Traffic Injury Prevention, 5:382–389, 2004

ISSN: 1538-9588 print / 1538-957X online
DOI: 10.1080/15389580490510507

Taylor & Francis
Taylor & Francis Group

WalkSafe: A School-Based Pedestrian Safety Intervention Program

GILLIAN A. HOTZ, STEPHEN M. COHN, ANDREA CASTELBLANCO, SHERIKA COLSTON, MARTIN THOMAS, ALYSSA WEISS, JACOB NELSON, ROBERT DUNCAN, and THE PEDIATRIC PEDESTRIAN INJURY TASK FORCE

Dewitt Daughtry Family Department of Surgery, Divisions of Trauma and Surgical Critical Care, and the Department of Epidemiology and Public Health (R.D), University of Miami School of Medicine, Miami, Florida, USA

Objective: *To evaluate the effectiveness of the WalkSafe program, an elementary school-based pedestrian safety program in a single high-risk district in Miami-Dade County.*

Methods: *Sixteen elementary schools were identified in a single high-risk district and enrolled in a one-year study. All schools implemented the WalkSafe program on the last week of January 2003. A pre, post, and three-month post testing of pedestrian safety knowledge was conducted. An observational component was also implemented at four schools that were randomly chosen. Engineering recommendations and law enforcement initiatives were also performed.*

Results: *A total of 6467 children from K–5th grade from 16 elementary schools participated in the program. Of these 5762 tests were collected over three different testing times. A significant difference (p-value < 0.001) was found between the pre and post testing conditions across all grade levels. There was no significant difference found between the post and three-month post testing conditions across all grade levels (p-value > 0.05). The observational data collected at four schools across the different testing times demonstrated a significant difference found between pre and post testing conditions for Group A (stop at the curb and look left, right, left) and also for Group B (midstreet crossing and darting out) (p-value $<$ 0.05). There was no difference found between comparing the pre-test or post-test condition with the three-month post-test time. There were many environmental modifications that were recommended and actually performed.*

Conclusion: *The WalkSafe program implemented in a single high-risk district was shown to improve the pedestrian safety knowledge of elementary school children. The observational data demonstrated improved crossing behaviors from pre-test to post-testing conditions. Future research will focus on sustaining the program in this district and expanding the program throughout our county.*

Keywords Pedestrian; Injury-Education; Prevention; Children; Road Safety

Each year in the United States approximately 25,000 children 0–15 years of age are struck by motor vehicles. This accounts for 22% of total injury by this population (NCSA, 2000). According to the U.S Department of Transportation for 2000, the age groups with the highest percentages of pedestrian injury are the elderly population older than 59 years (10%) and the children less than 16 years (30%); this accounts for 24,000 pedestrians injured. The 5–9 age group accounted for 50% of the total children pedestrians injured in this population and 30% of the fatalities. Most school-age pedestrians are killed in the afternoon rather than the morning, with 42% of the fatalities occurring in crashes between 3:00 and 6:00 P.M. (Stuffts & Hunter, 2000; NHTSA, 2001).

The state of Florida has the third highest pedestrian fatality and injury rates in the nation. The mortality rate after pedestrian trauma (3.9 per 100,000) is higher than the national average (2.3 per 100,000) (McCann & DeLille, 2000). In 2001, 489 pedestrians were killed in crashes on Florida roadways (FARS, 2001). Miami-Dade County is ranked number one in the state of Florida for pedestrian fatalities and injuries. Due to the significant numbers of children injured there remains an emergent need for injury prevention programs. This paper will focus on the WalkSafe program an educational program implemented in the public school system of Miami-Dade County.

In our preliminary studies (Phase I, II) investigating the epidemiology of pediatric pedestrian traffic injuries in South Florida, at University of Miami/Jackson Memorial Medical Center and the Ryder Trauma Center (RTC) we found that (53%)

Received 22 January 2004; accepted 25 June 2004.

Funded in part by the Florida Department of Transportation, Grant # PS-03-08-04 and the Trauma Research Institute at the Ryder Trauma Center.

Address correspondence to Gillian A. Hotz, Ryder Trauma Center, #405, 1800 NW 10th Avenue, Miami, FL 33136, USA. E-mail: ghotz@med.miami.edu

of the pediatric pedestrian accidents occurred in children ages 5–13. The majority of cases were males with 60% of all cases being African American. A significant proportion of these pedestrian crashes (71%) took place in the vicinity of elementary schools between 1 and 7 P.M. and 46% were attributed to "dart out" behavior (Hameed et al., 2004).

