



Mapping commuter cycling risk in urban areas

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ABSTRACT

Cycling is becoming an increasingly important transportation option for commuters. Cycling offers exercise opportunities and reduces the burden of motor vehicle travel on society. Mapping the risk of collision between cyclists and motor vehicles in urban areas is important to understanding safe cyclist route opportunities, making informed transportation planning decisions, and exploring patterns of injury epidemiology. To date, many geographic analyses and representations of cyclist risk have not taken the concept of exposure into account. Instead, risk is either expressed as a rate per capita, or as a count of events. Using data associated with the City of Hamilton, Canada, we illustrate a method for mapping commuter cyclist collision risk per distance travelled. This measure can be used to more realistically represent the underlying geography of cycling risk, and provide more geographically and empirically meaningful information to those interested in understanding how cycling safety varies over space.

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1. Introduction

With growing concerns over the rise in motorized vehicle use and its contribution to serious environmental, economic and public health problems, there has been a growing interest in the promotion of bicycles as an alternative form of transportation. Cyclists identify safety as one of their highest priorities in selecting a route for their trip (Winters et al., 2010a). Understanding the geography of safe cycling environments is important for safety-promoting interventions, but also for informing cyclists about their route options.

We present a method for better understanding geographic patterns of cyclist commuter risk by combining cyclist-motor vehicle collision data with a cyclist commuter travel model. This method can be used to make local estimates of the risk of cyclist-motor vehicle collisions as a function of both the number of collisions and the distance that cyclists travel in a given area. This risk-based approach provides an empirical perspective on the geography of cyclist commuter safety within urban areas. Risk models based on this method could be useful for transportation engineers and planners in determining the general location of safe bike routes, and evaluating the effectiveness of existing transportation infrastructure. It could also be used to provide cyclist commuters information about the safety of their current and prospective commuting routes. For researchers, the method described in this paper could be useful

for understanding the spatial equitability of safe cyclist commuting options, as well as offering a way for studying associations between neighbourhood-level environments and cyclists collision risk.

1.1. Representing geographical variations in cycling risk

Representing the geographical variations in the risk of cyclist collisions is not new. Existing ways of measuring collision risk can be divided into four categories: collision frequencies, collisions per capita, collision rates per cyclist, and collision rates per distance travelled. Below, we discuss each of these approaches, and evaluate their use for understanding the geographic variability of cyclist collision risk.

1.1.1. Cyclist collision frequency

The simplest way of representing the geographic distribution of cyclist collisions is to map the locations of collisions. Data on the location of collisions have been widely used to map cyclist and pedestrian collisions involving motor vehicles (Levine et al., 1995; Lightstone et al., 2001; Schuurman et al., 2009). Mapped locations provide a visual representation of the frequency of cyclist collisions in different areas, and when combined with street network data and other transportation infrastructure, these maps can be useful for visual identification of areas where cyclist collisions may frequently occur. GPS technology has greatly increased the precision of mapping these data, and is now regularly included in incidence report databases maintained by many emergency services. Methods of analyzing spatial patterns in point data—such as kernel density

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