Introduction

S1 Introduction.
J J. Tepas III, MD, FACS, FAAP

Editorial Comment

S2 EDITORIAL COMMENT.
Judy Schaechter, MD

Simple Things That Work

S3 Unintentional Scald Burns in Children Under 5 Years Old: Common Mechanisms of Injury.
G Lowell; K Quinlan

S3 A Home Visitor Program for Improving Home Safety in a Low-Income Community.
K K. Kangas; L K. Lee; P Forbes; S K. Osganian; D P. Mooney

S4 Effect of a Child Safety Street Program on Improving Safety Knowledge.
R D. Kregenow; D Jaffe

S4 This is RED: A Novel Program For Teen Driving Offenders.
B A. Gaines; C M. Vitale; D Jornsay-Hester; L Maloney

S4 All-Terrain Vehicle Safety and Use Patterns in West-Central Illinois Youth.
J W. Hafner; S M. Hough; M A. Getz; Y R. Whitehurst; R H. Pearl

S5 Booster Seat Usage in Alabama Children.
W D. King; N Wright; M Kahn; K Monroe

S5 Child Safety Seat Inspections Made Easy: An Online Referral System.
E M. Walston; M Foxworth

Article

S6 Using Focus Groups in Pediatric Injury Prevention Research.
Kyran Quinlan, MD, MPH

S7 Innovations in Injury Prevention Education.
Michael J. Mello, MD, MPH; Marjorie A. Getz, MA, MPHIL; Garry Lapidus, PA-C, MPH; Joann Moss, BBA; Pamela Soulou, BA

Joyce C. Pressley, PhD, MPH; Lisa Trieu; Tiffany Kendig, MSPT; Barbara Barlow, MD
Judy Schaechter, MD; Stephen Dearwater, MS; Susan B. Uhlhorn, PhD

William D. King, RPH, MPH, DrPH; Kathy Monroe, MD; Janie Applegate, RN, MPH; Julie Cole-Farmer, RN

Identifying Interventions That Promote Belt-Positioning Booster Seat Use For Parents With Low Educational Attainment.
Flaura K. Winston, MD, PhD; Danielle Erkoboni, BA; Dawei Xie, PhD

"Cubs Click It for Safety": A School-Based Intervention for Tween Passenger Safety.
Mary E. Aitken, MD, MPH; Samantha H. Mullins; Virginia E. Lancaster; Beverly K. Miller, MEd

Reducing Injury Rates Using a Community-Based Approach.
Michael A. Gittelman, MD; Wendy J. Pomerantz, MD, MS; Talicia McNealy, MBA
Introduction

J. J. Tepas III, MD, FACS, FAAP

The only effective vaccine against the disease of injury is prevention. The heart of prevention is effective education. The Robert Wood Johnson Injury Free Coalition for Kids, which now consists of 43 centers throughout the United States, continues to provide committed clinicians and experienced social scientists a unique clearinghouse for the exchange of concept and construct of effective programs designed to control the scourge of childhood injury. This year’s meeting once again brought together recognized experts in all aspects of injury surveillance and prevention education for three days of intense discussion and peer review of concepts that worked, and those that did not. This supplement is dedicated to these individuals. They are frequently invisible to those who see the drama and pain of trauma care, yet they push ahead on a daily basis to educate society about the disease of injury and to make our children’s environment a safer place.

This year’s edition consists of four groups of abstracts describing injury prevention initiatives that apply new ideas and simple solutions to ongoing problems. The fourth of these describes effective prevention programs in four separate cities. Dr. Mello and his colleagues combined their efforts to produce a more detailed manuscript that examines all four of these programs together.

The depth of other problems equally related to the control and understanding of the disease of childhood injury is then more definitively described and analyzed in the scientific reports that follow. The intent of this publication is to present an overview of the components of childhood injury prevention and education that stimulates thought and provides insight and new ideas that will push the tide of effective prevention even higher.
EDITORIAL COMMENT

The Injury Free Coalition for Kids has always stressed the importance of site-specific prevention programming. The Injury Free model calls for local surveillance to dictate local priorities and for each site to work with local partners to determine programming initiatives. The resultant programs are conducted in a variety of neighborhoods and agencies that are nearby, but often extrinsic to the hospital itself. Injury Free staff may carry with them a vinyl banner or other signage and most often nomadically operate under someone else’s sign post—at a child care center, school, house of worship, police station, health fair, etc.

Still, despite the diversity of program delivery, most every site has in common the inclusion of child passenger safety (CPS) and home safety among its core offerings. All sites are hospital-based, thus many have focused their CPS and home safety activities within a medical center, creating “safety centers” located in a hospital or clinic. Others, however, have created mobile units, moving the safety center out to the community. Safety centers of both types provide education, and have space to house learning tools, including to scale vehicles, home interiors or street models. They may have access to multimedia equipment and storage space for safety items for on-site distribution. Both mobile and stationary safety centers provide sites with tangible and intangible benefits. A visual and physical presence increases awareness in the community, provides a location for media visits, and raises a site’s profile for staff and potential donors. Importantly, safety centers can extend educational reach beyond those already interested in safety to the casual passerby who comes in for “just a look,” but spends an hour learning, leaving with cabinet locks and a choke tube tester. As with program development, whether a mobile or stationary safety center is chosen depends on the fit at each Injury Free site, as well as other factors such as population density, public transportation, and potential resources to be leveraged.

Summary

The five abstracts that follow provide insight into four safety centers. Dr. Gittleman, Dr. Belkowitz and Dr. Emery each report on evaluations of their safety centers. Dr. Gittleman’s group tracked services provided, product distribution and quality of service in the first 6 months of Cincinnati’s safety center operation. The data are important to both the center’s formative evaluation and its ability to justify future funding. Dr. Belkowitz reports on Miami’s mobile safety center’s progress in parent safety education, showing a knowledge increases in nearly all participants. Dr. Emery’s evaluation of Denver’s Junglemobile, a mobile safety demonstration center targeting children, showed significant gains in child knowledge regarding CPS, but change was neither sustained nor related to behavior.