The number of pedestrian injuries and fatalities are reported each year through the state motor vehicle crash data, a database that contains comprehensive information about people, vehicles, and conditions recorded in the motor vehicle collision police reports for Miami-Dade County. In 2002, there were 297 injuries and 3 fatalities for children (<14 years) hit by motor vehicles in our county (Henderson, 2002).

While conducting a pilot study, Hotz et al. (2004) found that by comparing students in two schools that received an educational school based injury prevention curriculum to students in two schools that did not receive an intervention, the students who participated in the prevention curriculum had higher post-test scores on a safety knowledge test.

These studies allowed us to compile a comprehensive characterization of the problem in our community and formed the basis for the implementation of a multidisciplinary, community-oriented approach that included primarily education, and secondarily enforcement and engineering in an injury prevention program targeting elementary school age children.

The process of developing and implementing the WalkSafe Program included a systematic literature review of other programs (NSTSA & NSC, 2000; Berman, 2000). All provided beneficial resources toward the creation of this program. In addition, these programs have clearly demonstrated that the best place to teach pedestrian safety is in the classroom.

The purpose of this study was to further validate the WalkSafe program an elementary school program that educates children about pedestrian safety. We hypothesized that the implementation of the WalkSafe program in a single large high-risk school district would allow us to demonstrate improvement in pedestrian safety knowledge, which would equate to safer crossing behaviors.

METHODS

Subjects

The University of Miami Institutional Review Board and the Miami Dade School Board approved this study protocol. A Miami-Dade County school district associated with a high risk of pedestrian injury and fatality rates per population, reported from data available from the Metro Planning Office, was selected. A randomized trial study design was used for this study, the school and grade being the unit of assignment. This was a one-year study funded by a grant from the Florida Department of transportation from October 1, 2002 through September 30, 2003. All 16 Elementary Schools located in this district were included in this protocol. A total of 6,764 children from 295 classes attending kindergarten through 5th grade participated in the study (age range 5–11 years). In addition to the study of the population described above, the researchers prospectively identified all pediatric pedestrian patients (0–13 years of age) seen at the Ryder Trauma Center (RTC) as a pedestrian hit by car (PHBC) from October 1, 2002 to September 30, 2003. Demographic and medical data were prospectively collected on children seen from this high-risk district. The demographic profile of school participants is presented in Table I.

Table I Demographic characteristics of all sixteen elementary schools

Characteristics	Grades K–1	Grades 2–3	Grades 4–5
Number of students			
Gender			
Male	1269	1375	1374
Female	1287	1395	1391
Ethnicity			
White	9	7	10
Black	2094	2332	2320
Hispanic	442	398	406
Multiracial	9	11	5

Educational Intervention

A school-based educational injury prevention program, the WalkSafe program (Hotz et al., 2004), was implemented targeting students from kindergarten through grade five (standardized for each grade level). This comprehensive, pedestrian safety program originated from a pilot study for pediatric pedestrian trauma (PPT). The pilot version of WalkSafe was modified as a result of the feedback and recommendations from teachers and other educational specialists who were involved in the pilot program.

The current version of the WalkSafe program was created with the advice of numerous elementary school teachers working in a number of cities throughout the United States including Miami-Dade County. The WalkSafe program utilizes videos, formal educational curricula, workbooks, and outside simulation activities (imaginary road located on school grounds) to promote pedestrian safety among school age children. The curriculum is hierarchically based to account for the differing stages of children's behavior and development of pedestrian skills. The Miami-Dade School Board approved the WalkSafe educational program prior to its implementation in the 16 elementary schools. WalkSafe week was conducted during the last week of January 2003, with daily half-hour sessions, classroom education and video (Days 1 & 3), outside simulation (Days 2 & 4), and a Poster contest (Day 5). A total of 2.5 direct contact hours in classroom educational training was provided for each student who participated during the week.

For study purposes this high-risk district was divided into four zones according to geographic location, with each zone containing four schools. Research Assistants (RAs), specifically trained by a safety specialist to teach pedestrian safety, were randomly assigned to one of the four zones. Logistically, this better allowed the RAs to coordinate the implementation and execution of the WalkSafe program.

Teacher training sessions were scheduled during the month preceding the implementation of the WalkSafe program. All homeroom teachers (K–5) and physical education teachers from the participating schools were required to attend a training session. A single training session per school was administered by the RAs using a standard PowerPoint presentation, lasting approximately 60 minutes. A total of 295 homeroom teachers and 28 physical education teachers from the chosen schools were trained by the RAs to teach the pedestrian safety curriculum in their classrooms.

