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Pedestrian injuries due to collisions with bicycles in New York and California

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ABSTRACT

Introduction: Scant attention has been given to pedestrians injured in accidents resulting from collisions with cyclists. This scholarly neglect is surprising given the growing popularity of cycling. This study examines the incidence of pedestrians injured by cyclists in New York between 2004 to 2011 and in California from 2005 to 2011. The study also profiles the pedestrians injured in these two states during these two time frames. *Method:* The data for this study are based upon patient-level hospital records from New York and California. The data for New York comes from the Statewide Planning and Research Cooperative System (SPARCS) under the auspices of New York State's Department of Health. The data for California come from two sources: the Healthcare Cost and Utilization Project (HCUP) and the California Office of Statewide Health Planning and Development. *Results:* The rate of pedestrians injured in collisions with cyclists has decreased over time. This decline has occurred despite the increase in the number of cyclists in these states during this same time period. Two possible explanations for this decline are: (a) less exposure of children to cyclists, and (b) improvements in the cycling infrastructure. *Practical applications:* Although the rate of injuries to pedestrians from collisions with cyclists has been decreasing, improvements to the cycling infrastructure will need to continue. Bike lanes, particularly protected bike lanes, have been shown to be an effective way of reducing cycling–pedestrian accidents. The results of the current study are consistent with this research. Educational campaigns aimed at cyclists that emphasize the safety of all road users – including pedestrians – will also need to continue to assure that this downward trend in the number of accidents is not reversed.

1. Introduction

While considerable attention has been paid to pedestrians injured in motor vehicle accidents, little attention has been accorded to pedestrians injured in accidents resulting from collisions with cyclists. A search of the literature reveals the existence of only one published study devoted to this topic (Graw & Konig, 2002). This single study provides data on the incidence of pedestrian–bicycle collisions in Germany for the three years from 1997 to 1999.

Given the growing popularity of cycling in many countries in Europe and North America, the lack of scrutiny concerning pedestrian–bicycle accidents is surprising. In the United States, for example, the number of bike commuters increased by 64% during the time span from 1990 to 2009. In Canada the number of bike commuters rose by 42% during the years from 1996 to 2006 (Pucher, Buehler, & Seinen, 2011). With many more individuals adopting cycling as an alternative means of transportation, the potential for collisions with pedestrians has also grown.

Considerable anecdotal evidence already exists that suggests that collisions between pedestrians and cyclists are a fairly common occurrence. The media are filled with stories about individuals being hit or being nearly hit by cyclists (Goodman, 2010; Kavanagh, 2012). Cyclists who disobey traffic laws by running red lights, riding against the flow of traffic, riding on sidewalks, etc. — have received extensive media coverage. Yet little systematic inquiry has been undertaken to either support or refute this anecdotal evidence. How frequently are pedestrians injured in collisions with cyclists? Has the incidence of injuries increased or decreased over time? What is the profile of pedestrians injured in accidents involving cyclists? Has this profile changed over time? The present study attempts to answer these questions based upon empirically-gathered data.

2. Materials and methods

This study rests upon patient-level hospital records from New York and California. These two states were selected for this study because of their population size and number of bike commuters. California and New York rank first and third, respectively, in terms of state population size. Moreover, in 2010, New York City ranked number one among U.S.

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cities in terms of the absolute number of bike commuters, and the State of California had five cities (Los Angeles, San Francisco, San Diego, Davis, and Sacramento) which ranked 3rd, 4th, 13th, 14th and 17th respectively, in terms of the absolute number of bike commuters (League of American Bicyclists, 2013).

The data for New York come from the Statewide Planning and Research Cooperative System (SPARCS) under the auspices of New York State's Department of Health. A basic description of SPARCS is provided on its website: "SPARCS currently collects patient level detail on patient characteristics, diagnoses and treatments, services, and charges for every hospital discharge, ambulatory surgery patient, and emergency department admission in New York State (New York State Department of Health, 2013)." The data for New York cover the years from 2004 (the first complete year in which emergency department data were collected) to 2011. A comparable data set for California was derived from two sources. The first source was the Healthcare Cost and Utilization Project (HCUP) consisting of inpatient data records for the years 2005 to 2011 and emergency department and ambulatory surgery data records for the years 2005 to 2008 (Agency for Health Care Research, Quality, 2013). (The year 2005 was the first year in which all three types of patient records were available.) The second source was the California Office of Statewide Health Planning and Development (2013) consisting of emergency department and ambulatory surgery records for the years from 2009 to 2011.

A key feature of both the New York and California data sets is the inclusion of the cause of the injury for each patient using the International Classification of Disease (ICD) code. One of the values of this ICD code is for patients who were injured in a pedestrian–cyclist accident (E826.0). This code pertains only to the pedestrians who necessitated medical treatment — not the cyclists.