In a separate abstract regarding Miami’s mobile safety center, Ms. Stepanian reports on the unexpected adjustments needed, the lessons learned, over the first year of operation. Ms. Philbrook reports on the biggest challenge of all—sudden loss of funding for the hospital-based safety center in Minneapolis.

Judy Schaechter, MD
University of Miami
Simple Things That Work

The following abstracts demonstrate real risks within the environment of almost every child every day. Lowell and colleagues point out how the microwave can transform from convenience to threat. The group from Boston Children’s Hospital then describes how modification of an existing social resource can significantly improve family awareness of this type of risk. Kregenow and Gaines each describe how their institutions have extended the prevention mission to a community level. Finally, the last three abstracts in this group define the continuing problem with vehicular injury. Hafner demonstrates the effectiveness of safety education in limiting ATV injury; King et al. describe the limited appreciation of the value of booster seats among children and parents of Alabama, and Walston presents a simple and effective system of on-line coordination of safety seat inspection. Taken together, these short presentations clearly indicate that effective prevention can indeed come from simple solutions.

J Trauma. 2007;63:S3–S5.

Unintentional Scald Burns in Children Under 5 Years Old: Common Mechanisms of Injury

G. Lowell and K. Quinlan

Background: Previous studies have identified hot beverages or cooking liquids as the most common scalding substance in young children. Few studies have described and analyzed common mechanisms of scald burn injury.

Methods: The University of Chicago Burn Center’s database was used to identify children under age 5 years who were admitted for scald burns between January 1, 2002 and December 31, 2004. A retrospective chart review identified basic epidemiologic data as well details of the circumstances and mechanisms of injury.

Results: Of 640 admissions, 140 (22%) were children under age 5 years with scald burns. Of the 137 charts available for review, 118 (86%) were unintentional injuries. A total of 104 (88%) scalds were related to hot cooking or drinking liquids; 71 (60%) injuries occurred in the kitchen. In 39 (33%) cases, substances were heated by a stove; 29 (25%) were heated by a microwave. There were 9 (8%) children between the ages of 18 months and 4 years who were scalded after the children opened countertop microwaves and removed the hot substance themselves. The 6 most common mechanisms of injury were as follows: 41 (35%) patients pulled over a cup, bowl, or cookware onto themselves; 16 (14%) patients climbed to reach the hot substance; the hot substance spilled onto 16 (14%) patients by someone else; 9 (8%) patients opened the microwave, scalding themselves; 8 (7%) patients were scalded during a bath; 5 (4%) patients were scalded while being carried or held.

Conclusions: We conclude that easy access to a microwave is an under recognized scald risk to young children who operate them. An engineering design modification of microwaves could help prevent this fourth most common mechanism of scald burn injury. Progress in preventing the most common mechanisms of child scalds will require innovation beyond the currently recommended prevention strategies.

A Home Visitor Program for Improving Home Safety in a Low-Income Community


Background: More than 4.5 million U.S. children are injured in the home annually. Home visiting programs incorporating education, environmental modification, and safety product distribution can help protect children from home injuries. The objective of the Safer Homes Program is to increase parental home safety knowledge and practices in a low-income population using home visitors.

Methods: Bilingual home visitors from community organizations were trained to conduct home safety visits. Visitors performed an initial home safety assessment. Home safety kits were given to each family (e.g. smoke detectors, cabinet locks, electrical outlet covers and Poison Center stickers) with other products available upon request, and parents were educated in their use and importance. Three months later a follow-up home visit was performed to directly observe changes in home safety practices.

Results: Twenty-seven baseline home visits and 20 follow-up visits have been conducted. The use of cabinet locks increased from 47% at baseline to 80% at follow-up. Forty-three percent of families had a fire escape plan at baseline and 86% at follow-up. Smoke detector testing increased from 87% to 100%. Observed Poison Center sticker and outlet cover use also increased to 100% at follow-up from 71% and 64% at baseline respectively.
change was demonstrated in the areas of kitchen, bathroom, or child passenger safety.

**Conclusions:** Providing safety products was effective in changing the home environment for the areas of fire safety, poisoning prevention, and the use of outlet covers and cabinet locks. In areas where only anticipatory guidance was offered, the Safer Homes Program did not demonstrate an appreciable change.

**Effect of a Child Safety Street Program on Improving Safety Knowledge**

**R. D. Kregenow and D. Jaffe**

**Background:** Children between the ages of 5 to 9 years are at risk for pedestrian, motor vehicle, bicycle, animal bite injuries, and stranger assaults. A mobile Safety Street was developed to educate children in this age group about safe behaviors using didactic teaching and practical training.

**Methods:** A quasi-experimental study was conducted on kindergarten through second grade children from St. Louis region schools. Students were tested using a previously validated testing method. Intervention school children were tested 1 week before the Safety Street arrival, 1 month later, and 4–6 months after enrollment. Control school children were tested 1 month before the Safety Street arrival, 1 month later, and 4–6 months later. Control school children were tested immediately before the Safety Street arrival.

**Results:** Five hundred eighty-seven intervention subjects and 343 control subjects took test 1, 2, and 3. Between test 1 and test 2, test scores of intervention subjects increased 13% while control subjects increased 4% (p < 0.001). Between test 1 and test 3, test scores of intervention subjects increased 16% while control subjects increased 5% (p < 0.001). This statistical difference was observed when stratified by grade. Intervention, increasing age, and grade were significant independent predictors of higher scores (p < 0.001).

**Conclusions:** Using a validated testing method, we tested the Safety Street Program’s ability to transmit safety knowledge to children between the ages of 5 to 9 years. The results support the efficacy of the program to teach this knowledge, and to maintain this improvement for 4–6 months.