Engineering and Enforcement Intervention

During the WalkSafe week the researchers conducted a survey of the principals, parents, teachers, and security/safety personnel at each of the 16 schools in order to identify the main engineering (Dade County Public Works Department) and enforcement (Miami-Dade School Board Police and City of Miami Police Departments) problems surrounding each school's perimeter.

The Metropolitan Dade County Public Works Department formulates and expedites appropriate engineering modifications and eliminating barriers which includes; signage, school speed zone flashers, and road striping. These changes are necessary as they improve the environment in which children and other pedestrians travel. The researchers met with an engineer from this department to assess engineering concerns at the 16 elementary schools in the high-risk district. These concerns were formally submitted for department approval.

The enforcement component was the responsibility of the Miami-Dade School Board Police Department. This department was responsible for enforcing traffic laws among drivers traveling in and around school zones. Along with the City of Miami Police Department these agencies have provided a schedule for radar and ticketing of traffic for a three-month period to help us enforce traffic laws around the elementary schools.

Data Collection

One class per grade level was randomly selected for testing at each school. This provided a significant sample of the population. A ten question test that assessed knowledge of pedestrian safety was administered to 88/295 classes (30%), including 2022 students. In order to account for the differing stages of how children behave and develop pedestrian skills the tests were developed in conjunction with the curriculum. Students were administered one of three tests according to the grade level in which they were enrolled. The test administered to students in K-1 included pictures and yes/no questions. The test given to the students in grades 2–3 consisted of multiple-choice questions only, and the test for grades 4–5 had a combination of fill-in-the-blank style and multiple-choice questions (see Appendix). The pre-test was given one week prior to the start of the WalkSafe program. The post test was administered on the last day of the program, and again at three months after the end of the program. The same grades were tested at all three testing conditions in order to follow trends in scoring. Each exam was scored according to a standard scoring system.

Observational Component

To evaluate the effectiveness of the WalkSafe program in changing pedestrian behavior, pre, post and 3 months post-testing comparisons of pedestrian safety behaviors were analyzed following the intervention program. Four schools from the 16 schools in the study were randomly chosen for observational evaluation. A single observational test site was chosen at each school. These sites were located at a busy intersection characterized by a high volume of pedestrian traffic during school dismissal, and located a maximum of two blocks from the school. Students were observed under the same conditions (time of day, day of the week, and traffic environment) for a period of 20 minutes after school. Video cameras were set up in an unobtrusive place to monitor the behavior of all pedestrians in the intersection at all times. There were a total of four indicators: (1) Stop at the curb; (2) Look Left-Right-Left; (3) Midstreet crossing; and (4) Darting out. These indicators were divided into two groups: Group A (positive behavior) and Group B (negative behavior). Group A included stopping at the curb or the edge and looking to the left, right and then to the left again (Stop & Look). Group B included a pedestrian walking outside the crosswalk area; mid street crossing and darting out. If a positive behavior was present or a negative behavior was absent then it was considered the correct behavior for the pedestrian.

Each video was assigned to the reviewer panel, which consisted of the four research assistants of the project. They were blind to the time of condition and school that was being observed. For study purposes, an event was defined as present or absent for the four behavioral indicators in a child that attempts to cross the street at the test site at a specific time after school. Safety pedestrian indicators were applied by the panel to evaluate each video; these indicators were arranged hierarchically in the order of difficulties they represent to pedestrians; the indicators chosen were graded by the panel using a tracking sheet as a present or absent when the behavior is conducted in each event. The indicators that were considered are summarized in Table II.

Statistical Analysis

The four research assistants were assigned to four elementary schools each to coordinate the WalkSafe program. They were

Table II Road crossing behavioral indicators

Group A
1. Not stopping at the curb or edge:
A pedestrian who does not stop at the edge of the curb or pavement before crossing.
2. Not looking left, right and then left again:
A pedestrian who after stopping does not turn his/her head to the left, to the right and to the left at the line of vision before crossing the street.
Group B
3. Pedestrian outside the crosswalk area:
Mid street crossing:
A pedestrian who does not cross the road at the safety place; at a corner, island, traffic light crossing, crossing guard.
4. Dart outs:
A pedestrian who without stopping or slowing down crosses he road at an unsafe place without looking.

responsible for grading all the tests from each condition (pre, post, and 3-months post). The database manager was responsible for entering all test scores into a Microsoft Access database. They were also responsible for entering the reviewer panels observational scores into a database. For the educational score analysis, the classroom was treated as the experimental unit in statistical analyses. For each classroom the total percent correct responses were computed at baseline (pre-intervention) and the two follow-up periods. The statistical model was a repeated measures experiment with school as a blocking factor, grade as a grouping factor and time of measurement (baseline, post-intervention, and three-month follow-up) as the repeated factor. Following the overall Analysis of Variance (ANOVA), the baseline versus the post-intervention scores and the post-intervention versus the three months scores were tested within grade level. The observational data were analyzed using logistic regression (desired behavior versus un-desired behavior) comparing post-intervention behavior to baseline, three-month behavior to baseline, and three-month behavior to post-intervention behavior.

