Establishing an Injury Prevention Program to Address Pediatric Pedestrian Collisions

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■ ABSTRACT
The implementation of a pedestrian safety education program in public schools can change the knowledge and beliefs about safe pedestrian behaviors among students and their parents or caregivers with the goal of reducing morbidity and mortality of children. WalkSafe is a well-established, multiphase pedestrian safety intervention program. This program has been shown to improve pedestrian safety knowledge of school-aged children in kindergarten through grade 5 after receiving a 3-day educational curriculum. A reduction in pediatric pedestrian struck injuries is anticipated following program implementation in an urban area with significantly increased incidence of such injuries.

■ KEY WORDS
Crashes, Morbidity, Mortality, Pedestrian, Pediatric, Trauma, WalkSafe

■ TOPIC
The US Department of Transportation “Traffic Safety Facts of 2007” reveals that crashes involving motor vehicles are the leading cause of death of children younger than 14 years.1 According to this report, there were 4,654 pedestrian fatalities nationally of which 354 involved children younger than 16 years.1 Twenty percent of these fatalities were children between the ages of 5 and 9 years.1 Of these pedestrian fatalities, approximately 80% occurred at nonintersection locations, 73% in urban areas, 90% in normal weather conditions, and 67% at night.1 Other related factors that contributed to pedestrian fatalities included the following: (1) improper crossing of roadway or intersection (20.7%); (2) walking, playing, working, and other activities in roadway (18.3%); (3) failure to yield right of way (16.3%); (4) not visible (10.6%); and (5) darting or running into road (9.7%).1

In 2007, Connecticut ranked 42 nationally for motor vehicle fatalities with 277 deaths of which 8 were children younger than 16 years.1 Pedestrian fatalities accounted for 11.2% of these deaths with another 40,100 individuals suffering nonfatal injuries.2 Although Connecticut's fatality rate of 0.9 per 100 million miles of travel is well below the national figure of 1.4 fatalities per 100 million miles of travel, the State's nonfatal injury pedestrian rate was 35 per 100,000 population compared with a rate of 20 nationally.2

A query of Yale-New Haven Hospital’s (YNHH’s) Trauma Registry (Trauma Base, Clinical Data Management, Denver, Colorado) shows that in 2007, approximately 10% of all evaluated motor vehicle–related crashes involved children younger than 16 years. Eighteen of these cases were classified as pedestrian-struck accidents. The numbers of motor vehicle crashes involving child pedestrians in New Haven, Connecticut,
represent a unique opportunity for intervention with the goal to reduce both morbidity and mortality.

**DEMOGRAPHICS**

New Haven is the third largest city in Connecticut (124,000 persons) and one of the most densely populated (6,558 persons per square mile). Compared with the other parts of Connecticut, its population is racially and socioeconomically diverse. Four times as many African Americans (37% vs 9%) and twice as many Hispanics (21% vs 9%) live in New Haven than live in other parts of the state. Children and adolescents comprise 25% of the city's population, and 30% of these are younger than 5 years.

**PURPOSE**

A prior 2002 study by Merrell et al examined pediatric pedestrian struck collisions with motor vehicles in New Haven, Connecticut, mapping them to census tracts and determining peak time periods and locations for traumatic injuries. The rate of pediatric pedestrian-struck injury was found to be more than twice the national average of 2.23 children per 100,000 compared with 1.11 per 100,000. Not surprisingly, children between the ages of 5 and 9 years were at highest risk, with most collisions occurring during the summer and during the afternoon.

There have been no subsequent studies performed in the New Haven area to evaluate pediatric pedestrian-struck collisions.

The high incidence of pedestrian injuries in the pediatric population that occur in the city of New Haven and require evaluation at these trauma centers is of concern. At YNHH, an American College of Surgeons–verified and Department of Public Health–designated level I adult and pediatric trauma center in New Haven, Connecticut, the overall mortality rate is only 4.3% if admitted from within the city limits as compared with the rest of Connecticut as a whole, which is approximately 10%. This decreased mortality rate is attributed to the proximity of level I trauma care and not to a decreased incidence of these injuries.

**REVIEW OF THE LITERATURE**

Miami-Dade County, Florida, has one of the highest rates of pediatric pedestrian-struck injuries in the country, ranking number 1 in the state and third in the nation. Recognizing the safety problem they were experiencing and the significant costs associated with injuries, Florida Department of Transportation partnered with the Ryder Trauma Center at the University of Miami's Miller School of Medicine to determine the causes, effect, and possible solutions to the high pediatric pedestrian injury rates. Hotz et al found that the majority of children injured were males, and 60% were African American. They also found that there were long intervals between marked intersections promoting vehicle acceleration and obstruction of driver view, which was also recognized as "dart-outs." To address these problems, WalkSafe, a formal educational school-based program for elementary school children from kindergarten through fifth grade, was developed in 2003 by the Ryder Trauma Center at the University of Miami School of Medicine/Jackson Memorial Medical Center. WalkSafe was implemented in 184 countywide elementary schools from 2002 to 2005. The postimplementation evaluation showed a decrease in the number of pediatric pedestrian injuries evaluated or admitted to the 2 level I trauma centers in Miami-Dade County and in the county overall. The total number of injuries evaluated or admitted dropped from 93 in 2002–2003 to 52 in 2005–2006.

**WALKSAFE PROGRAM**

The WalkSafe pedestrian education program (http://www.walksafe.us) is used to educate children and their caregivers regarding safe pedestrian behaviors. The usefulness of this program has been previously evaluated and demonstrates improved pedestrian safety knowledge of elementary school–aged children. This program has content-specific curricula for teachers and children in kindergarten through fifth grade and consists of classroom sessions, workbooks, videos, and simulations of pedestrian crossing scenarios. The WalkSafe curriculum takes about 3 months to complete and is taught to school administrators, physical education teachers, classroom teachers, and teacher’s aides in the beginning of the academic school year, so that the preassessment, intervention, and evaluation all occur within the same school year.