**This is RED: A Novel Program For Teen Driving Offenders**

**B. A. Gaines, C. M. Vitale, D. Jornsay-Hester, and L. Maloney**

**Background:** Motor vehicle crashes are the leading cause of death in teens, with those aged 16–19 four times more likely to crash than older drivers. We hypothesized that providing a multi-faceted educational program to teens with documented poor driving habits would result in increased knowledge regarding driving risks and improved compliance with safe driving practices.

**Methods:** District justices offered participation in our program to teens 16–18 years of age who received a moving motor vehicle citation as part of their sentencing. Subjects were randomly assigned to either the intervention (I) or control (C) group. Teens assigned to I-group spent a half day participating in a multi-disciplinary, hospital based program. Questionnaires were administered at baseline, 6, and 12 months after enrollment. Subjects’ driving records were also reviewed. IRB approval and informed consent were obtained.

**Results:** Eighty teens (40 I and 40 C) were enrolled in the 2 year pilot study. Participants were predominantly male (73%) and cited for speeding (62%). At both 6 and 12 months after enrollment, the I-group showed statistically significant improvement in their response to items on spinal cord injury and on duration of parental grieving after the death of a child. Behavioral improvement in seat belt usage and speeding approached statistical significance. There was no difference in the rate of recidivism (I = 25%, C = 21% p = NS). Both teens and parents uniformly believed that the program was beneficial.

**Conclusions:** We are encouraged by these documented improvements in knowledge and behavior and the overwhelmingly positive feedback from our participants. Future plans include increasing the number of programs offered and developing a standardized curriculum.

**All-Terrain Vehicle Safety and Use Patterns in West-Central Illinois Youth**

**J. W. Hafner, S. M. Hough, M. A. Getz, Y. R. Whitehurst, and R. H. Pearl**

**Background:** All-terrain vehicles (ATVs) are increasing in popularity in the United States with an accompanying rise in injuries and deaths. Children under 15 years accounted for 31% of ATV-related injuries and 27% of deaths in 2003. Routine patterns of youth ATV use are largely unknown; this study seeks to clarify these practices.

**Methods:** Youth members in the 4-H club of America (4-H) of four West-Central Illinois counties were surveyed. The instrument consisted of multiple choice, Likert scale and open-ended questions. Questions focused on demographics, typical ATV use patterns, safety knowledge, safety equipment usage, ATV crashes and injuries. Questionnaires were sent to all eligible youth in a household in two separate mailings.

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From St. Louis Children’s Hospital.
From Children’s Hospital of Pittsburgh.

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Results: Out of 1850 surveys, 634 were returned (34%); 280 indicating recent ATV use (44%; study population). Respondents were principally adolescent males from farms or rural locations. Most were drivers (87.9%), drove on average 1 day per week (60.2%), and used ATVs for recreation (36%), work (22.6%), or on farms (27.1%). Most never used safety gear, including helmets, and few (14.6%) had received safety education. Of the 67% who experienced a crash on an ATV, almost half (44%) were injured. Rollover crashes were uncommon (7.2%) but produced more severe injuries (30%). Children with safety training had less crashes ($p = 0.01$). Those riding after dark ($p = 0.13$) or without adult supervision ($p = 0.042$) were more often injured.

Conclusions: ATV use is common in a rural 4-H population. Most child ATV users are adolescent boys, have little safety training and do not use safety equipment or helmets.

Booster Seat Usage in Alabama Children

W. D. King, N. Wright, M. Kahn, and K. Monroe

Background: The majority of states do not specifically report booster seat use. This observational survey was performed at several Alabama elementary schools to estimate booster seat use among children ages 4 to 8 years.

Methods: An experienced team of child passenger safety technicians visited a sample of Alabama elementary schools to observe booster seat use among students 4 to 8 years old. Schools were randomly assigned to an intervention group with written educational material and personal counseling or to a control group. Two separate observations were made at all schools (1,249 total intervention school observations and 1,599 control school observations).

Results: Intervention schools (n = 23) had overall booster seat use rate of 36.6% before and 38.5% after educational intervention ($z = 0.62$, $p = 0.53$). Control group schools (n = 20) had 21.6% use and 31.6% use during the same time frame ($z = 4.45$, $p < 0.001$). Intervention schools had higher pre education booster seat use than controls (36.6% versus 21.6%, respectively), ($z = 5.80$, $p < 0.001$). Post intervention use was higher in the intervention group schools versus control group schools (38.5% versus 31.6%, respectively), ($z = 2.82$, $p = 0.005$). The highest individual booster seat use rate was 90.6%, (lowest was 3.0%).

Conclusions: This survey provides the first statewide estimates of booster seat use at elementary schools in Alabama. 2005 state survey reported child restraint use as 92%. This survey reported an overall booster seat use of 31.6%. Although both study groups had improvements in observed booster seat use, only the controls had a significant increase. Control group schools also had significantly lower pre- and post-usage rates.

Child Safety Seat Inspections Made Easy: An Online Referral System

E. M. Walston and M. Foxworth

Background: Referrals for child safety seat inspections are made at all times. Keeping personnel available to receive referrals, schedule appointments, and track data from child safety seat checks is expensive. We developed a user-friendly online referral system to address this need.

Methods: A laminated card is given to all potential referral sources. The card directs referring community care providers to a website that guides the provider through an online appointment process. After the demographic information is submitted online, a map to the permanent inspection station and appointment time is provided. This system allows the child passenger safety technicians to estimate the number of child safety seats needed. Information collected at the events is maintained in a database that is used for tracking the number of child safety seats distributed, the number of seats checked, and the number of correctly versus incorrectly installed seats.

Results: There have been 467 online appointments made since the inception of the system in November of 2004. Clients, providers, and child passenger safety technicians are very pleased with the system. Other outcomes include saving time and money.

Conclusions: The database provides accurate data that can be utilized for tracking purposes. The data serves as an indicator of child safety seat safety trends in eastern North Carolina and allows for development of targeted interventions. The database facilitates the streamlining of required reports. All child safety seat programs should consider implementing an online referral system. Information regarding this site and its URL can be obtained from ewalston@pcmh.com/sfoxwort@pcmh.com.