RESULTS

The research team and the biostatistician reviewed all data. All children <13 years of age seen at the RTC where mechanism of injury included PHBC had their medical records reviewed by a member of the research team. From October 1, 2002 through September 30, 2003 there were 48 children injured, 9 of these were from the high-risk district that we studied. The year prior we evaluated a total of 58 children PHBC.

Educational Results

A total of 6,467 school aged children from 16 elementary schools located in a single high risk district in Miami-Dade County were enrolled to participate in the WalkSafe Program; of these children, 31% (2022) were tested. A total of 5,762 pedestrian safety tests were administered over three testing times to 88 classes with an expected 90% of student attendance. Of these, 1,808 were pre-tests, 2,022 post-tests and 1,932 tests were administered at 3 month follow-up.

The classes tested included: 15 kindergarten classes, 15 first grade classes, 16 second and third grade classes; and 13 fourth and fifth grade classes. A statistically significant difference was found between the pre- and post-testing conditions within and across all grade levels K–5 (Figure 1). In all grades higher test scores were seen in post-testing conditions, testing administered a few days following the intervention. The older grades (4th and 5th) demonstrated the least amount of change between testing. The highest change in test scores (by ANOVA model) was found in the 2nd, 3rd, and kindergarten classes consecutively (Table III).

There were no significant differences found between the post and 3 month follow-up testing conditions within and across all grade levels. (p-value > 0.05). The individual grade level post and 3-month test scores are reported in Table IV.

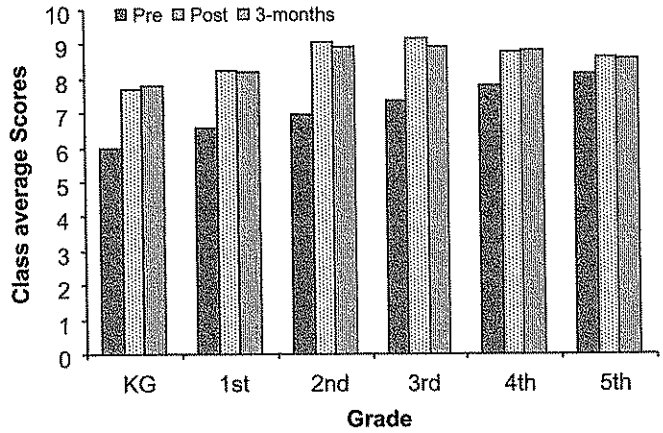

Figure 1 Student test scores (% correct) by grade level and time.

Observational Results

The data collected from the four schools were analyzed as a single set of data for the three testing conditions (pre, post, and three-month) using the safety pedestrian indicators. A significant difference was found between pre and post- test conditions for Group A (p-value = 0.018). The children that received the intervention were more likely to stop and look when crossing the street. This represent a beneficial effect in the behavior (Odds Ratio = 1.7037) shown as an improvement from 12.5% (47/376) to 19.5% (46/235). This change in behavior was sustained over a three-month period from the post-test to the three-month follow up testing condition (p-value = 0.533). However, a comparison of the data from the pre-test and three-month follow up test conditions failed to reach a significant statistical differences (p-value = 0.19). Nevertheless, a tendency of sustained improvement have been shown with a beneficial effect (OR = 1.46) rising from 12.5% (47/376) to 17.29% (37/214). See Table V.

