Partnering for Injury Prevention: Evaluation of a Curriculum-Based Intervention Program Among Elementary School Children

Louise S. Gresham, PhD, MPH
Dorothy L. Zirkle, RN, MSN
Sidney Tolchin, MD
Clair Jones, MS
Azarnoush Maroufi, MPH
John Miranda

A randomized pretest and posttest comparative design was used to evaluate the outcome of implementing Think First for Kids (TFFK), an injury prevention program for children grades 1, 2, and 3, among intervention and controls schools. The study showed that children often lack basic knowledge regarding safety and do not recognize behaviors considered high risk for injury. By using multivariate analysis, the intervention children had a significantly greater increase in knowledge about the brain and spinal cord and safe behaviors to prevent traumatic injury, and a decrease in self-reported, high-risk behaviors ($p < .001$) when compared with control subjects, adjusting for the covariates gender, socioeconomic status, and race/ethnicity. African American and Hispanic children, although displaying the lowest test scores at baseline, had the largest absolute improvement in posttest scores. The TFKK prevention program addresses the leading causes of trauma among children including sports, motor vehicle crashes, falls, drowning, and pedestrian injuries.

DESPITE YEARS OF legislative and public health efforts, injuries remain an intractable public health problem claiming more lives in the first 4 decades of life than infectious or chronic disease (National Center for Injury Prevention and Control, 1997). The toll of injury-related deaths would be greater if not for primary prevention efforts, improvements in prehospital transport, and organized trauma systems (California Department of Health Services, 1997a; EPIC Proportions, 1997). Fatal injuries represent only a fraction of all injuries. On the basis of national data, it is estimated that for every childhood death from injury, there are an additional 34 hospitalizations and more than 1,000 emergency department visits, many more visits to private clinicians and school nurses, and injuries treated at home (California Department of Health Services, 1997b; National Center for Injury Prevention and Control, 1999). Often the difference between a fatal and nonfatal injury is a subtle difference (i.e., a few feet in a pedestrian injury, a few inches in a gunshot wound, or a few seconds in a near drowning).

Of all types of injury, those to the brain are most likely to result in death or permanent disability. According to national traumatic brain injury (TBI) data for 1995 to 1996, one million people are treated and released from hospital emergency departments, 230,000 are hospitalized and survive, and 50,000 people die (National Center for Injury Prevention and Control, 2000). It is estimated that medical care costs alone are $7.5 billion per year (Losh, 1994). The emotional and social impact on the individual, family, and society is devastating and calls for more effective ways to prevent injuries and provide care for those who are injured.

Leaders in health and education are calling for the school to be the setting in which to teach

From San Diego State University, Graduate School of Public Health, San Diego; Sharp HealthCare, San Diego; Health and Human Services Agency, San Diego County; San Diego Unified School District, San Diego, CA.

Address reprint requests to Dorothy L. Zirkle, RN, MSN, Sharp HealthCare/Grossmont Hospital, 5555 Grossmont Center Drive, La Mesa, CA 91942.

E-Mail: dorothy.zirkle@sharp.com

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children how to manage their health and risky behavior, including injury prevention (Main et al., 1994; Schall, 1994). The premise of the American Medical Association and the National Association of State Boards of Education is that risks children face each day, such as risk of injury, are interconnected with other risks and decision-making skills (National Commission on the Role of the School, 1990). The Centers for Disease Control and Prevention (CDC), Healthy People 2000, and the Institute of Medicine Committee on Comprehensive School Health Programs kindergarten through 12th grade recommend health education and promotion interventions that (1) are sequential during all grade levels of elementary school, (2) must be evaluated, (3) include activities that help young persons develop skills to avoid risky behaviors, and (4) are taught by trained professionals (Gielen, 1992; National Commission on the Role of the School, 1990; U.S. Department of Health and Human Services, 1995). The CDC's National Center for Injury Prevention and Control is active in school and community injury control programs that address this leading cause of child and adolescent death and disability (Sleet, Bonzo, & Branche, 1998).