From Children’s Hospital of Alabama.

From Pitt County Memorial Hospital.
Using Focus Groups in Pediatric Injury Prevention Research

Kyran Quinlan, MD, MPH

Preventing childhood injuries often involves changing behaviors. A focus group is an interview of usually 6–8 participants conducted for the purpose of better understanding perceptions of the group on a certain topic. This type of inquiry has a unique role in child injury prevention research. Here are five examples of the use of focus group methodology in child injury prevention research.


Preventing childhood injuries often involves changing behaviors. Research into the way individuals make choices about their safety behaviors frequently necessitates going beyond the capacity of closed-ended questions on surveys or questionnaires. A focus group is an interview of usually 6–8 participants conducted for the purpose of better understanding perceptions of the group on a certain topic. This type of inquiry has a unique role in child injury prevention research. For example, focus group research led to an understanding that parents who negotiate with their children regarding motor vehicle restraint choices are less likely to use belt-positioning booster seats when they should.

Here are five examples of the use of focus group methodology in child injury prevention research.

Quinney et al. from the University of Chicago report the findings from focus groups of urban caregivers of children less than 5 years to better understand perceptions of risk and control regarding child scalds. They found that successful scald prevention efforts will need to be effective with some parents who are overconfident and others who felt helpless in protecting their children from scalds.

Richardson and colleagues from Hennepin County Medical Center conducted focus groups of injury prevention professionals working in Minneapolis/St. Paul. This work allowed for a Twin City-wide picture of the range of activities, including a self-assessment of “strengths, weaknesses, opportunities and threats” in these efforts.

In Providence, Rhode Island, Palmisciano et al. organized focus groups of 8th and 9th graders to determine effective communication strategies for a substance abuse prevention campaign. They found that focus group participants frequently overestimated the true rate of substance abuse. This insight has helped in the design of their campaign which will emphasize that non-use is the norm.

At the Children’s Hospital of Denver, Emery and Faries conducted focus groups of migrant and seasonal farm workers who were also parents. This work provided a better understanding of the injury concerns of these parents and helped mold injury prevention efforts in this community.

Focus groups also were used by Pomerantz et al. at Cincinnati Children’s Hospital to involve parents and children in the design of after-school activities in a high-risk neighborhood. Considering the interests of both parents and children may boost participation in these programs and better protect children by giving them enriching and safe activities.

These abstracts demonstrate that using focus groups to gather complex information regarding safety behavior can offer key insights. This qualitative research proves that “not everything that counts can be counted.”

REFERENCES

Innovations in Injury Prevention Education

Michael J. Mello, MD, MPH, Marjorie A. Getz, MA, MPHIL, Garry Lapidus, PA-C, MPH, Joann Moss, BBA, and Pamela Soulos, BA

Innovations in Injury Prevention Education describes four programs presented at the Annual Injury Free Coalition for Kids National Meeting in December 2006. The programs were developed by Injury Free sites in Providence, RI; Detroit, MI; Hartford, CT; and Peoria, IL. Each demonstrates how education continues to be an essential aspect of injury prevention interventions, either as a means of disseminating knowledge among children or as a way to assess baseline knowledge to develop more appropriate interventions. For each program, summaries of methods are provided, along with the results of basic statistical analyses. The need for continued research on education’s role in injury prevention is emphasized.

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This article was written for the proceedings from a conference entitled “Innovations in Education.” The session presented four Injury Free programs, each discussed in detail below. Each abstract addressed a specific topic in injury prevention, and in so doing, demonstrated the variety of ways in which education may be used to extend injury prevention knowledge to various populations. Two of the presentations described programs that utilized traditional educational settings to teach children about safety. The other two examined the need for education beyond what is provided in the classroom with programs that used community based education techniques.

Injury Free of Providence, RI, piloted a program that aimed to increase knowledge about dog bite prevention in third-graders. Dog bite injury is common and affects an estimated 4.7 million individuals annually. To assess the magnitude of this health problem locally, investigators tallied the frequency of dog bite injuries in patients presenting to the Emergency Department of Hasbro Children’s Hospital in Providence, RI. Hasbro Children’s Hospital is a pediatric specialty hospital, the state’s only pediatric trauma center, and a regional referral center. Over the 7-year period under review, there was a total of 411 documented dog bite injuries to children. Descriptive analyses of these data showed that 59% of dog bite victims were male and 41% female. The most common injury sites were head/neck (34.4%), lower extremity (30.0%), upper extremity (28.3%), and trunk (5.8%). Head and neck bites were the most common site of injury in those under age five. Those children aged five and older were significantly more likely to sustain upper and lower extremity bites. These data are comparable to national statistics which show the same type of gender distribution and variation in injury site by age. These findings, in conjunction with published recommendations from the Centers for Disease Control and Prevention and the American Veterinary Medical Association, strongly support the need for dog bite prevention education. Injury Free of Providence has partnered with researchers at Brown University to develop a dog bite prevention program intended to decrease the incidence of dog bites to children.

The pilot program reported on during the “Innovations in Education” session was delivered in three third grade classrooms in Rhode Island. Fifty-one students participated in this program. The program consisted of three classroom sessions and was delivered over the course of 4–5 weeks. Components of the sessions included interaction with a pet therapy dog, a video demonstrating various dog behaviors, and written compositions in which the students wrote a letter to the pet therapy dog describing what they had learned. To test the...
effectiveness of the program, anonymous, coded surveys were administered at baseline (session one) and at completion of the program (session three). The surveys included eight “Safe or Not Safe” classifications, which asked students to determine whether pictures portraying dogs and children in various situations were safe or not and eight mood classifications in which students viewed eight pictures of different dogs and decided whether each dog’s mood was friendly, mean, scared, or not clear.