There was a significant difference found between pre and post-test conditions for Group B (p-value = 0.0207). A statistical significant improvement was found between the pre and post-test conditions from 32.98% (126/382) to 24.4% (62/2,540). This change in the behavior was beneficial effect (OR = 0.6561) causing a decrease of the presence of the dangerous situations. The effect of the intervention program seems to be sustained at the three-month follow up, showing no difference between the post and three-month follow up test conditions. However, if the initial test is compared with the three-month follow up there is no statistic difference of improvement (p-value = 0.197). There seems to be a beneficial effect in behavior, evidenced by the

Table III Students test scores (% correct ± S.E.) by grade and time

Grade	Pre-test (Std error)	Post-test (Std error)	Means difference	p-value
K	5.966 ± 0.1383	7.682 ± 0.204	1.72	<0.0001
1st	6.589 ± 0.147	8.234 ± 0.206	1.65	<0.0001
2nd	6.962 ± 0.152	9.093 ± 0.175	2.13	<0.0001
3rd	7.361 ± 0.127	9.169 ± 0.139	1.81	<0.0001
4th	7.774 ± 0.0886	8.784 ± 0.138	1.01	<0.0001
5th	8.158 ± 0.09	8.614 ± 0.1189	0.46	<0.0014

Table IV The comparison of student's test scores at post-test and three-month post-test conditions

Grade	Post-test (S.E.)	3-month Post-test (S.E.)	Means difference	*p*-value
K	7.682 ± 0.204	7.818 ± 0.0859	0.14	0.51
1st	8.234 ± 0.206	8.2 ± 0.151	−0.03	0.79
2nd	9.093 ± 0.175	8.903 ± 0.1669	−0.19	0.35
3rd	9.169 ± 0.139	8.903 ± 0.1219	−0.27	0.09
4th	8.784 ± 0.138	8.838 ± 0.119	0.05	0.76
5th	8.158 ± 0.1189	8.569 ± 0.1522	−0.04	0.77

OR = 0.810 and a sustained change in the percentages (32.9% to 28.5%; Table V).

Engineering and Enforcement Intervention

Many environmental risk factors for pedestrian injuries were found around the sixteen elementary schools. This includes: Inappropriate street signage for pedestrians (16/16), absent of pavement markings (16/16), flashing signals (3/16), speed and loading zone (5/16), poor maintenance of the street (2/16), relocation of signals and crosswalks (4/16), and request for additional crossing guards (2/16). The RAs proposed a letter to the City of Miami Public Works Department requesting that modifications need to be made to these sixteen schools.

Table VI illustrates the actual status of 48 requested orders for modification. The order status includes: orders in progress (IP), not done (ND) and under investigation (UI). The IP group included a total of 32 orders (60%), which will be eventually corrected during the year 2003.

The ND group included 11 orders (20%) that were rejected from the sixteen schools. The remaining suggestions were either rejected or not considered because it was out of the Miami Dade Public Works Department jurisdiction. Another 20% (5/48) of the original requested orders fall under the UI category, requiring additional investigation in order to be able to categorized as a standard order.

Unfortunately the Miami-Dade School Board Police and the City of Miami Police Department were unable to keep records of the speeding tickets given during the time of the program to compare to the same time period the year before.

Table V Crossing behaviors at pre, post, and three-month post-testing conditions

Behavioral Indicators	Pre-test	Post-test	*P*-value*	OR**	95% C.L***
Stop at Curb L-R-L	12.5% (47/376)	19.5% (46/235)	0.018	1.704	1.093–2.656
Mid Street Dart Out	32.98% (126/382)	24.4% (62/254)	0.0207	0.6561	0.45–0.9376
Stop at Curb L-R-L	19.5% (46/235)	17.29% (37/214)	0.53336	1.16	0.72–1.87
Mid Street Dart Out	24.41% (62/254)	28.5% (61/214)	0.3164	1.11	0.90–1.38
Stop at Curb L-R-L	12.5% (47/376)	17.29% (37/214)	0.109	1.46	0.97–2.33
Mid Street Dart Out	32.98% (126/382)	28.5% (61/214)	0.258	0.810	0.56–1.16

*P-value < 0.05, **OR = Odds Ratio, ***95% C.L = 95% confidence Limits.

DISCUSSION

The primary objective in this study was to decrease the number of pedestrian motor vehicle accidents involving children in a single, high-risk district. Along with this objective, we sought to validate, and implement the WalkSafe program in 16 elementary schools (Grades K–5). During the preceding year, the didactic educational component was studied in order to evaluate whether grade school children retain the safety information taught within the classroom. This year we incorporated an observational and behavioral component into the curriculum. The purpose of incorporating this component was to determine if application of the concepts learned within the classroom transmitted to correct street crossing behavior.

Pedestrian fatalities constitute a third of traffic deaths among children 3–9 years old. In 2001, 1,740 children (0–14 years of age) died in motor vehicle crashes with 21% of these related to pedestrian injuries; with the fatality rate being higher among males (67%) than females (33%). Pedestrians are more likely to be struck in urban areas especially in central city areas, where vehicle traffic is heavy and recreational space is limited. Child pedestrian fatalities occur most often between the hours of 4:00 P.M. to 8:00 P.M. and on Friday and Saturday.