A nurse manager for a hospital-based injury prevention program initiated a research project to evaluate the impact of Think First for Kids (TFFK), a curriculum addressing injury prevention, on self-reported, high-injury risk behavior and knowledge about safety behaviors and the brain and spinal cord. The sample studied was a racially/ethnically diverse elementary school population, grades 1, 2, and 3.

REVIEW OF THE LITERATURE

School health education is one of the most important ways to address enduring public health problems, such as injury (Institute of Medicine, 1997; Polivka & Ryan-Wenger, 1999; Public Health Service, 1994). Several curricular interventions have been successful in influencing behaviors, such as reducing rates of tobacco and alcohol use among youth and decreasing unintentional pregnancies (Connell & Turner, 1985; Pentz et al., 1989; Vincent, Clearie, & Schluchter, 1987). Schall (1994) suggests that school-based education that starts early and continues through several grades provides considerable and sustained effects on overall health knowledge, attitudes, and practices. Targeting young children and including curriculum activities beyond the classroom has also been effective in decreasing sexual risk-taking behaviors in adolescents (Krug, Brener, Dahlberg, Ryan, & Powell, 1997; Main et al., 1994).

Bandura's social learning theory synthesizes cognitive, behavioral, and environmental explanations of learning and behavioral changes (Bandura, 1977). It is one of the most formally developed theories of health behavior and has gained recognition as a predictor of health behavior change and maintenance. Bandura viewed learning as the result of interaction between humans and their environments. In the social learning view, people are neither driven by inner forces nor buffeted by environmental stimuli. Instead, behaviors are explained in terms of a continually reciprocal interaction of personal and environmental determinants.

Self-efficacy, a construct developed within the framework of social learning theory, is concerned with the effects of self-referent thought based on psychosocial functioning. Self-efficacy is commonly used in studies of health behavior and the concept has been incorporated into the theoretical foundations such as the health belief model (Rosenstock, Strecher, & Becker, 1988). Social learning theory provides a rich source of behavioral techniques that can be applied to early school-aged children in an educational setting to promote changes in health behaviors. Bandura's (1985) model suggests that behavior is affected by the primary influence of environment, reinforcement, and cognitive mediation.

Several studies have targeted young children and behavior change. Walters (1989) initiated the Know Your Body project in New York in 1975 that was developed in response to the empirically validated suggestion that the primary prevention of chronic disease should begin in childhood. The program was classroom-based and teacher-delivered and after 6 years appeared to be associated with favorable changes in levels of knowledge, as well as rate of initiation of cigarette smoking.

Potts, Martinez, and Dedmon (1994) examined several measures of physical risk-taking and sensation-seeking among children aged 6 to 9. These variables were targeted as potential predictors of unintentional injury. An injury behavior checklist was completed by parents as well as a summary of the child's injury history. Among the important findings, risk taking, whether measured by self-report or knowledgeable informants, was indicative of physical injury.

Rivara et al. (1994) described the impact of a community bicycle helmet campaign on helmet use and the incidence of bicycle-related head injury. The community-wide bicycle helmet cam-

paign sought to promote use of helmets and increase parental awareness of the need for helmets. An increased use of helmets and a decrease in bicycling-related head injury in the target population of children suggests that a concerted and coordinated community-wide effort encountering a specific injury problem with an identified intervention can be effective.

Pendergrast, Ashworth, Durant, and Litaker (1992) used an experimental design to test the utility of school-level intervention for child bicycle safety and to identify social and behavioral factors. An intervention was conducted in two suburban elementary schools; the control school receiving safety literature and safety coupons, and the intervention school receiving the same items plus an intense safety campaign with Parent-Teacher Association (PTA) activities, establishment of a safety committee, and classroom presentations throughout a period of 10 months. The results suggest minimal impact of the intervention, with the intervention school students being more likely to perceive helmets as protective when compared with the control school. The investigators found it difficult to interpret the data regarding the experimental differences because of an inability to match the children's pretest to their posttest scores (Vincent et al., 1987). More recently, Krug et al. (1997) examined the effect of an elementary school-based violence prevention program and visits to the school nurse. A randomized comparative design was used, matching the schools on demographic factors. When the number of visits to the school nurse was compared, the rate of visits related to an injury decreased significantly in the intervention schools and remained unchanged in the control schools.