The WalkSafe program consists of a 5 “Es” approach: (1) education—a 3-day standardized curriculum taught in the classroom; (2) engineering—a partnership with local public work officials to evaluate high-risk areas and suggest potential engineering restructuring to prevent future accidents; (3) enforcement—a development or enhancement of partnerships with local police departments and associations to ensure enforcement of traffic-related issues around the school; (4) evaluation—validated survey tools utilized to examine safety-related issues from teachers, parents, and students; and (5) encouragement—a grassroots effort encouraging everyone in the community to uphold and support this child safety initiative. WalkSafe originally consisted of a 5-day educational program. Following teacher and other educational specialists feedback, the program was shortened to 3 days. The shorter version was implemented in a high-risk district and has since been evaluated. The 3-day program has shown to increase the pedestrian safety knowledge of elementary school–aged children.
However, behavioral changes from the knowledge gain have yet to be determined with the 3-day curriculum.7

**PROGRAM IMPLEMENTATION**

A prospective cohort study evaluating the usefulness of the WalkSafe program will be targeted in 3 New Haven public elementary school students enrolled in kindergarten through fifth grade. The YNHH Trauma Registry data revealed that in 2007, the New Haven zip code of 06511 represented the highest density of motor vehicle crashes involving child pedestrians. There were 28 children hospitalized for injuries sustained in these crashes. There are 3 New Haven public elementary schools within this zip code, Wexler-Grant, King-Robinson, and Katherine Brennan, which together have a school population of 1,200 children in prekindergarten through eighth grade. This school population represents a fixed audience in which a pedestrian safety educational intervention would likely increase knowledge of safe pedestrian behaviors and reduce the number of child collisions with motor vehicles in this area. Permission will be sought from the New Haven Public School’s Board of Education and the administrative staff of each school, and parents or caregivers of all potential program participants. Letters will be sent to all parents and caregivers, informing them of the study, its purpose, and what responsibilities of being a subject in the study entail. Those parents or guardians who are interested in participating in the study will then return a consent form to the study investigators, who will then contact all families to ensure that they have been appropriately informed and consent to have themselves and their children participate in the study. The parent or caregiver survey tools are available in English, Spanish, and Creole language versions. Inclusion and exclusion criteria will be determined by the parent or caregiver’s informed consent for participation. For those parents or caregivers who are unable to read, the questionnaires will be verbally administered in English or Spanish.

Children will be educated in safe pedestrian behavior, such as the best place on a block to cross the street; how old must one be before he or she can cross the street without an adult; what happens when someone gets hit by a car; the best time to cross at an intersection; and how one knows when it is safe to cross an intersection or the street. The WalkSafe program will be obtained.

Prior to the introduction of the educational intervention, a preintervention baseline assessment of the student’s and his or her parent or caregiver’s knowledge of safe pedestrian behaviors will be obtained 1 week prior to the start of the WalkSafe program. The enrolled subjects will then undergo a pedestrian safety educational intervention by utilizing the WalkSafe curriculum material appropriate for their grade level. The curriculum is hierarchically based to account for the different stages of children’s behavior and development of pedestrian skills.6–8,11 A posttest is administered on the last day of the program and again at 3 months after the end of the program.6–8,11 Safe pedestrian behavior skills among students are also assessed prior to implementation of the program and immediately after the completion of the program and again 3 months postcompletion. If the pedestrian demonstrated the correct behavior, it was considered positive conversely, and if the pedestrian demonstrated an incorrect or absent behavior, it was considered a negative behavior.6–8,11 Institutional review board and school board approval will be obtained prior to program implementation.

**BUDGET**

All educational materials for the WalkSafe program may be found at the WalkSafe Web site (www.walksafe.us) under the “Materials” section and are free of charge.9 A login ID and password are required to access materials and can be obtained after completing the “Contact Form” under the “Materials” section.9 Estimated costs to establish an injury prevention program to address pediatric pedestrian collisions can be located in Table 1.

**OUTCOME EVALUATION**

It is anticipated that the evaluation process of the WalkSafe program will demonstrate a significant increase in student and parent or caregiver knowledge of safe pedestrian behaviors. We anticipate a drop in the number of pedestrian struck collisions in the area that the WalkSafe program is implemented. Primary and secondary data sources will be tracked to monitor the incidence of pediatric pedestrian struck injuries in the greater New Haven area including the review of police department, emergency department trauma logs, and trauma registry data. Comparison data of pedestrian-motor vehicle crashes before and after implementation of the WalkSafe Program will be obtained.
Future data may provide information to support and evaluate increased law enforcement measures that will lead to reduced vehicle speeds, as well as infrastructure changes. It is anticipated that the attitudes of parents or caregivers will improve regarding the safety and security concerns related to walking to school.

**CONCLUSION**

Using the 3 main learning modalities (audio, visual, and motor) and arts projects, WalkSafe has shown to significantly increase the pedestrian safety knowledge of elementary school children. New Haven is the ideal location for implementation of this program, given the 2-fold incidence of pediatric pedestrian-struck injuries relative to the rest of the state and the increased incidence overall relative to national statistics. This outcome would complement the YNHH Trauma Department’s Injury Prevention program and the Injury Free Coalition for Kids of New Haven’s mission to (1) raise awareness of traffic safety issues and (2) build community support for an urgent and comprehensive strategy that will reduce the unacceptable number of traffic-related injuries and fatalities in New Haven. State data indicate that the streets of New Haven, Connecticut, are dangerous for children, and without additional measures to improve safety and walking, successes will be limited.

**REFERENCES**