For the New York data set, all "non-identifying" information (non-personal information) was attached to each patient's record. This information included both individual-level variables such as age, sex, race, ethnicity (Hispanic origin/non-Hispanic origin), principal diagnosis (not to be confused with the ICD code for cause of the injury), and geographic variables such as county, city, and zip code. The geographic variables refer to the patient's place of residence, not where the injury occurred. The California data set did not contain geographic variables.

To estimate the simultaneous effects of year, geographic location (New York State, New York City, California State), and demographic variables such as age, sex, and race on pedestrian injuries incurred in cycling accidents, two hierarchical regression analyses were performed. In the first analysis, the response variable was the rate of injuries sustained by outpatients and in the second analysis the response variable was the rate of injuries sustained by inpatients. Both analyses employed the same set of predictor variables. Year was an interval-level variable with values ranging from 0 (2004) to 8 (2011). To estimate the possible curvilinear effect of year on the injury rate, a year-squared term was also entered into the model as a predictor variable. Geographic location consisted of a set of two dummy-coded variables representing New York State (excluding New York City) and New York City by itself with California serving as the reference category. Age consisted of a set of two dummy-coded variables representing patients 0–14 years of age and patients 15–64 years of age with patients 65 years of age and older being the reference category. Sex was coded as a dichotomous variable with females serving as the reference category. Race was coded as a set of three dummy variables representing white non-Hispanic patients, black non-Hispanic patients, and Asian non-Hispanic patients with Hispanic patients being the reference category.

The injury rate for outpatients was calculated by first tallying the number of pedestrians injured in cycling collisions in a specific year in a specific geographic location belonging to a given sex, age, and racial group who were treated as outpatients. This figure was then divided by the corresponding total population figure (based on census data) for a specific year in a specific geographic location with the same demographic characteristics as the outpatients. This ratio was then multiplied by 100,000. A parallel calculation was undertaken to derive an injury rate for inpatients. Predictor variables were entered into both analyses in the following sequence: geographic location, year, year-squared, sex, age, and race. The entry of variables followed this sequence in order to control for the effects of location and time before examining the contributions of the demographic variables. Altogether, there were 552 cases included in each model.

A typology of body part injuries resulting from pedestrian–cyclist accidents was created using the following methodology. An ICD code was attached to each principal diagnosis that was reported 10 or more times in the emergency department (ED) visits. For inpatient and ambulatory visits, an ICD code was appended to each principal diagnosis that was reported three or more times. Employing these numerical criteria, 90.9% of the ED visits in New York and 85% of the ED visits in California were assigned ICD codes. Similarly, 71.2% of inpatient visits in New York and 62.3% of the inpatient and ambulatory visits in California were assigned ICD codes. Based upon these ICD codes, a classification of body part injuries from pedestrian–cyclist accidents was constructed with four categories: head and neck, shoulder and upper extremity, hips and lower extremity, and trunk. These same codes were also used to examine the severity of injuries to pedestrians involved in cycling accidents.

3. Results

In New York State, including New York City, there were 7904 pedestrian injuries from collisions with bicycles that were treated in a hospital between 2004 and 2011. Of this total, 54% were injuries incurred by residents of New York City. In California, the corresponding figure was 6177 injuries for the time span 2005–2011. In both states, the overwhelming majority of individuals who sustained these injuries were treated as outpatients (approximately 92% in New York and 91% in California).

In both New York State (excluding New York City) and New York City by itself, the incidence of pedestrian injuries from collisions with bicycles tends to incline upwards from 2004 to 2008 and then spiral downwards from 2008 to 2011. As Table 1 shows, the rate per 100,000 population for New York State rises from 3.29 to 5.45 during the years 2004–2008 and then drops to 3.78 by 2011[1]. In New York City, the rate climbs from 4.26 in 2004 to 7.54 in 2008 and thereafter falls to 6.06 in 2011[2]. In California, the rate is stable between 2005 and 2007 (2.68 - 2.63), but then also drops in the most recent years to a consistently lower level. The rates for each location are displayed graphically in Fig. 1.

The demographic characteristics of pedestrians injured by cyclists are shown in Table 2. In all three locations males have consistently higher rates than females. The incidence of injuries to individuals 0 to 14 years of age is, by far, the highest among the age groups. There does not appear to be any consistent pattern across the three locations in terms of race/ethnicity, except to note that non-Hispanic blacks have higher rates in New York State and non-Hispanic whites have higher rates in New York City.

Importantly, an analysis of the data reveals that in each geographic area the pedestrian injury rate for patients in the youngest age group (0 to 14 years of age) underwent a decline over time. A comparison between the injury rate for the time period 2004–2006 with the rate for the period 2009–2011 shows that the rate for the youngest age

[1] Unless otherwise noted, text, tables and graphs pertaining to New York State mean the entire state not including New York City.

[2] The rates for New York State and New York City are based on the county of residence of the injured pedestrian, not necessarily the county where the injury occurred. This is potentially a problem in New York City due to the influx of tourists and workers. The data set for New York City, however, also includes the county of the medical facility where the patients were treated. Using this information as a surrogate measure for the county where patients were injured, the results closely parallel those in Table 1.