Lack of information exists pertaining to the implementation and evaluation of grade-specific injury prevention curricula. The primary aim of this study was to determine the impact of the TFFK injury prevention curricula on reduction in self-reported, high-injury risk behavior and increase in knowledge about safety behaviors and the brain and spinal cord among a racially and ethnically diverse elementary school population.

METHODOLOGY

A randomized pretest and posttest comparative design was used for this study, the school being the unit of assignment. The study was conducted in two urban school districts in San Diego County, California. The data were collected within the classroom setting for both the intervention and control schools.

Sample

Sixteen schools were identified as potential study sites. Eight intervention schools, four in each school district, were randomly chosen to receive the TFFK intervention program from trained educators. Only seven of the remaining eight schools provided a sufficient match to the intervention schools (on district, socioeconomic status [SES], school-defined reading scores, and race/ethnic composition) to serve as controls, and receive no intervention.

Intervention

TFFK is an innovative curriculum on injury prevention created by the American Association of Neurological Surgeons and the Congress of Neurological Surgeons that addresses the major causes of traumatic injury that pose considerable risks for children (Think First Foundation, 1996). TFFK meets the CDC goal of conducting planned, sequential, and evaluated comprehensive school-based health programs to reduce childhood morbidity and mortality. The TFFK curriculum integrates math, literacy, and science objectives and is used in 45 states across the nation. Classroom interactions and homework assignments have children count, read, and perform problem-solving exercises. Safety components were developed to elucidate and enhance interest, learning, and acceptance of safety measures. Four school district nurses, 88 schoolteachers, and 8 life-skills educators were trained in a 5-hour session to implement the TFFK curriculum. Training consisted of a review of all course and interactive materials, audiovisual aides, and local injury statistics. TFFK staff was available during the implementation to assist with questions that arose.

Sponsored by a local nonprofit health care agency, the same program was conducted across all intervention schools during a 6-week period in the fall semester 1997 and consisted of curricula written for developmentally appropriate age groups, grades 1, 2, and 3. The grade-specific curriculum has the following six modules: (1) violence prevention, gun safety, and conflict resolution; (2) playground, recreation, and sports safety; (3) bicycle safety; (4) water safety; (5) vehicle and pedestrian safety; and (6) the anatomy and function of the brain and spinal cord. The module objectives are shown in Table 1. The modules were taught sequentially, one module each week; each module

Table 1. Think First For Kids Module Objectives

1. Violence, safety around weapons, and creative problem-solving
Assess the student's knowledge about the dangers of firearms and knives, and safety habits around weapons.
Assess the student's current practices of problem resolution.
Increase the student's knowledge of how to behave around firearms and knives.
Increase the student's knowledge and skills in handling daily problem situations.
2. Playground, recreation, and sports safety
Assess the student's knowledge of hazards while on playgrounds and playing sports.
Increase the student's knowledge of safety rules when playing and participating in sports.
Increase the student's knowledge of safety as an individual, family, and community responsibility.
3. Bicycle safety
Increase the student's knowledge of bicycle safety and the importance of bicycle helmets in protecting the brain from injury.
Increase the student's knowledge and skills in collecting and reporting information.
Provide visual reinforcement and hands-on experience with bicycle helmets.
4. Water safety
Assess the student's knowledge of the hazards of brain and spinal cord injury and drowning in different bodies of water.
Increase the student's knowledge of water safety rules.
Increase the student's knowledge and awareness of how to prevent water-related injuries and drowning.
Increase the student's awareness that preventing injuries is the responsibility of individuals, families, and the community.
5. Vehicle safety
Assess the student's knowledge of the dangers of cars and other vehicles, and good vehicle safety habits.
Introduce the importance of safety belts in protecting people from injury.
Enhance the concept of safety and correct safety belt use as everyone's responsibility.
Increase the student's knowledge about safety belt laws.
Increase the student's knowledge and awareness of vehicle and pedestrian safety and injury prevention measures.
6. Introduction to preventing brain and spin cord injury
Assess the student's knowledge of safety and safety habits to prevent injury.
Introduce simple facts related to the anatomy and functions of the brain, spinal cord, and related structures.
Increase the student's ability to incorporate the concepts of brain and spinal cord injury prevention and protection into their daily activities.
Increase parents' knowledge of awareness of brain and spinal cord injuries and prevention measures.