Results of the pilot test indicated a significant increase in dog bite prevention knowledge among participants when comparing pretest survey scores (67%) and posttest survey scores (77%; F(1,50) = 25.1, p < 0.01). Classroom teachers who observed each session were satisfied with program content and indicated that the program was optimal in number of sessions, session length, and in age-appropriate content. Results of this pilot test demonstrate both the effectiveness and acceptability of this program and underscore its potential as a means of educating school-age children about dog bite prevention. The positive results validate the use of a traditional education setting, the school classroom, as an appropriate venue for delivering non-traditional safety education on safe behaviors for children around dogs. Injury Free of Providence is continuing its work and will be conducting a randomized control trial measuring the program’s efficacy in other elementary school populations.

“KTK 2 B Safe (Kids Teaching Kids to be Safe)” is a program designed by Injury Free of Detroit, MI, to investigate alternative methods of providing injury prevention education to elementary school students. Recent budget cuts have led to reductions in the availability of community educators (e.g. firefighters) who usually provide this information, prompting the Detroit site to explore the effectiveness of using high school students to disseminate injury prevention knowledge.

The KTK 2 B Safe presentation described two related studies in which high school students were trained to teach elementary school students about motor vehicle safety and “How to call 911,” respectively. The classes were interactive and provided educational materials for the students to take home to reinforce the information gained. Pre- and posttests were administered to assess change in level of knowledge. For the motor vehicle safety study, pre- and posttest scores were 29% and 77.1% respectively, demonstrating a significant increase in knowledge; for the “How to call 911” study, scores were 47.2% and increased to 91.7% after the program, another significant increase.

The results from these two studies strongly affirm the effectiveness of high school students as injury prevention educators. Especially notable is that the benefits were not restricted to the elementary school students; the high school students acquired safety knowledge, leadership and communication skills, gained self esteem and confidence, and were exposed to the concept of service-learning projects. Injury Free of Detroit intends to conduct further studies examining the efficacy of this educational approach for teaching a variety of injury prevention topics.

Injury Free of Hartford, CT, presented “Fire Safety Knowledge and Practice among Hartford’s Albanian, Bosnian and Hispanic Populations.” The presentation described a study conducted to assess the level of fire safety knowledge of Albanian and Bosnian immigrants compared with that of Hartford’s Hispanic population. Since the 1990s, CT has experienced an influx of immigrants from Bosnia and Albania. Immigrants often face many challenges, including language barriers, unemployment, lack of education, illegal immigration status, and, for these two immigrant groups, post traumatic stress disorder due to experiences of war. Because of these and other challenges, it is reasonable to expect that this population would suffer from diminished access to knowledge about safety and injury prevention.

The objectives of this study were useful in ascertaining whether fire safety education is needed in Hartford’s Bosnian, Albanian, and Hispanic populations. By understanding the cultural differences across diverse communities, and Balkan immigrants in particular, fire safety programs can be tailored to more appropriately educate population subgroups.

To assess the Bosnian and Albanian immigrant populations’ knowledge about fire safety, Injury Free of Hartford surveyed 100 individuals recruited from a convenience sample of parents attending local elementary school PTO meetings and conferences. The English language survey was translated into Bosnian, Albanian, and Spanish. Of the 100 parents recruited 96 agreed to participate. Thirty-one percent self-identified as Bosnian (n = 27), 28% as Albanian (n = 30), and 41% as Hispanic (n = 39). Questions included in the survey were, “Does your home have a working smoke detector with active batteries?,” “Does your family have an escape plan, either verbal or written?,” and “Do you keep matches and lighters out of reach of children?” Figure 1 summarizes the survey responses.

There were no significant differences between the three ethnic groups with regards to having a working smoke detector and keeping matches/lighters out of reach of children. However, a sizable proportion of Bosnians (48%) and Hispanic parents (54%) did not have a fire escape plan. Injury Free of Hartford used these results to guide its community fire safety program and to emphasize the need for fire escape plans among these 2 ethnic subgroups.

The abstract presented by Injury Free of Peoria, IL, “All-terrain vehicle dealership point of sale child safety compliance in Illinois,” investigated how all-terrain vehicle (ATV) dealerships function as a source of injury prevention education. Over 100,000 children under 15 years of age were treated for nonfatal ATV injuries in United States Emergency Departments between 2001 and 2003. While child safety recommendations for use of ATVs are described by the Consumer Product Safety Commission, the extent to which the dealerships convey these recommendations to customers is unknown.

The subject pool for this study was all 2004 licensed motorcycle dealers in Illinois. Trained investigators conducted telephone surveys of the dealerships by posing as parents of a 13 year-old child and indicating that they were interested in purchasing an ATV, but were uninformed of ATV usage and safety
issues. All information from the conversations was recorded on a standardized form and each dealership surveyed was debriefed by letter after completion of the study.

A total of 589 dealerships were surveyed, with 127 completing the survey. In 124 of these cases, investigators spoke with a salesperson. See Table 1 for percentages of respondents who made specific recommendations about riding ATVs and use of safety equipment. The results of the telephone surveys indicated that most dealerships followed the appropriate recommendations for child use of ATVs. Injury Free of Peoria determined that efforts aimed at promoting injury prevention messages among ATV dealerships may be unnecessary, as they simply reinforce what the dealers already do; however, they maintain that sustaining such efforts or increasing them to be universally implemented may decrease ATV injury rates.

By organizing the “Innovations in Education” symposium, the entire Injury Free Coalition for Kids organization has highlighted its commitment to developing novel programs that promote the use of education in preventing childhood injury. As the programs discussed above have illustrated, investigating the role of education in injury prevention can be undertaken in many different ways. Though the traditional classroom setting and the teacher/student environment may be an adequate system for disseminating injury prevention knowledge, it is important to continue researching alternative, more effective and engaging methods. In addition to providing varied programming, however, it is essential to continually evaluate the effectiveness of educational programs. Especially because education can reach such a wide range of populations, cultural differences must be accounted for by assessing the role education may play in specific communities.

