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Comparison of cycling injury hospitalization rates in Canadian provinces with different helmet legislation and mode shares

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1 INTRODUCTION

International comparisons have shown that northern European countries where bike infrastrastructure and cycling are common and helmet use is rare have lower fatality rates than in North America where bike infrastrastructure and cycling are rare and helmet use is common. [1,2] However, there are many other transportation policy differences between these countries, making it difficult to draw conclusions. In Canada, cycling conditions, mode shares, and helmet laws differ across provinces, but there are broad similarities in most traffic safety policies, for example, default speed limits, intersection control, and drunk driving laws. This provides the basis for a within-country comparison of injury rates, useful for considering the value of certain cycling policies. This study compared exposure-based cycling injury hospitalisation rates across Canadian jurisdictions with different helmet legislation and commute mode shares (Figure 1).

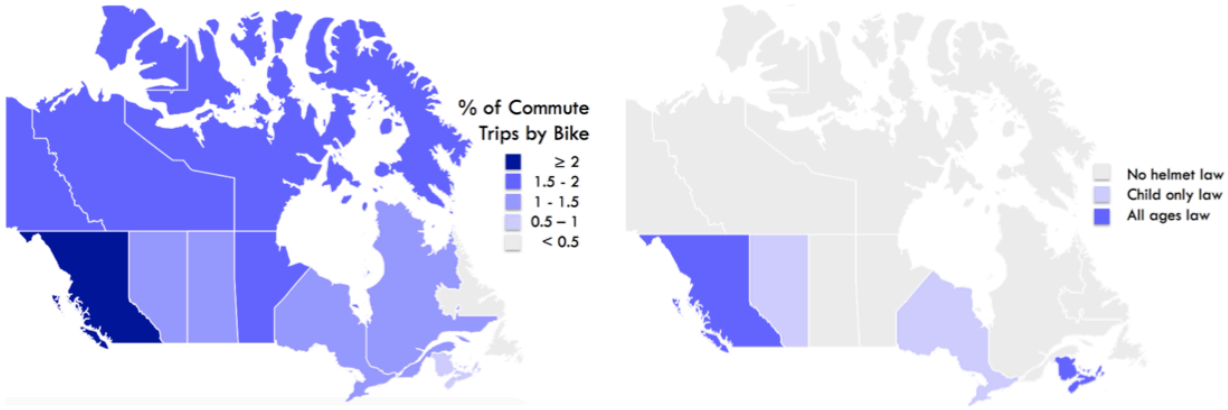

Figure 1. Maps of Canada showing % of commute trips by bike (left) and helmet laws (right) in the study period (2006-2011 inclusive).

2 METHODS

This study used administrative data on all cycling hospitalisations (from the Canadian Institute for Health Information) and on cycle trips (from the Canadian Community Health Survey) for the 6-year period from 2006 to 2011 inclusive. This period was chosen because it is bracketed by census years and represented a period of stability in helmet laws nationwide. The study was restricted to individuals aged 12 years or older because data on cycle trips were available only for these ages. Hospitalization rates were calculated for all causes for 44

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strata: 11 jurisdictions x 2 age groups x 2 sexes. Hospitalization rates were also calculated for traffic-related causes for 22 strata: 11 jurisdictions x 2 age groups. Inferential analyses compared hospitalization rates (logit-transformed) across strata to see if there were associations with the following characteristics: sex; age group (youth from 12 to 17 years old, adults 18+); helmet laws; and cycling commute mode share.

3 RESULTS AND DISCUSSION

There was an average of 3,690 hospitalizations per year for cycling injuries among youths and adults across Canada in the study period. About half of the injuries had traffic-related causes (that is, they occurred on public roads). There were an estimated 593 million cycle trips per year. The overall nationwide hospitalization rate was 633 per 100 million trips, but there was a great deal of variation in rates across strata.

3.1 Sex and Age Group

Figure 2 shows hospitalization rates for all causes and any body region, indicating whether the rate was for males or females. Females had consistently lower hospitalization rates than males (odds ratio (OR) = 0.45, 95% confidence interval (CI): 0.37, 0.53) in every province (represented by a column of rates in the figures). A lower injury risk for females has been observed in other transport modes, an effect thought to be related to a lower propensity for risk taking. For example, women have been found to cycle more slowly and to be less likely than men to ride on major streets without bike facilities, infrastructure that has been shown to have higher injury risk. [3-6] Age group (youths, adults) was not related to hospitalization rates.

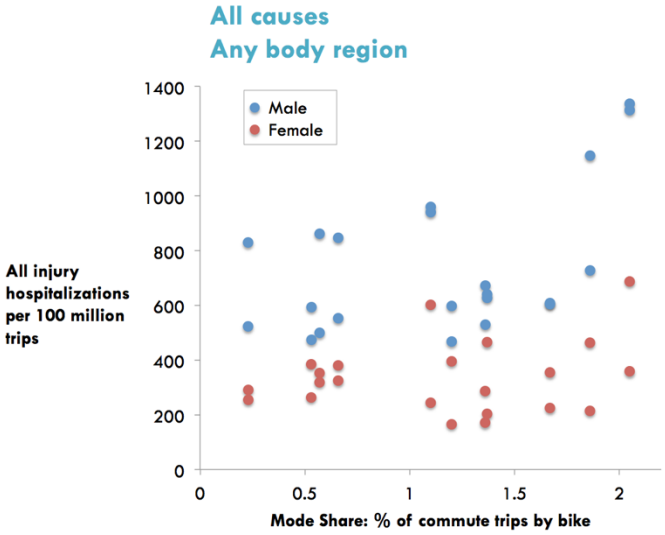

Figure 2. Hospitalization rates (all causes, any body region), 44 strata, highlighting male & female rates.