Data from Think First Foundation (1996).

required approximately 35 to 40 minutes. Mandatory homework was sent home with each student, requiring parental participation and signature.

The curriculum was based on the principles of applied learning and behavioral theories that defend varied messages delivered throughout time which increase understanding, knowledge retention, and sustained behavior (Bandura, 1977). Reliability and validity testing of the pretest and posttest instruments were conducted by the Oregon Health Science University and the Oregon State Health Division (Neuwelt, Coe, Willkinson, & Avolio, 1989).

Learning strategies included role-playing, hands-on activities, reading, math, visual reinforcement, and discussion. The TFFK comic strips and Streetsmart video (1996) were provided to each intervention school. The comic strips made visual references to six lessons that incorporated critical thinking ability as the child worked his or her way through the storyline dealing with injury prevention behavior. The Streetsmart video is an entertaining presentation that models injury prevention behavior. Multiethnic elementary school-aged animated characters were depicted in real-life situation and demonstrated critical thinking requirements to avoid common and everyday injuries faced by young children. A spinal cord injured speaker presented information on injury prevention and disability awareness to each participating class during the 6-week period of the intervention.

A typical module (for example playground, recreation, and sports safety) would have three objectives taught by the classroom educator (school nurse/teacher), with points of emphasis being playground hazards, safety rules when participating in sports, protective gear, cooperation, and safety as an individual, family, and community responsibility. In addition, classroom posters, an animated video, and comic strips are used to reinforce messages in that specific lesson. The teacher may take the children around the classroom and discuss potential hazards or make a playground checklist of rules. Students are given scenarios and asked to provide solutions for a safer playground environment. A brain or spinal cord injured speaker could come to the classroom and talk to the children and answer their questions. The recreation homework assignment consists of finding recreation and safety words in a puzzle, fill-in-the-blank questions, and counting objects such as helmets and baseballs in pictures.

Evaluation of Program Effects

The program was evaluated by using a student self-report pretest and posttest consisting of questions of a forced-choice format, multiple-choice, and sequencing questions relating to knowledge or concepts presented in the TFFK curriculum at each grade level. Grades 1, 2, and 3 had unique testing instruments, consisting of questions appropriate to

the developmental stage and grade-specific reading level. The 1st grade test had 22 questions, 2nd grade had 24 questions, and 3rd grade had 26 questions. The pretests and posttests were administered within 10 days of the implementation and within 10 days of the completion of the 6-week program, respectively, by trained volunteers from a school of public health who read the questions aloud in the classroom setting.

Analysis

The students' pretests were matched to their posttests. Several primary endpoints were measured (overall scores for knowledge, overall scores for reported behavior, and module-specific scores). The *t*-test procedure was used to compare mean change in scores. Ninety-five percent confidence intervals were constructed around the changes in scores from pretest to posttest for the intervention and control schools stratified by grade, gender, and race/ethnicity. A generalized estimating equation (GEE) regression was performed adjusting for the covariates pretest, gender, SES, and race/ethnicity to assess the intervention as a predictor of improved performance. SPSS was the statistical software used for univariate analysis and calculation of 95% confidence intervals; SAS (Statistical Analysis Software, SAS Institute, NC) was used to perform the multivariate GEE regression.

The study used stratified random sampling to assign schools to the TFFK curriculum-based intervention. Individuals in the same school tend to be more similar than other clusters based on their environment. Therefore, to account for within-cluster correlation, the GEE method was used (Lian & Zeger, 1986) to reduce the potential for biased standard errors and conclusions about the statistical significance (a bias that can occur in either direction, but usually leads to false-positive treatment effects). The problem of the within-cluster correlation and the benefits of GEE were illustrated by Norton, Bieler, Ennett, and Zarkin (1996). GEE has robust application for the analysis of clustered data in prevention studies, thus, the advantages are the ability to apply the model to many types of dependent variable and minimal distributional assumptions.