### Table 1 Percentage of Respondents Making Specific Recommendations About Riding ATVs and the Use of Safety Equipment

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made appropriate recommendation for engine size (&lt;90 mL)</td>
<td>70.3</td>
</tr>
<tr>
<td>Believed rider training was necessary</td>
<td>83.5</td>
</tr>
<tr>
<td>When pressed about training, indicated that training could be arranged through a dealership course</td>
<td>49.6</td>
</tr>
<tr>
<td>Spontaneously mentioned CPSC guidelines for child ATV use</td>
<td>33.3–66.6</td>
</tr>
<tr>
<td>Mentioned age/engine size recommendation</td>
<td>36.2</td>
</tr>
<tr>
<td>Mentioned that guidelines recommend vehicles with an engine size of 90 mL or smaller for the child being shopped for</td>
<td>66.9</td>
</tr>
<tr>
<td>Provided information on size of vehicle best suited for a child</td>
<td>69.3</td>
</tr>
<tr>
<td>Stated that ATVs were dangerous</td>
<td>4.7</td>
</tr>
<tr>
<td>Considered the vehicles safe</td>
<td>2.4</td>
</tr>
<tr>
<td>Recommended rider training</td>
<td>76.4</td>
</tr>
<tr>
<td>Offered training at point of sale</td>
<td>33</td>
</tr>
</tbody>
</table>

![Fig. 1. Percentage of affirmative response to three fire safety measures as stratified by ethnicity. Fire Safety Survey Responses.](image-url)

Joyce C. Pressley, PhD, MPH, Lisa Trieu, Tiffany Kendig, MSPT, and Barbara Barlow, MD

Background: Examination of expenditures in areas where more universal application of effective injury prevention approaches is indicated could identify specific mechanisms and age groups where effective intervention may impact public injury-related expenditures.

Methods: The Healthcare Cost and Utilization Project 2003 (KID-HCUP) contains acute care hospitalization data for U.S. children and adolescents residing in 36 states. The study population includes 240,248 unweighted (397,943 weighted) injury-related hospital discharges for ages 0 to 19 years. Injury severity was assessed using ICDMAP-90 and International Classification of Injury Severity Scores (ICISS). SUDAAN was employed to adjust variances for stratified sampling. Expenditures were weighted to represent the U.S. population.

Results: Injury-related hospitalizations (mean $28,137 ± 64,420, median $10,808) were more costly than non-injury discharges, accounting for approximately 10% of all persons hospitalized (un-weighted), but more than one-fifth of expenditures. Public sources were the primary payer for 37.7% of injured persons. Incidence and cost per case variations across specific injury mechanisms heavily influenced total mechanism specific expenditures. Motor vehicle crashes were the largest expenditures for private and public payors with two thirds of expenditures ($192 million) of burn expenditures and 59.2% in 0–4 year olds. Expenditures per case (mean ± SD, median) were: firearm ($36,196 ± 58,052, $19,020), motor vehicle driver ($33,731 ± 50,583, $18,431), pedestrian ($31,414 ± 57,103, $16,552); burns ($29,242 ± 64,271, $10,739); falls ($13,069 ± 20,225, $8,610); and poisoning ($8,290 ± 15,462, $5,208).

Conclusions: More universal application of proven injury prevention has the potential to decrease both the public and private health expenditure burden among several modifiable injury mechanisms. With Medicaid as the largest single payer for children living in such neighborhoods, we hypothesize that such measures represent a potentially modifiable component not only to injury morbidity, disability and death, but also to public expenditures for injury.

As the number one cause of death among the age groups studied here, injuries are important on several fronts—first from a burden of illness vantage point and secondly from a cost of care perspective. Historically, we have seen modifiable injury mechanisms continue to contribute significantly to the health care burden despite having an effective best practices approach available for prevention. When considered in the context of an expanded national child health insurance program, periodic re-evaluation of public expenditures may catalyze and inform policy debates regarding levels of funding for prevention relative to cost of care and the injury-related mortality, morbidity, and disability burden.

Methods

Data Source(s)

The 2003 Kids Inpatient Database of the Health Care Cost and Utilization Project (KID-HCUP) contains treatment and hospital outcome data for discharges from acute care hospitals in 36 states. Variables include demographic, socio-economic (median income for zip code of residence), diagnostic, place and mechanism of injury (e-codes), admission...
source/type, month of admission, weekend day, length of stay, number of e-codes, condition codes, procedure codes, and others.24

The data set is an 80% sample of the Nationwide Inpatient Sample (NIS) sampling strata, with an additional stratum for freestanding acute care children’s hospitals. Six states limited hospitals in the sampling frame (Connecticut, GA, HI, SC, SD, and Virginia). National estimates of expenditures were facilitated by a weight variable based on the American Hospital Association’s universe of hospitals and provided in the KID-HCUP database for such purposes.24

**Patient Population**

KID-HCUP 2003 includes 2,984,129 acute care hospital discharges of persons aged 0 to 20 years of age. The final population for this study included 240,248 discharges identified through an injury-related condition or an e-code indicating injury. Study exclusions were age greater than 19 years, adverse medical or surgical events not associated with prior injury, and patients transferred to another hospital for care. Injured patients transferred between hospitals (n = 7,050) were included at the receiving hospital, but not the transferring hospital. When weighted to produce national estimates, the study population totaled 397,943 discharges for injury-related diagnoses.

**Geographic Region**

The 36 participating states providing statewide hospital discharge data in 2003 included: AZ, CA, CO, CT, FL, GA, HI, IL, IN, IA, KS, KY, MD, MA, MI, MN, MO, NE, NV, NH, NJ, NY, NC, OH, OR, RI, SC, SD, TN, TX, UT, VT, VA, WA, WV and WI.24

**Variable Classifications**

**Demographic and Socioeconomic Variables**

KID-HCUP provides uniform coding for race which included Hispanics of all races, and non-hispanic whites, blacks, Asians/Pacific Islanders, and American Indian/Alaskan natives.24 Seven states reported all races as other/unknown (GA, IL, KY, ME, OR, WA and WV). These states are excluded from race and ethnicity analyses, but included in totals not stratified by race/ethnicity. At least two states did not report age for persons who also had HIV/AIDS or alcohol or substance abuse diagnoses.

