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Safe Routes to Play? Pedestrian and Bicyclist Crashes Near Parks in Los Angeles

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ABSTRACT

Background: Areas near parks may present active travelers with higher risks than in other areas due to the confluence of more pedestrians and bicyclists, younger travelers, and the potential for increased traffic volumes. These risks may be amplified in low-income and minority neighborhoods due to generally higher rates of active travel or lack of safety infrastructure. This paper examines active travel crashes near parks and builds on existing research around disparities in park access and extends research from the Safe Routes to School and Safe Routes to Transit movements to parks.

Methods: We utilized the Green Visions Parks coverage, encompassing Los Angeles County and several other cities in the LA Metropolitan area. We used negative bionomial regression modeling techniques and ten years of geolocated pedestrian and bicyclist crash data to assess the number of active travel injuries within a quarter mile (~400 m) buffer around parks. We controlled for differential exposures to active travel using travel survey data and Bayesian smoothing models.

Results: Of 1,311,736 parties involved in 608,530 crashes, there were 896,359 injuries and 7317 fatalities. The number of active travel crash injuries is higher within a quarter-mile of a park, with a ratio of 1.52 per 100,000 residents, compared to areas outside that buffer. This higher rate near parks is amplified in neighborhoods with high proportions of minority and low-income residents. Higher traffic levels are highly predictive of active travel crash injuries.

Conclusions: Planners should consider the higher risks of active travel near parks and the socioeconomic modification of these risks. Additional traffic calming and safety infrastructure may be needed to provide safe routes to parks.

1. Introduction

Walking, jogging, and bicycling, can reduce the risk of cardiovascular disease, diabetes, breast and colon cancer, dementia, and depression (Woodcock et al., 2009). Walking and biking for transportation can assist in meeting recommended physical activity and with reducing burdens caused by motor vehicles (de Nazelle et al., 2011; Sanders et al., 2012). As such, there have been increased efforts to promote active and multimodal transportation.

Safe Routes to School and Safe Routes to Transit encourage physical activity and reduce the risks faced by pedestrians and cyclists accessing important public spaces (Safe Routes to School, 2012; Ragland et al., 2014; Weinzimmer et al., 2015). Parks, like schools and transit, are valuable public amenities that should be accessible for pedestrians and bicyclists (hereafter active travelers). Active travelers tend to be more vulnerable to motor vehicle crashes and subsequent injuries (Cooper et al., 2008; Beck et al., 2007; Grembek, 2012). Parks are places that tend to be relatively free from conflict with motor vehicle traffic and, therefore, may be safer in terms of traffic safety and exposure to air pollution, which may also make it more comfortable and pleasant for physical activity (Su et al., 2011). Ensuring that people have "Safe Routes to Play" could encourage physical activity and provide safe, equitable access to parks for pedestrians and bicyclists.

Neighborhoods surrounding parks could pose a higher risk of

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crash injury or death as it may be an area that attracts more vulnerable road users. Areas near parks may host more young active travelers. Children suffer pedestrian injuries at a higher rate than the adult population (American Academy of Pediatrics, 2009). Child pedestrian injuries tend to occur while playing or walking to destinations (Karsch et al., 2012). In some situations, children are more likely to walk or bicycle to a neighborhood park than other destinations in an area (Pont et al., 2009).

Moreover, active travelers, in general, are more vulnerable without the appropriate infrastructure. Parks in urban areas might be surrounded by high capacity roads and parks with recreation facilities may attract higher volumes of motor vehicle traffic, thereby, increasing the exposure of active travelers in the neighborhood to traffic (Byrne and Sipe, 2010). It is also reasonable to conjecture that there may be a spatial-temporal relationship between active travel by children and adults as well as motor vehicle trips around parks. An after-school soccer tournament, for example, is likely to draw large numbers of neighborhood walkers or bicyclists and regional traffic simultaneously. Much like school zones, motor vehicle and active travel conflict may be greater certain days and times.

Research also suggests an elevated risk of crash injury for pedestrians and cyclists in low-income and minority neighborhoods (Laflamme and Diderichsen, 2000; Durkin et al., 1994). Higher active travel rates and greater motor vehicle volumes are important components of crash risk in any neighborhood. People may walk more in lower income neighborhoods. Pedestrian crashes tend to be negatively associated with income and walking trips negatively associated with income (Karsch et al., 2012). Low-income and minority neighborhoods have more vehicle kilometers traveled (Gunier et al., 2003), which increases the risk to pedestrians and bicyclists (Houston et al., 2004). In Montreal, pedestrian and cyclist injuries are heightened in low-income neighborhoods, but this association is attenuated after accounting for higher numbers of pedestrians and cyclists exposed to greater volumes of motor vehicle traffic (Morency et al., 2012).