Intervention research often confronts the methodological issue of having to account for correlation among subjects clustered within sampling units (in this case, schools) to reduce the potential of biased standard errors. The standard errors will be biased usually in a direction that exaggerates the significance of the intervention effect (Norton et al., 1996). This study used the GEE model to address intracluster correlation because students clustered within schools may be more similar to each other in experiences, neighborhood, and social environment. The potential for confounding of effects was reduced by the use of a randomized design and by matching control schools on variables likely to impact knowledge and behavior (i.e., reading level, racial/ethnic group, and SES). Another strength of this study was the ability to match a student pretest with their posttest when analyzing changes in scores.

RESULTS

There were 2,465 student participants for the pretests and posttests. Statistical analysis was restricted to the 1,977 students who had linked pretests and posttests (80% match) (grade 1, 697; grade 2, 639; and grade 3, 641). The attrition rate of 20% was caused by absenteeism resulting in a missed pretest or posttest. Regarding participant ethnicity 52% were white, 16% African American, 18% Hispanic, and 3% Asian. All grades showed diverse racial/ethnic representation. The intervention and control groups were similar on demographic profile with respect to age, gender, race/ethnicity, and pretest baseline scores (Table 2). Baseline scores of students in grades 1 to 3 reflect a lack of knowledge about safety practices; 28% of

Table 2. Comparison of Demographics, Intervention, and Control Schools

		Intervention (%)*	Control (%)*
Grade 1		N = 405	N = 292
Gender	Male	218 (53.8)	144 (49.3)
	Female	179 (44)	147 (50.0)
Race/ethnic	White	230 (56.8)	151 (51.7)
	Hispanic	84 (20.7)	47 (16.1)
	Black	55 (13.6)	49 (16.8)
	Other†	24 (5.9)	43 (14.7)
Grade 2		*N* = 383	*N* = 256
Gender	Male	189 (49.3)	128 (50.0)
	Female	178 (46.5)	125 (48.9)
Race/ethnic	White	180 (47)	130 (50.8)
	Hispanic	86 (22.5)	48 (18.8)
	Black	59 (15.4)	37 (14.4)
	Other†	28 (7.3)	40 (15.6)
Grade 3		*N* = 338	*N* = 303
Gender	Male	155 (45.9)	141 (46.5)
	Female	165 (48.8)	161 (53.1)
Race/ethnic	White	169 (50)	169 (55.8)
	Hispanic	58 (17.2)	60 (19.8)
	Black	54 (16)	41 (13.5)
	Other†	35 (10.3)	31 (10.2)

Note: *May not total 100 because of missing data and rounding.
†Asian/Pacific Islander and American Indian.

grade 1, 38% of grade 2, and 46% of grade 3 students reported practicing behaviors considered to be high risk for injury. For example, 30% of grade 2 stated they never wore a helmet when riding a bicycle and 13% reported darting into a street without looking. Among grade 1 students, more than one-fourth said they did not check to see if someone was near them before swinging a bat.

Effect of the TFFK Intervention

The *t*-test procedure was used to determine that the TFFK intervention schools exhibited a significantly greater increase in the overall knowledge/behavior score than comparison students ($p < .01$ at each grade level). Looking at absolute values, intervention schools had a 19% to 23% improvement from pretest scores. Confidence intervals were constructed around the change in mean score, from pretest to posttest for the intervention and control schools (Table 3). That the confidence intervals around the mean scores do not overlap between the intervention and control schools shows the significant difference in improvement between intervention and control schools. Control schools showed natural improvement in scores likely caused by experience in taking the test a second time and maturation. Boys and girls displayed similar baseline scores and absolute increases. Ninety-five percent confidence intervals around the change from baseline to posttest score show significantly greater improvement among boys and girls from the intervention schools at each grade level when compared with controls.

The TFFK had its greatest impact on minority students' absolute change in score. Although displaying the lowest baseline scores at all grade levels, African Americans and Hispanics had the largest increase in scores for grades 2 and 3. In grade 2, African American students in the intervention program improved their pretest scores by 31% and Hispanics by 25% compared with 12% or less among their matched control schools. Table 4 presents 95% confidence intervals around change in scores from pretest to posttest showing significantly greater increases among intervention students (whites at all grade levels, Hispanics at grades 1 and 2, and African Americans at grade 3).