In KID-HCUP, income is provided at the community level using median income for the zip code of patient residence with the following 4 categories: 1) $1–$35,999; 2) $36,000–$44,999; 3) $45,000–$59,999; and 4) $60,000 or higher.24 The U.S. Census Bureau reported median household income in 2003 to be approximately $43,318 with 15.9% of households earning less than $15,000 and 15.1% earning more than $100,000.25 Urban/rural was categorized as: 1) large metropolitan area with at least 1 million persons; 2) small metro area of less than 1 million persons; 3) non metropolitan areas (micropolitan areas); or 4) non-urban area. Patient disposition was categorized as: 1) routine discharge with/without outpatient services; 2) transfer to another acute care/short term facility; 3) discharge to skilled nursing, intermediate care, or other facility; 4) discharge to home health care; 5) left against medical advice; 6) died in hospital; or 7) other/unknown disposition.24

**Injury and Injury Mechanisms**

We defined injury using standard classifications based on external cause of injury (e-codes) and conditions from the International Classification of Diseases, ninth clinical modification (ICD-9-CM)26,27 as well as predefined variable classifications available through Clinical Classification Software (CCS) present in KID-HCUP.28

**Severity of Injury**

We employed 2 methods to estimate injury severity. A program developed by the University of South Florida was used to calculate International Classification of Injury Severity Scores (ICISS) and ICDMAP-90 was used for injury severity scores (ISS).29,30 The program for ICISS provides three survival risk ratio (SRR) databases as reference populations for calculation of SRR. The Florida Agency for Health Care Administration (AHCA) 2000–2004 database was selected for use in deriving SRRs. ICISS scores are derived as a product of the SRRs generated for each ICD-9 code with higher scores representing lower severity. The ICDMAP-90, also used to produce injury severity scores (ISS) for traumatic injuries, allows the user to choose among several options when processing the ICD-9 CM codes. For the purposes of this study, we used the high severity assumption and ignore unknown options.29,30 ICDMAP-90 ISS scores were categorized as follows: 1) 1–8; 2) 9–15; 3) 16–24; 4) 25–40; and 5) 41–75.29 ISS scores range from 1 (lowest severity) to 75 (highest severity) and ICISS scores ranged from 0 (highest severity) to 1.0 (lowest severity).

**Public versus Private Payors**

We estimated private versus public expenditures for hospitalization due to injury using the uniform recoded expected primary payor data provided in KID-HCUP 2003 for self-pay/uninsured, Medicaid, Medicare, private insurance, and other. The “other” category was quite heterogeneous and sometimes contained payors that could be identified as a public funding source. Using the original expected primary payor category data as submitted by individual hospitals (non-uniform data), we further refined the differentiation of public payment for injury care by including the following as public pay sources: local, state, and federal corrections, Champus, the Indian Health Service, Title V, aid to dependent children, and other governmental as public expenditures. Medicare (n = 1,016), identified separately in KID-HCUP, was grouped with public payors. Medicaid represented 34.0% of the 37.7% of public funding sources for injury.
Hospital Charges

Charges are in 2003 U.S. dollars rounded to the nearest dollar.24 Zero and inconsistent charges were set to missing during the production of the KID-HCUP database.24 These do not appear in mean or median calculations of expenditures. Total charges may include emergency department fees for the admitting hospitalization, but do not include noncovered charges or professional fees except where noted in KID-HCUP documentation.24

Statistical Analyses

This study includes analyses of nearly 400,000 weighted hospitalizations (240,000 unweighted) of children residing in 36 states. Individual median and mean charges across individual patient categories and injury mechanisms were calculated using unweighted data. Weights provided by KID-HCUP 2003 are used to estimate national level expenditures.24,31 Because the sample of KID-HCUP discharges is not a simple random sample, estimation of variance calculations were made using SUDAAN software (version 9) as recommended in HCUP methods series reports.31–33 Wilcoxon rank sum was used to assess differences between continuous nonnormally distributed variables. The Chi-square ($X^2$) test was used in univariate analyses of categorical variables with statistical significance defined as $p \leq 0.05$. Means are presented with standard deviations. SAS 9.1 was used for processing the large database.34

RESULTS

Population Characteristics

The population tended to be older with nearly 40% aged 15 to 19 years of age, predominately male (58.0%), and white (59.3%). Most lived in a large metropolitan region (56.2%) and few resided in a rural area (6.5%). Nearly 80% of the population was relatively evenly distributed across the lower three zip code based income categories. Approximately one-fifth lived in zip codes with incomes of $60,000 or higher (Table 1).

Characteristics by Payor/Insurance Status

The age structure of the population varied significantly by payor (Table 1) ($X^2 588.7, p < 0.0001$). Overall, 37.7% of the study population was covered by public sources of insurance, but this rose to 52.4% of children aged 0–4 years. Within public funding sources, Medicaid was the largest payor covering nearly two thirds of very young black and Hispanic children. One-third of privately insured patients were aged 9 years or younger compared with half of all Medicaid patients (Table 1). Medicaid covered 41.1% of all injury-related hospital days and 34.0% of all injury-related hospitalizations.

Although fewer than 7% of injured adolescents were self-pay, among the self-pay category nearly 60% were aged 15–19 years of age. Self-pay patients were significantly older than both private and public pay sources. Compared with whites, blacks and Hispanics were more likely to have Medicaid and to be self-pay. Privately insured patients were concentrated in the higher income levels while self-pay and Medicaid patients were predominately lower income.

There were relatively small differences in the urban/rural distribution across payors with more than 80% of patients in all payor groups residing in a metropolitan area (Table 1).

