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Cycling injuries on streetcar or train tracks: causes & solutions

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1 INTRODUCTION

Tram or train tracks in urban areas are difficult for bicyclists to negotiate and are a cause of crashes and injuries. We studied bicycling injuries in Vancouver and Toronto, Canada, and found a three-fold increased injury risk on routes with tram or train tracks.[1,2] Vancouver has few tracks, but Toronto has the largest tram system in North America (80 km of two-way tracks) and 32% of the 276 injuries in that city directly involved tracks. [2]

2 METHODS

We used mixed methods to identify measures to prevent such crashes, by examining track-related crashes that resulted in injuries to cyclists, and obtaining information from the local transit agency and bike shops. We compared personal, trip, and route infrastructure characteristics of the 87 crashes in Toronto that directly involved tram or train tracks to 189 crashes in the city with other circumstances. The Chi^2 test (categorical independent variables) and t-test (continuous independent variables) were used to identify factors that differed between categories of the dependent variable: injury directly involved tram or train tracks *vs.* other or unknown injury circumstances. Variables that were significant in the bivariate analyses were offered to multiple logistic regression. We complemented this with engineering information about the rail systems, interviews of personnel at seven bike shops about advice they provide to customers, and width measurements of tires on commonly sold bikes.

3 RESULTS

This study included 276 people who were injured while cycling and attended one of the three participating Toronto emergency departments. Of these, 139 had crashes on routes where tram or train tracks were present and 87 of those had crashes that directly involved the tracks. Three of the people who crashed at a tram track location could not remember enough detail about their crash to determine if the tracks were directly involved; these were classified as having unknown circumstances. None of the study participants had a collision with a tram or train.

The vast majority of the track crashes (85%) resulted from the bike tire being caught in the rail flangeway (the gap in the road surface alongside rails). The rest (15%) involved slipping on the rail surface (more common in rain, fog, or snow conditions). None of the track crashes included collisions with other parties, but a common feature was sudden maneuvers to avoid collisions (mainly with motor vehicles, but also cyclists and pedestrians); these resulted in unanticipated track crossings or crossings at shallower angles than planned.

Track crashes were significantly more common on major city streets with parked cars and no bike infrastructure, less common on streets without car parking or with painted bike lanes, and did not occur on streets where tram lines had dedicated rights of way. Most of the crashes were at non-intersection locations (68%). In those at intersections (32%), the odds of a track crash was 40 times higher with left turns than with right turns or straight-through passage.

Track crashes were higher with racing bikes (tires typically < 30 mm wide) and with hybrid and city bikes (both typically sold with a broad range of tire widths: 26-56 mm). Commonly sold bikes usually had tire widths narrower than the smallest track flangeways (about 37 mm) and very few had tire widths wider than the widest track flangeways (about 50 mm). Bikes used by Toronto's bike share system had wider tires than most: 49.5 mm.

Women were over-represented in track crashes (60% female) compared to other crashes (37%) and compared to the Toronto cycling population (34%). [3] Younger adults (ages 20 to 39, 67%) were also somewhat over-represented in the track-involved crashes, but not significantly so compared to other crashes (62%). [3] Inexperience and less frequent cycling were associated with track-involved crashes, but those crashing on tracks were not especially inexperienced (average cycling frequency of 123 trips per year).

4 CONCLUSIONS & POLICY IMPLICATIONS

Given our results, prevention efforts might be directed at individual knowledge, bicycle tires, or route design, but their potential for success is likely to differ. Certain demographics were more likely to have track-related crashes, suggesting that increased knowledge about how to avoid them might be helpful. For example, there is little information provided in training materials about the excess risk from tracks during left turns, so the value of two-stage left turns (as done by pedestrians or by cyclists using protected intersections) would be worth conveying.

Figure 1. Features of tracks, turning movements, and bike infrastructure related to track crashes

However a number of factors suggest education may not make a great difference. Most of the crashes were not at intersections and many resulted from sudden maneuvers to avoid collisions with motor vehicles, other cyclists and pedestrians, situations that did not allow prior knowledge to be used as planned. In addition, some cyclists (children, people with certain disabilities, or who do not speak English) may not be reached by or be able to implement guidance about tracks.

Using tires wider than tram or train flangeways could prevent some crashes, but this idea needs verification with field tests of different tire widths during bicycle and track interactions. This would be worthwhile research, but risky to participants. There are other considerations that lead many cyclists to have narrow tires.

To prevent track-involved injuries, route design measures including dedicated rail rights of way, cycle tracks (physically separated bike lanes), and protected intersections would be the best strategies. [1,4] Dedicated rail rights-of-way would have the added benefit of more efficient movement of the trams, likely attracting people to this mode of travel. Similarly, cycle tracks and protected bike lanes would have the added benefit of minimizing interactions with motor vehicles and this would attract many more people to cycle. These are policy measures concordant with a Vision Zero standard; they would prevent most of the track-involved injury scenarios observed in this study.

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