As demonstrated in our pilot program (Phase III), child education programs are the most effective approach to prevention (Hotz et al., 2004; Schieber & Vegega, 2001). There is a wide acceptance of the value and necessity of teaching pedestrian safety skills by using knowledge-based approaches and practical training exercises in a real traffic environment (Zeedyk et al., 2002). The United States, Canada, and the United Kingdom have spent many years and millions of dollars researching pedestrian and bicycle safety; however, few comprehensive interventions designed to reduce pedestrian injuries in children have been evaluated. Of those currently available, most have not been subjected to rigorous evaluation, including the measurement of long-term knowledge and behavioral changes.

Our center's previous research on pediatric pedestrian trauma (Phase I and II) was valuable in defining this problem within our community, and further enabled us to take an active approach towards prevention (Hameed et al., 2004). In order to create an intervention program that would be implemented into our high-risk districts, we first reviewed the existing literature on previous pediatric injury prevention programs.

Past attempts to lower the incidence of pediatric pedestrian injury have had limited success. These programs failed to provide prospective data confirming their benefits, and had difficulties being sustained once grants were terminated. A validated model that would include a pedestrian injury prevention program that could be used in all demographic, socioeconomic, and geographic areas had not been created. However, we did identify some programs that appeared to be beneficial, and thus helpful in developing our own program.

Table VI Engineering recommendations and modifications

Engineer modifications	Street signage	Pavement markings	Flashing signal	Speed zone/ loading zone	Maintenance of street (visibility, remove trash)	Crossing guard	Relocation (Crosswalk, flashing signal, pedestrian signals)
School 1	IP	IP		NRPW			NRPW
School 2	IP	IP					ND
School 3	D	D					
School 4	IP	IP	IP				
School 5	IP	IP	UI				
School 6	D	D				D	ND
School 7	IP	IP		ND		UI	
School 8	IP	IP					
School 9	D	IP	D				
School 10	D	D					
School 11	D	IP					
School 12	IP	D	UI	UI			ND
School 13	ND	ND		ND			
School 14	D	ND		ND	D		
School 15	D	IP					
School 16	IP	IP			D		

IP: In progress, D: Done, ND: Not done, UI: Under Investigation, NRPW: Not the Responsibility of Public Work.

One of the most noted nationally accepted programs is the U.S. Department of Transportation/National Highway Traffic Safety Administration program called Walk—Ride—Walk (NSC, 2000). This program utilizes video and formal education to promote pedestrian safety among children in grades K–6. Another program utilized was sponsored by the Utah Department of Transportation. This agency sponsors an annual statewide Green Ribbon Week (Berman, 2000) in which green ribbons are distributed to members in cities throughout the community to remind drivers to slow down near school zones and to be more aware of the pedestrians that surrounding these areas. In addition, each school participated in a traffic safety education program throughout the Green Ribbon Week.

Another beneficial resource was the United Kingdom Department of Transportation. This agency has spent many years studying child development and the outcomes of road safety education. The United Kingdom Department of Transportation conducted a detailed analysis of pedestrian behavior and the skill components required in practicing traffic safety (Whitebread & Neilson, 1999) . These included: (a) detecting the presence of traffic, (b) visual timing judgments, and (c) coordinating information from different directions (Tolmie et al., 1999). Some children have tendencies to become risk-takers when crossing the street (West et al., 1999). Children like to see if they can out run the cars. These children are more likely to make poor traffic decisions (Hoffrage, 2003).

Developmental theorists agree that practical training methods are more successful then knowledge-based approaches, thereby reinforcing the idea that the best way for young children to develop traffic safety skills is to undergo training exercises that would result in changing actual behavior in the traffic setting (Zeedyk et al., 2002; Zeedyk et al., 2001; Young & Lee, 1987).

Since the pilot studies of the WalkSafe program there has been a 17% decrease in the number of children <13 years of age seen at our trauma center which serves as the only adult trauma center and also receives two-thirds of traumatized children in our large region. All children injured in the district we investigated here, would have come to the Ryder Trauma Center. The results of the implementation of the WalkSafe program demonstrate that children were able to learn the pedestrian educational knowledge, with improvement between the pre and the post-test scores (Figure 1). Findings also indicated knowledge retention pertaining to pedestrian safety. These results confirmed program success regarding learning and retention of important pedestrian safety knowledge to children in grades K–5. Most experts feel that teaching pedestrians how to deal with the traffic environment is a fundamental component of injury prevention (Duprerrex et al., 2002).