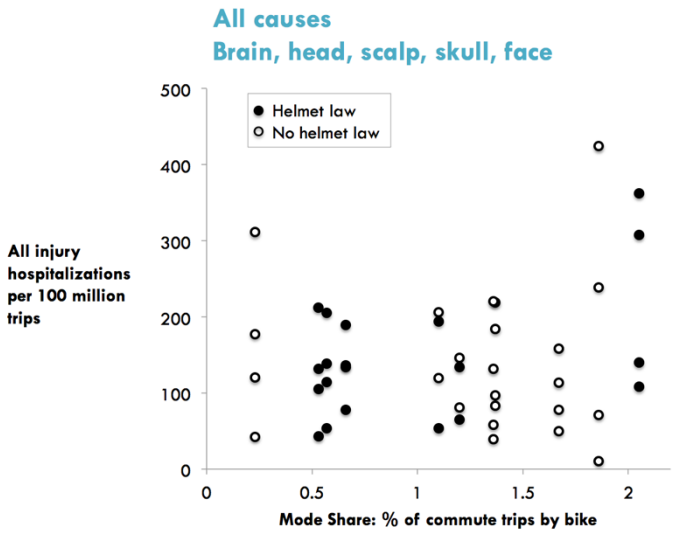

Figure 3. Hospitalization rates (all causes, head injuries), 44 strata, highlighting helmet law & no helmet law rates.

3.2 Helmet Laws

Figure 3 shows hospitalization rates for injuries to the brain, head, scalp, skull or face, and indicates whether the rate was for jurisdictions and age groups with helmet laws or not. Helmet laws resulted in consistently higher helmet use (67% on average vs. 39%), but there was no relationship with hospitalization rates (OR = 1.06, 95% CI: 0.78, 1.43). This was also true for traffic-related causes. A potential explanation for the lack of a helmet law effect is that our study examined head injury risk, which includes both the chance of being in a crash as well as the chance that the crash caused a head injury. Helmet use has been consistently shown to reduce the latter. [7] It is possible that helmet laws and helmet use may increase the chance of being in a crash via reduced cycling (thus reduced "safety in numbers") and via risk compensation (e.g., faster cycling, mountain biking). [8,9]

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3.3 Mode Share

Figure 4 shows that hospitalization rates for traffic-related injuries were lower with higher commute mode share (OR = 0.69, 95% CI: 0.49, 0.97). This phenomenon has been consistently observed and is called "safety in numbers", though the explanation could also be "numbers in safety" as safer bike infrastructure attracts more people to cycle. [8,10] We did not observe the same trend for all cause injury rates (Figure 2). Off-road mountain biking is very popular in some provinces and may have influenced all cause rates. Such injuries are not expected to be related to commute mode share.

4 CONCLUSIONS & POLICY IMPLICATIONS

These results indicate that cycling injury hospitalization rates were lower for females than males, and traffic-related injury rates were lower with higher commute mode shares. Head injury hospitalization rates did not differ in provinces with and without helmet laws. This suggests that policymakers interested in reducing injury rates would be wise to focus on factors related to higher cycling mode shares and female cycling choices. Bike routes physically separated from traffic or along quiet streets are a promising fit for both and are associated with a lower risk of injury. [1,3-6,10]

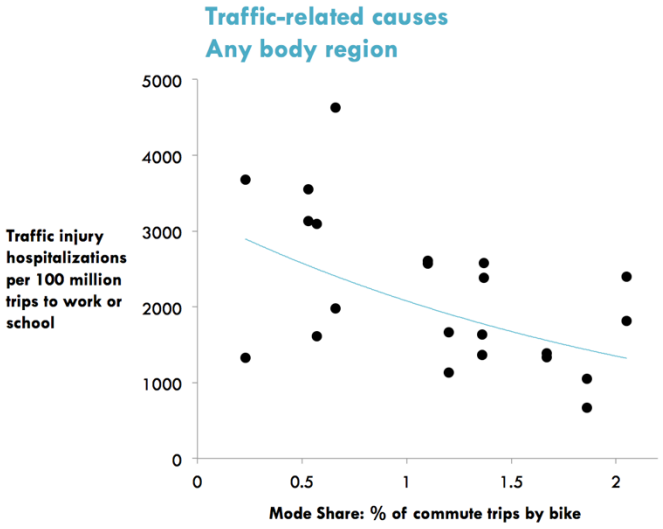

Figure 4. Hospitalization rates (traffic-related causes, any body region) vs. commute mode share, 22 strata

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