



Effect of a community-based pedestrian injury prevention program on driver yielding behavior at marked crosswalks



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ABSTRACT

Background: Few studies have comprehensively evaluated the effectiveness of multi-faceted interventions intended to improve pedestrian safety. “Watch for Me NC” is a multi-faceted, community-based pedestrian safety program that includes widespread media and public engagement in combination with enhanced law enforcement activities (i.e., police outreach and targeted pedestrian safety operations conducted at marked crosswalks) and low-cost engineering improvements at selected crossings. The purpose of this study was to estimate the effect of the law enforcement and engineering improvement components of the program on motor vehicle driver behavior, specifically in terms of increased driver yielding to pedestrians in marked crosswalks.

Methods: The study used a pre-post design with a control group, comparing crossing locations receiving enforcement and low-cost engineering treatments (enhanced locations) with locations that did not (standard locations) to examine changes in driver yielding over a 6-month period from 2013 to 2014. A total of 24,941 drivers were observed in 11,817 attempted crossing events at 16 crosswalks in five municipalities that were participating in the program. Observations of real pedestrians attempting to use the crosswalks (“naturalistic” crossing) were supplemented by observations of trained research staff attempting the same crossings following an established protocol (“staged” crossings). Generalized estimating equations (GEE) were used to model driver yielding rates, accounting for repeated observations at the crossing locations and controlling other factors that affect driver behavior in yielding to pedestrians in marked crosswalks.

Results: At crossings that did not receive enhancements (targeted police operations or low-cost engineering improvements), driver yielding rates did not change from before to after the Watch for Me NC program. However, yielding rates improved significantly (between 4 and 7 percentage points on average) at the enhanced locations. This was true for both naturalistic and staged crossings.

Conclusions: This study provides evidence that enhanced enforcement and low-cost engineering improvements, as a part of a broader program involving community-based outreach, can increase driver yielding to pedestrians in marked crosswalks. These data are important for the staff and decision-makers involved in pedestrian safety programs to gain a better understanding of the different engineering and behavioral mechanisms that could be used to improve driver yielding rates.

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1. Introduction

Injury, and in particular traffic-related injury, is a leading cause of morbidity and disability, resulting in a substantial loss of productive years and accounting for a considerable cost to the U.S. health system (Finkelstein et al., 2006). In both the U.S. and North Carolina (NC), pedestrians represent more than 13% of all motor vehicle crash (MVC) fatalities occurring on public roadways. According to the latest data available from the National Highway Traffic Safety Administration, 4743 pedestrians were killed in MVCs in the U.S. in 2012, and another 76,000 pedestrians were injured (National Highway Traffic Safety Administration, 2014). In NC, there are 2200 pedestrian-involved MVCs each year, resulting in between 150 and 200 pedestrian deaths and an additional 500 serious injuries (University of North Carolina, 2011). The Centers for Disease Control and Prevention (CDC) has recognized transportation-related injuries as one of public health's "winnable battles," and has identified pedestrian safety as a primary research area within transportation safety (Centers for Disease Control and Prevention (CDC), 2009).

A key injury research priority in the area of pedestrian safety is to evaluate the effectiveness of multifaceted strategies (e.g., those involving education/outreach, law enforcement, and changes to the built environment) to prevent pedestrian injuries (Centers for Disease Control and Prevention (CDC), 2009). Such research is needed to understand the effectiveness of pedestrian interventions and assist localities in planning and implementing such programs. However, to date there is limited research available that quantifies the effectiveness of multifaceted community-based pedestrian injury prevention interventions.

1.1. Prior research

Few evaluations of community-based pedestrian safety programs have been conducted using pedestrian injuries and/or crashes as the outcome. Most studies have examined the outcome of driver behavior, such as compliance with laws requiring that drivers yield (give way) to pedestrians using marked crosswalk ("yielding laws"). Only a handful of studies (described below) have evaluated the impact of multifaceted pedestrian safety interventions on behavioral driver outcomes, and the results from these studies have been mixed.