Table 3. Mean Scores for Pretests and Posttests, Difference Between Pretest/Posttest Scores, and 95% Confidence Intervals by Grade Level

	Intervention Schools	Control Schools
Grade 1	difference = 3.06	difference = 1.70
	CI = (2.76 - 3.35)	CI = (1.35 - 2.06)
	$p < .01$	$p < .01$
	$N = 405$	$N = 292$
Grade 2	difference = 2.80	difference = 1.10
	CI = (2.46 - 3.14)	CI = (0.74 - 1.46)
	$p < .01$	$p < .01$
	$N = 383$	$N = 256$
Grade 3	difference = 3.27	difference = 1.55
	$p < .01$	$p < .01$
	CI = (2.91 - 3.63)	CI = (1.17 - 1.93)
	$N = 338$	$N = 303$

Note: *N*, sample size; CI, 95% confidence interval.

When examining the impact of the TFFK program by individual safety module by using the *t*-test procedure, the results were as follows. Grade 1 intervention schools performed significantly better than comparison schools in all six modules: bicycle safety and brain and spinal cord ($p < .001$), vehicle, sports and water safety ($p < .01$), and violence/conflict resolution ($p < .01$). Grade 2 in all modules except violence prevention. Grade 3 in four of the six modules: bicycle ($p < .001$), vehicle ($p < .01$), water safety ($p < .001$) and violence prevention ($p < .001$). The TFFK had its greatest impact on self-reported behavior for intervention schools grades 1 ($p < .001$) and 3 ($p < .05$).

Through the use of the GEE regression method and adjusting for the covariates pretest, gender, SES, and race/ethnicity (because of collinearity between reading score and SES, the reading score was removed from the model), the TFFK educational intervention was a significant predictor of an increase in score from pretest to posttest ($p < .001$) (Table 5). Intervention students had significantly improved scores in grade 1 (maximum likelihood [ML] estimate = −0.2792), SE = .0548, $p < .0001$), grade 2 (ML estimate = −0.3628, SE = .0512, $p = .0001$), and grade 3 (ML estimate = −0.2928, SE = .0493, $p = .0001$). For grade 2, SES was also an independent predictor of change in pretest to posttest scores (ML estimate = .0858, SE = .0302, $p = .005$). The TFFK intervention was associated with a significant decrease in self-reported risky behaviors, such as no helmet use and darting into the street, for grades 1 and 3 and a significant increase in knowledge for all grades ($p < .001$).

DISCUSSION

The TFFK study provides data on the baseline level of knowledge and behavior relating to safety among a diverse elementary school population in San Diego County. The data shows that students at all grade levels lack some basic knowledge that would help them reduce their risk of injury, and that many students are engaging in unsafe behav-

Table 4. Change in Pretest and Posttest Mean Score and 95% Confidence Interval by Grade and Race/Ethnic Group

	Black		White		Hispanic	
Grade	Control	Intervention	Control	Intervention	Control	Intervention
1	1.82* (0.74-2.90) $N = 49$	2.16* (1.48-2.85) $N = 55$	1.96* (1.50-2.42) $N = 151$	3.42* (3.02-3.81) $N = 230$	0.32 (−0.43-1.07) $N = 84$	2.86* (2.22-3.50) $N = 47$
2	2.16* (1.07-3.26) $N = 37$	2.27* (1.37-3.18) $N = 59$	0.88 (0.38-1.39) $N = 130$	2.81* (2.29-3.32) $N = 180$	0.67 (−0.12-1.46) $N = 86$	3.00* (2.38-3.62) $N = 48$
3	1.26* (0.35-2.05) $N = 60$	3.88* (3.07-4.69) $N = 58$	0.67 (−0.12-1.46) $N = 169$	3.36* (2.85-3.86) $N = 169$	1.85* (0.92-2.79) $N = 54$	3.30* (2.33-4.26) $N = 41$

Note: N, sample size; * = $p < .01$.

iors that put them at high risk. Multivariate analysis shows that students receiving the TFFK intervention had significantly greater improvements in posttest scores after controlling for gender, race/ethnicity, and SES.