The Cochrane Review (2002) offers a systematic review of 15 randomized controlled trials of safety education programs for pedestrians of all ages (Duperrex et al., 2002). The findings indicate that none of the trials assessed the effect of safety education on the occurrence of pedestrian injury however six assessed the effect on observed behaviors. Only some of these trials demonstrated behavioral changes following pedestrian safety education but it was difficult to predict what effect this may have on risk of pedestrian injury. There is also evidence that changes in safety knowledge and observed behavior decline with time suggesting that it may be beneficial to repeat safety education at regular intervals. Our study demonstrated that a significant change was seen in safety education knowledge however we also evaluated initial changes in pedestrian behavior.

With the implementation of the WalkSafe program the children's behavior was improved through the reinforcement of the activities involved in this program. At the end of the study our

results demonstrated that the education component was reinforced by the addition of the observational and behavioral component. Findings indicated that the educational program transferred over to the correct street crossing behavior shortly after the intervention. This illustrates that the WalkSafe curriculum influences behavioral changes by reinforcing the cognitive activities involved in the program.

LIMITATIONS OF THE STUDY

Several limitations became evident in this study. Initially a tremendous amount of planning, organization and scheduling for the implementation of this program at 16 schools with multiple agencies was needed. As meeting dates were met and training began the research team was able to use the latter half of the year for data analysis and review of the program after the implementation of the program in the beginning of the year. There was difficulty in scheduling appropriate dates for training administrators and teachers. Timing of the program was a limitation as it interfered with the scheduled preparation of the Florida Comprehensive Achievement Test. Teachers also found implementation difficult as the integration of this program into their curriculum interfered with planning time and regular classroom activities. However as they began the program they realized the importance and effect it could have on saving lives and decreasing injury.

The observational component was also difficult to organize at the four schools. Deciding on when to videotape and where only was agreed upon by the research team following some review of busy intersections, dismissal time from school, positioning of the camera etc. This attempt was preliminary. In order to conduct a thorough analysis of pedestrian behavior, behavioral specialists need to be included. Lastly, the ability to work with multiple agencies in a single district was challenging, as it was often difficult to meet with the right individual who could assist with the program. It was difficult to coordinate meeting times that were convenient for all agencies (Miami-Dade School Board, Dept. of Public Works, Miami-Dade Police Dept.) and the research team. With the RTC and research team being the lead agency of the study coordination of all study aspects were centralized in the WalkSafe office, which assisted with all components of the program. To implement the program county or statewide the School Board and agencies that have a stake in safety and decreasing pedestrian injuries need to be included.

CONCLUSION

Our study evaluated the effectiveness of this injury-prevention program with the primary component being education. An observational component was included but was a preliminary attempt at observing children's street crossing behaviors. However, in order to decrease the number of injuries and fatalities for young pedestrians, a combination of efforts by a number of agencies is clearly needed. The successful implementation of elementary school-based injury prevention program in a high-risk district was found to be an effective strategy to reduce the number of PHBC cases, to increase pedestrian knowledge and awareness, and to observe short-term behavioral changes.

Future research needs to study the implementation of this school based pedestrian injury prevention model in an entire county, and then expand the program statewide. We will need to continue to work with the other agencies and conduct larger studies. The WalkSafe task force has committed to further investigate ways to decrease the incidence of pediatric pedestrian injuries in this county and across the State. The RTC is committing to track the number of children that are injured and update the WalkSafe program on a yearly basis. The program curriculum must be easy to implement in all school districts with a minimum of modification and be web based. In order to ensure success we will encourage and train elementary school teachers in the implementation of the WalkSafe program in their schools.

ACKNOWLEDGMENTS

Funded in part by the Florida Department of Transportation, Grant #PS-03-08-04 and the Trauma Research Institute at the Ryder Trauma Center, Miami, Florida.

Pediatric Pedestrian Injury Task Force: Frank Cobo, Joy Riddell, Jose Guerrier, Brian Hannigan, David Henderson, Mimi Sutherland, Chief P. Cuccaro, Officer Linda Fitts, John Dibenedetto, Catherine Poindujor, Harvey Bernstein, Jayne Greenberg, and Paul Taber.

Instructors: Jake Nelson, Andrea Castelblanco, Martin Thomas, Sherika Colston, and the teachers and school staff at the 16 elementary schools in Liberty City, Miami, Florida. Elementary school teachers: Rebecca Cudini and Cathy Annbal.