In an evaluation of an intervention involving law enforcement, engineering improvements, and a public information campaign in Shoreline, WA from 1999 to 2003, researchers used observations at two locations (with no control locations) (Nee and Hallenbeck, 2003) to quantify pedestrian crossing behaviors and driver yielding behaviors before and after the intervention. Driver yielding increased from 0% to 17–70%, likely due to the significant package of roadway improvements and pedestrian crossing facilities. Driver yielding increased on only one crossing of one intersection following enforcement, but enforcement intensity was noted to be limited.

A repeated measures study of driver behaviors before, during, and after a two-week long enforcement-oriented intervention (supplemented by an education/outreach component) was performed in Miami-Beach, FL (Van Houten and Malenfant, 2004). Unadjusted estimates of the percentage of drivers yielding at eight treated and twelve comparison locations for each measurement wave indicated that driver yielding increased from 3.3% and 18.2% at baseline to 27% and 33.1% at the two intervention locations, respectively. However, driver yielding at the untreated locations also rose by a similar amount, from 20.5% to 32.1%, which authors attributed to a spill-over effect of the high-visibility education component.

In Gainesville, FL, researchers randomized enforcement to six of 12 crosswalks and conducted repeated measures of driver and pedestrian behaviors (Van Houten et al., 2013a). Time-series regression models were used to estimate changes in observed driver and pedestrian behavior. Yielding to pedestrians was assessed using staged crossings (pedestrians were members of the research team following a standardized road crossing protocol) and rose from 31.5% to 62.0%, while yielding to real pedestrians (in naturalistic crossings) rose from 45.4% to 82.7%. Increases in driver yielding were also observed at crosswalks not targeted for enforcement and changes in yielding were inversely proportional to the distance from the treated crossings, suggesting a potential spill-over treatment effect.

In general, the studies above reported positive associations between the interventions studied and changes in driver yielding, particularly when the intervention used multiple components integrated in a cohesive program. However, the few studies that have used pre/post research designs with control groups typically did not utilize multivariate analysis methods to adjust for potential sources of confounding such as temporal/seasonal factors, time of day, and aspects of the built environment (e.g. crosswalk markings) that may influence driver yielding behavior.

1.2. "Watch for Me NC" intervention

In NC, a pedestrian safety intervention, "Watch for Me NC," was developed and implemented with the aim of reducing pedestrian crashes and injuries. Watch for Me NC is a community-based program involving a comprehensive set of education, outreach, and law enforcement measures. A key emphasis was to increase awareness of, and compliance with, laws requiring drivers to yield to pedestrians in marked crosswalks. The program was predicated on the concept that education and enforcement could modify driver and pedestrian behavior and therefore reduce pedestrian crash rates. The main components of the program were: (1) a widespread community-based media and local outreach campaign designed to increase awareness of pedestrian safety and related laws, and (2) a law enforcement program that involved educating police officers about pedestrian traffic laws and assisting them in enhancing pedestrian safety by implementing high-visibility enforcement activities and public outreach at selected crossing locations. "High visibility" enforcement typically involved an extensive effort by police to make the public aware of its enforcement operations, which may have included issuing press releases before or after an operation was conducted, using signs or banners at the location of enforcement, going door to door to alert local residents and business owners of enforcement plans, and other public outreach efforts. Additionally, a small number of low-cost engineering improvements (such as signage and pavement markings) were made at selected crosswalks in the same timeframe as the Watch for Me NC program delivery. A timeline of the Watch for Me NC program is provided in Table 1.

Details on the development and delivery of the Watch for Me NC are described elsewhere and can also be found on the program website, www.WatchforMeNC.org (Sandt et al., 2015).

The aim of this paper was to examine the effect of the enhanced high-visibility enforcement activities and low-cost engineering treatments components of the Watch for Me NC intervention. We hypothesized that driver yielding rates would be higher at the locations receiving enhanced enforcement and other treatments in comparison to the pre-intervention yielding rates at the same locations and the post-intervention yielding rates at "standard" enforcement locations (i.e., comparison locations that did not receive additional law enforcement operations or engineering improvements).

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