The TFFK goes beyond previously successful community health education programs managed by local hospitals and sponsored by community organizations by directly involving elementary schools and parents (Liller, Smorynski, McDermott, Crane, & Weilbley, 1995; Rivara et al., 1994). School health education could be one of the most effective avenues to reduce the burden of the most serious health problems in the United States, such as injury (Grunbaum, Kann, & Williams, 1998; Institute of Medicine, 1997). Peterson and Roberts (1992) have reflected on the consensus that, in addition to the focus on children, behavioral interventions with parents are a promising avenue of childhood-injury prevention.

Limitations

Limitations of the study design include the self-report nature of the survey and the inability to control all threats to internal validity. Community activities, media coverage, or family events may have occurred during the implementation period but are not thought to have occurred differentially among schools. Self-reported response to behavior and not actual observations of behavior were recorded. A random design was used to minimize the potential for confounding, and multivariate analysis was used to adjust for individual covariates. A second limitation was that the posttest was administered within a short time of the intervention, so that it is not possible to comment on whether the demonstrated affects were sustained for any length of time. Lastly, a limitation to consider is that the posttest was delivered at the end of the intervention, perhaps causing higher scores for more recently completed material. The data did not support this supposition.

Table 5. Analysis of GEE Parameter Estimates: Standard Errors and *p*-Values

Characteristics	Grade 1	Grade 2	Grade 3
TFFK intervention	$p < .001$	$p < .001$	$p < .001$
Race/ethnic group*			
Black	$p = .795$	$p = .076$	$p = .986$
Hispanic	$p = .074$	$p = .914$	$p = .897$
Other	$p = .585$	$p = .098$	$p = .083$
SES	$p = .079$	$p = .005$	$p = .907$
Gender	$p = .287$	$p = .982$	$p = .058$

Note: GEE, generalized estimating equation.
*Reference group = white.

Nursing Implications

The increasing awareness of childhood injuries as an important public health problem in the U.S. and around the world has important implications for nurses in clinical practice and research settings. In clinical practice, injury prevention strategies focus on sociocultural issues and behavioral change in counseling with children and families. School-based education of children may help to broaden and reinforce counseling efforts (Lavin, Shapiro, & Weill, 1992).

The collaborative research described in this study provides avenues for nurses, community educators, and practitioners who may have unrecognized opportunities to join in a community effort to reduce injury related morbidity and mortality. These opportunities include developing nursing interventions, conducting evaluative research, and creating injury surveillance systems.

The focus of HP2010 on the prevention of injury and targeting health promotion is central to nursing practice. Linkages with community hospitals, nurse researchers, neurosurgeons, and health educators can be used to pose a unified approach to injury prevention strategies, including legislation,

leading to declines in injury related morbidity and mortality. Hospital nurses can begin dialogue with school nurses and school administrators to get permission to conduct the TFFK intervention and evaluation in neighborhood elementary schools. A set of curricula for all three grades costs approximately $200.00.

CONCLUSION

Children in grades 1, 2, and 3 often lack basic knowledge about safety and do not recognize behaviors considered high risk for injury. Defining baseline profiles of knowledge and recognition, which varied by race/ethnic group, will help one to become efficient in the use of prevention resources. The data shows that even in states that have implemented bicycle helmet laws and have high visibility water sports, such as California, there are new concepts provided in the TFFK curriculum that significantly impact student learning of bicycle and water safety.

School health education is a vital part of improving the health of our nation's children. It is important to recognize that schools not only have direct access to young children, but also have the unique capacity to affect the lives of staff, parents, and the entire community (Rivara et al., 1994). This study provides encouragement that early school-based, theory-driven injury prevention education may have a positive impact on young children. Definitive conclusions about injury reduction await results of longitudinal studies of sustained and sequential curriculum-based education among culturally diverse populations.

The TFFK program complements the national goal of conducting and evaluating comprehensive school health programs. There is a need for robust and ecological approaches to injury prevention that include a school-based curriculum approach with parental involvement, environmental modifications, and legislation if communities are to achieve a considerable sustainable injury reduction. Raising a generation of children schooled in injury prevention can only help achieve that goal.

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