Parks in low-income or minority neighborhoods also have a higher proportion of people to park-acres and may be more congested (Sister et al., 2010). Parks with a higher potential for congestion may have more active travelers and motor vehicles converging on the same space. Therefore, the risks may be heightened in park areas and, in particular, low income or minority park areas.

To our knowledge, there is no existing research comparing the active travel crashes near public parks and in other areas. In Southern California, many people live within a quarter-mile (ten to fifteen minute) walk or bicycle ride of a public park and the Mediterranean climate allows for year-round outdoor physical activity (Su et al., 2011). This study examines active travel crashes near parks in Southern California by comparing crashes occurring within one-quarter mile of a park to crashes outside that buffer. We separately look at crashes near parks in low-income and minority neighborhoods, where rates of active travel and infrastructure provision may differ from the rest of the region. We control for exposure to active travel as well as exposure to traffic using travel survey data and estimated vehicle kilometers traveled.

2. Objectives

In this context, we sought to address the following research objectives:

1. To determine if pedestrian and bicyclist crash injuries occur at higher rates in park-adjacent neighborhoods compared to the rest of the Los Angeles study area.
2. To identify if demographic characteristics predict crash injuries for active travelers after controlling for population, motor vehicle traffic, and the rate of active trips.
3. To assess if there is an amplified effect of park proximity for active crash injuries in low-income and minority neighborhoods after controlling for population and the rate of active trips.

We hypothesized that the number of crash injuries for pedestrians and bicyclists would be elevated near parks. We further hypothesized that the number of crash injuries in park-adjacent neighborhoods with a high proportion of low-income and minority residents would be significantly higher than park-adjacent neighborhoods in less disadvantaged neighborhoods.

3. Data and methods

3.1. Overview

The risk of injury to active travelers is influenced by the behavior of drivers, pedestrians, and cyclists traveling there as well as any risks that may stem from the built environment (e.g., pedestrian facilities, traffic calming devices). Two places with similar physical features and traffic volumes may see different levels of active traveland therefore have different absolute numbers of crash injury and fatality but similar rates. We used estimates of active travel and vehicle traffic kilometers traveled within each census tract of our study area to better isolate the effects of park proximity, race/ethnicity, and income on active travel crash injuries.

3.2. Study area and network buffer

We studied the area in the Green Visions Plan for 21st Century Southern California (GVP). The GVP encompasses most of Los Angeles county and parts of Orange and Ventura counties; it includes five watersheds: Los Angeles River, Calleguas Creek, Santa Clara River, San Gabriel River, and the Santa Monica Bay. The GVP area contains 1672 parks. We removed three large parks in the northern part of the study area that are not representative of urban parks (Angeles National Forest, Los Padres National Forest, and Vasquez Rocks Park) leaving 1669 parks. Parks in the GVP area were identified using a combination of field audits, available government digital maps, and private sector resources (see Sister et al., 2010 for details).

The GVP covers 2303 census tracts. We restricted the study area to those census tracts with reported travel survey data that could be used to estimate differential active travel exposure. The travel survey data is described below. Four additional census tracts within the GVP area were excluded from analysis for having zero residential population. The final analysis included 2249 census tracts covering 6097 km^2. Fig. 1 shows the study area and the 1669 parks in the Green Vision Plan.

We designated areas within one-quarter mile (or 402 m) of a park along the road network as park-adjacent. A quarter-mile network buffer is widely used in the urban park literature to define areas proximate to a park (e.g. Dill, 2004; Sister et al., 2010; Su et al., 2011; Wolch et al., 2005). A quarter-mile also represents approximately a ten to fifteen minute walk or a short bicycle ride for children and adults accessing a park from their homes. The GVP parks and the quarter-mile network buffer were created using ESRI's ArcGIS and data from the ESRI Business Analyst (ESRI) and TeleAtlas Dynamap 2000. Fig. 2 shows a quarter-mile network buffer around the Burns Park in Los Angeles. The buffer forms an irregular boundary around the park because it follows the road network.

Park and park adjacent areas account for approximately 18% of