit population health.

What we did

We reviewed all of the English language scientific literature that has examined how the basic facilities for transportation (infrastructure) affect the risk of injury to bicyclists. Two categories of infrastructure were identified: (a) intersections (e.g., roundabouts, traffic lights), and (b) "straightaways" between intersections (e.g., roads, bicycle lanes or paths). We included studies that examined the following outcomes: injuries; injury severity; and crashes (where a "crash" was defined to be a collision and/or a fall).

What we found

We found 23 papers suitable for our study. Eight examined intersections and 15 examined straightaways. These studies suggest that bicycle infrastructure is related to the risk of injury and the risk of crashing. These findings provide guidance about how transportation planners and policy-makers can improve cyclist safety.

The evidence suggests the following:

- Purpose-built bicycle-only facilities (i.e., bicycle lanes and paths) have the lowest risk of crashes and injuries. The risk is lower than cycling on-road with traffic and off-road with pedestrians, e.g. on sidewalks or multi-use paths.
- Minor roads have lower injury risks than major roads.
- Sidewalks and unpaved off-road trails have the highest risks.
- At intersections, multi-lane roundabouts are more hazardous to cyclists than other types of intersections, unless separated cycle tracks are provided.
- Street lighting, paved surfaces, and low-sloped grades are additional factors that seem to improve cyclist safety.

Although the effect of road and intersection design on cyclist safety was first studied more than three decades ago, we were surprised at how few studies examined these relationships. The conclusions are limited by the incomplete range of straightaway and intersection facilities studied previously and by difficulties in interpretation because facilities with different risks were often categorized together (e.g., any off road path, paved or unpaved, bicycle-only or multi-use) and not well described. Future research should examine a greater variety of clearly defined infrastructure. It should take into account how often people cycle on each type of infrastructure and confounding factors, such as cycling experience, age and sex.

Implications

Improvements to bicycling infrastructure in North America could make cycling safer, and evidence is beginning to accumulate for guidelines to accomplish this. The major advantage of infrastructure-based improvements, compared to personal protective devices such as helmets, is that safe infrastructure provides population-wide prevention of injury that does not require action by individuals or repeated reinforcement.

Considering that safety is a critical factor when people decide whether to cycle, creating safe facilities for cycling and the communication of safety improvements to the public should encourage more people to ride. Increased cycling will improve safety even further because evidence shows that, with cycling, there is “safety in numbers”. Improvements to infrastructure should not only prevent injuries and reduce their severity, but they should also result

in the ancillary benefits of active and sustainable transportation, including reductions in rates of chronic diseases such as diabetes, heart disease, lung disease, and cancer.

The authors are part of a research team that is studying the association between bicyclists’ injuries and the cycling environment in Vancouver and Toronto. See <http://www.cher.ubc.ca/cyclingincities/injury.html> for more information.

The full review has been published in the peer-reviewed journal *Environmental Health* and can be downloaded from <http://www.ehjournal.net/content/8/1/47>

The work was supported in part by the Bridge Program at the University of British Columbia, the Heart and Stroke Foundation of Canada, the Canadian Institutes of Health Research, the Transportation Association of Canada, and the Michael Smith Foundation for Health Research.

