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The effectiveness of installing a speed hump in reducing motor vehicle accidents involving pedestrians under the age of 21

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ABSTRACT

Pedestrian safety is a complex and pressing public health issue. Motor vehicle crashes are a leading cause of pedestrian injuries and fatalities and occur disproportionately in areas lacking environmental modifications. An increased number of pediatric trauma cases were treated at a children's hospital resulting from pedestrian-involved vehicle collisions near a middle school. Finding a lack of traffic calming measures and heavy pedestrian and vehicle traffic surrounding the middle school, the hospital championed an intervention to educate the school community on pedestrian safety and implement a speed hump adjacent to the school.

Incident data from a statewide database were collected to examine the number of collisions involving vehicles and child and adolescent pedestrians occurring 2.5 years before and 2.5 years after the installation of the speed hump. A 37.5% reduction in collisions was observed.

The reduced incidence of vehicle collisions with pediatric-aged pedestrians provides evidence in support of the preventive potential of speed humps. The hospital's success with this intervention exemplifies the academic-community partnership that hospitals should consider taking to align with the nationwide shift towards preventive medicine.

1. Introduction

Unintentional motor vehicle crashes are the leading cause of child and adolescent mortality in the United States (Center for Disease Control and Prevention, 2015). In 2014, 1 in 5 pedestrians under the age of 14 were killed as a result of vehicle collisions (Arbogast et al., 2014; National Highway Traffic Safety Administration, 2014). Child pedestrian injuries in the United States are even more common than fatalities, with almost 28,000 injuries in 2013 occurring among children under the age of 14 (National Center for Injury Prevention and Control, 2013). Pedestrian injuries are typically more severe than those sustained by motor vehicle occupants (Arbogast et al., 2014; Centers for Disease Control and Prevention, 2013). In 2011, there were approximately 3000 years of potential life lost before age 65 among victims of pedestrian-involved crashes (National Center for Injury Prevention and Control, 2011).

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Higher vehicular speeds increase the likelihood of a pedestrian being struck by a car and heighten the risk of severe injury (Centers for Disease Control and Prevention, 2013). Research demonstrates that if in the event of a collision vehicles are traveling approximately 20 miles per hour or less, pedestrians have a ninety percent chance of survival (Rothman et al., 2014). According to the Federal Highway Administration (FHWA), speed humps are a useful method for reducing vehicular speeds. The FHWA guide lists evidence-based Crash Reduction Factors, which give the expected decrease in collisions resulting from a specific traffic calming measure. Such measures include installing sidewalks, traffic signals, flashing beacons, and more. Speed humps have a Crash Reduction Factor (CRF) of 50, indicating that there is a 50% expected decrease in pedestrian involved collisions resulting from their installation (Ragland et al., 2014). Sidewalks have a CRF of 74, while traffic signals have a CRF of 38.

Speed humps are a common traffic calming measure in urban areas due to their proven effectiveness at reducing vehicle speeds and decreasing the incidence of collisions (Rothman et al., 2015). In a 2004 study, installing speed humps in a neighborhood led to a 53 – 60% reduction in the odds of children being struck by a vehicle (Tester et al., 2004). A more recent Canadian study analyzed 404 roadways with speed humps in over a period of 11 years and found an overall 22% reduction in pedestrian involved collisions, with a 44% reduction in collisions involving child pedestrians (Rothman et al., 2015). Similarly, a 2013 South African study introduced speed humps near 34 schools in two municipal cities and observed a 23% increase in pedestrian safety overall (Nadesan-Reddy and Knight, 2013). A review of traffic engineering measures including speed control, separation of pedestrians from vehicles, and increased visibility of pedestrians found a wide variety of results but concluded that roundabouts, sidewalks, and refuge were highly effective in reducing pedestrian crashes, with other measures such as pavement flashing lights requiring additional study (Retting et al., 2003). The review further purported the need to prioritize evidence-based countermeasures that align with available resources and are suitable to the setting.

In an effort to reduce the number of child and adolescent pedestrian-involved motor vehicle collisions (PMVC), the injury prevention program of a hospital championed the installation of a speed hump on a busy street near a middle school in Los Angeles. In the present study, we evaluate the effectiveness of this intervention. We hypothesize that the implementation of a speed hump will decrease the occurrence of injuries and fatalities among child and adolescent pedestrians, defined as any individual 0 to 21 years of age.

2. Methods

During bedside educational consults performed by the hospital's injury prevention program, which take place when traumatic and "preventable" injuries occur, an elevated number of Level 1 traumatic injuries resulting from PMVC near a middle school were observed. The injury prevention program then conducted a needs assessment investigating the traffic conditions surrounding the school.

The Statewide Integrated Traffic Records System (SWITRS), a database utilized by the California Highway Patrol to collect and process incident data, was used to gather PMVC data in the area immediately surrounding the middle school. Based on the incidence of pedestrian collisions in the region that was studied, the area was decided to be hazardous for young pedestrians. An intervention was subsequently implemented involving city and community engagement and the implementation of a speed hump.

A quasi-experimental pre and post study design was used to assess the impact of the speed hump. The number of PMVC involving pedestrians 21 years of age or younger was examined before and after the installation.

2.1. Data collection

Reports were generated from SWITRS for all pedestrian-involved collisions 2.5 years prior to and 2.5 years immediately following the installation of the speed hump. The analyzed area included one block east, west, north, and south of the school (Fig. 1). Inclusion criteria consisted of a collision between a motor vehicle and a pedestrian between the ages of 0 and 21 years in the defined region. The defined age range of the pediatric population varies; however, the American Academy for Pediatrics suggests that including adolescents up to age 21 is appropriate (Holroyd et al., 1988). Demographic data and fatal and non-fatal victim outcomes, as recorded

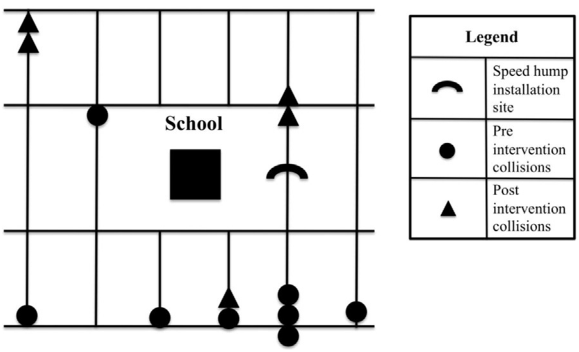

Fig. 1. The analyzed area surrounding the middle school where the speed hump was installed. Pre- and post-intervention incidents and speed hump location are displayed.