REFERENCES

Berman J. (2000) Pedestrian and Bicycle Safety Program (Utah). Traffic Safety Digest—Winter 2000. Utah Highway Safety Office. Salt Lake City, UT. Available http://www.nhtsa.dot.gov/people/outreach/safedige/winter2000/win00-14.html

Duperrex O, Bunn F, Roberts I. (2002) Safety education of pedestrians for injury prevention: A systematic review of randomized controlled trials, *BMJ*, 324(7346), pp. 1129.

Hameed MS, Popkin CA, Pernas F, Johnson WE, Henderson D, Histrov D, Varela JE, Cohn SM. (2004) The epidemic of pediatric traffic injuries in South Florida: A review of the problem and initial results of a prospective surveillance strategy, *American Journal of Public Health*, Vol. 94, No. 4, pp. 554–556.

Hoffrage U, Weber A, Hertwig R, Chase VM. (2003) *Journal of Experimental Psychology: Applied*, Vol. 9, No. 4, pp. 249–260.

Hotz GA, Cohn SM, Nelson J, Mishkin BS, Castelblanco A, Li P, Duncan R, Taber P. (2004) Pediatric Pedestrian trauma Study: A Pilot Project. *Traffic Injury Prevention*, Vol. 5, pp. 132–136.

McCann B, DeLille B (2000, June) American's Dangerous Streets. Mean Streets 2000 Report. Surface Transportation Policy Project. Washington, DC. Report No. 20036. Retrieved 20 January 2004 from http://www.transact.org/report.asp?id=181

National Center for Statistics and Analysis (NCSA) (2000) Traffic Safety Facts 2000: Children. Washington, DC, Report No. 809 324, pp. 2–3.

Stutts JC, Hunter WW. (2000) Injuries to Pedestrians and Bicyclists: An analysis based on hospital emergency department data, United States Department of Transportation Federal Highway Administration 2000 Report.

Schieber RA, Vegega ME. (2001, October) National Strategies for advancing child pedestrian safety. Center for Disease Control and Prevention, National Center for Injury Prevention and Control. Atlanta, GA, 6–13.

Tolmie A, Thomson J, Foot B, Mclaren, Whelan K. (1999) Problems of attention and visual search in the context of child pedestrian behaviour. Road Safety, Report No. 8.

Traffic Safety Facts. (2001) United States Department of Transportation National Highway Traffic Safety Administration (NHTSA). National Center for Statistics and Analysis. Washington, D.C. DOT HS 809478, pp. 1–6. Available http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2001/2001pedestrian.pdf

2001 Ranking of State Pedestrian Fatality Rates. (2001) Fatality Analysis Reporting System (FARS) Web-Based Encyclopedia. National Highway Traffic Safety Administration. National Center for Statistics and Analysis. NRD–3. Washington, DC. Available http://www-fars.nhtsa.dot.gov

National Safety Council (2000) School Bus Pedestrian Safety Training Program. Washington, DC.

West R, Train H, Junger M, Pickering A, Taylor E, West A. (1999) Childhood accidents and their relationship with problem behaviour. Road Safety, Report No. 7.

Whitebread D, Neilson K. (1999) Cognitive and metacognitive processes underlying the development of children's pedestrian skills. Road Safety, Report No. 6.

Young DS, Lee DN. (1987) Training children in road crossing skills using a roadside simulation, *Accident Analysis and Prevention*, Vol. 19, pp. 327–341.

Zeedyk SM, Wallace L, Spry L. (2002) Stop, look and think: What young children really do when crossing the road, *Accident Analysis and Prevention*, Vol. 34, pp. 43–50.

APPENDIX

WalkSafe Test Grades 2 & 3

Student Information: School: Age: Grade: Home Room Teacher:

Pediatric Pedestrian Trauma Study

Ryder Trauma Center/Florida Department of Transportation

Please circle the correct answer

1. What should you do when you come to a curb?
   a. Stop b. Run across the street
2. How do we look before crossing the street?
   a. Up, down, up b. Left, right, left
3. What do you do if there are cars parked on the street?
   a. Check to see if the car is off and empty
   b. Run across the street
4. If we see a car coming, what do we do?
   a. Wave at the driver
   b. Wait until the car has passed, then check the road again
5. Does a green light always mean go?
   a. Yes b. No
6. What should you do when you get to a light that is already green?
   a. Wait for a new green
   b. Cross quickly
7. Does a green arrow mean it is safe to cross?
   a. Yes b. No
8. What color is a Don't Walk sign?
   a. Red b. Green
9. If there is a Walk sign, do we still need to make sure that the street is safe?
   a. Yes b. No
10. What is a pedestrian?
    a. A person who walks
    b. A type of car