Admission Type

Most patients were admitted through the emergency department for all payors. Admission type and source varied significantly by payor ($X^2 105.4, p < 0.0001$, $X^2 266.7, p < 0.0001$, respectively). Persons classified as self-pay were more likely to be admitted through the emergency department, less likely to be transferred from another facility, and more likely to be classified as emergent admissions than other payor categories (Table 1).

Discharge Status

Patient discharge status varied significantly by payor ($X^2 299.1, p < 0.0001$). Self-pay patients had shorter hospital stays, were less likely to be discharged with home health care, more likely to be discharged against medical advice, and more likely to die during hospitalization than other payor groups. Persons with private insurance had the lowest in-hospital mortality. Patients covered by public funds had lengthier hospital stays than those with private insurance (Table 1).

Injury Mechanism by Payor

There were notable differences in the relative distribution of injury mechanisms by payor for all burns ($X^2 30.1, p < 0.0001$), residential fires ($X^2 19.7, p = 0.006$), all motor vehicle injury ($X^2 223.6, p < 0.0001$), motor vehicle driver injury ($X^2 299.1, p < 0.0001$), motor vehicle occupant injury ($X^2 248.2, p < 0.0001$), firearm ($X^2 120.0, p < 0.0001$) and falls ($X^2 65.1, p < 0.0001$) (Table 2). Medicaid patients had a higher portion of injury due to all-cause burns, residential fire, and suffocation than private patients and a lower likelihood of experiencing motor vehicle driver or motor vehicle occupant injury than private or self-pay patients. Persons covered by Medicaid were one-third less likely to be hospitalized as a motor vehicle driver than private pay patients (Table 2).

Persons with self-pay insurance were more likely to be hospitalized for poisoning-related diagnoses, being cut/pierced, and less likely to have adverse effects recorded (Table 2). Nearly 20% of persons with self-pay status were hospitalized following motor vehicle injury and were more likely to be the driver than persons covered with public insurance. Among self-pay patients, firearm injury was four-fold that of privately insured patients and two-fold that of publicly insured ones (Table 2).
The total estimated expenditure for injury in 0 to 19 year olds is shown in Figure 1a. The total hospitalization expenditures are $70.3 billion of which $14.8 billion (21.1%) is injury-related. The proportion of total hospital expenditures accounted for by injury varies only marginally among payors—21.8% for private and 20.1% for total public expenditures except among the self-pay category where the proportion of total hospital expenditures accounted for by injury approaches one-third (31.6%). Approximately 10% of all unweighted Medicaid hospitalizations are due to injury, but account for approximately 20% of all Medicaid hospitalization dollars.

**Mean/Median Expenditures for Injury versus Non-Injury Hospitalization**

The mean/median per case charges for ages 0–19 years are significantly higher for injury versus non-injury admis-

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### Table 1 Population Characteristics for Patients Aged 0 to 19 yr Hospitalized for Acute Injury by Payor as Calculated from Weighted KID-HCUP Data (2003)

<table>
<thead>
<tr>
<th>Population Characteristics</th>
<th>Private Insurance</th>
<th>Self-Pay</th>
<th>Medicaid</th>
<th>Total Public Cost (includes Medicaid/Medicare)</th>
<th>Total (includes all payers and other or unspecified)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (n, %)</td>
<td>209,468 (52.6)</td>
<td>27,235 (6.8)</td>
<td>135,108 (34.0)</td>
<td>150,155 (37.7)</td>
<td>397,943 (100.0)</td>
</tr>
<tr>
<td>Age median (interquartile range)</td>
<td>13.0 (10.0)</td>
<td>16.0 (8.8)</td>
<td>9.0 (14.0)</td>
<td>10.3 (13.6)</td>
<td>13.0 (11.8)</td>
</tr>
<tr>
<td>Gender; male</td>
<td>121,064 (57.8)</td>
<td>17,463 (64.1)</td>
<td>76,538 (66.7)</td>
<td>85,227 (66.8)</td>
<td>230,878 (58.0)</td>
</tr>
<tr>
<td>Race¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>105,331 (73.9)</td>
<td>8,911 (49.3)</td>
<td>38,430 (40.6)</td>
<td>43,981 (41.7)</td>
<td>161,856 (59.3)</td>
</tr>
<tr>
<td>Black</td>
<td>14,612 (10.3)</td>
<td>3,544 (19.6)</td>
<td>22,976 (24.3)</td>
<td>24,633 (23.4)</td>
<td>43,666 (16.1)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>18,059 (12.7)</td>
<td>5,118 (28.3)</td>
<td>30,251 (32.0)</td>
<td>33,373 (31.6)</td>
<td>58,615 (21.5)</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>3,746 (2.6)</td>
<td>407 (2.3)</td>
<td>2,011 (2.1)</td>
<td>2,382 (2.3)</td>
<td>6,639 (2.4)</td>
</tr>
<tr>
<td>Native American</td>
<td>783 (0.6)</td>
<td>107 (0.6)</td>
<td>926 (1.0)</td>
<td>1,107 (1.1)</td>
<td>2303 (0.8)</td>
</tr>
<tr>
<td>Urban/rural</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large metropolitan</td>
<td>118,679 (56.7)</td>
<td>16,034 (58.9)</td>
<td>74,850 (55.4)</td>
<td>83,045 (55.3)</td>
<td>223,743 (56.2)</td>
</tr>
<tr>
<td>Small metropolitan</td>
<td>57,285 (27.4)</td>
<td>6,124 (22.5)</td>
<td>36,309 (26.9)</td>
<td>40,959 (27.3)</td>
<td>106,949 (26.9)</td>
</tr>
<tr>
<td>Micropolitan</td>
<td>18,812 (9.0)</td>
<td>2,596 (9.5)</td>
<td>13,595 (10.1)</td>
<td>14,893 (9.9)</td>
<td>37,553 (9.4)</td>
</tr>
<tr>
<td>Non-urban</td>
<td>12,494 (6.0)</td>
<td>1,812 (6.7)</td>
<td>9,591 (7.1)</td>
<td>10,297 (6.9)</td>
<td>25,654 (6.5)</td>
</tr>
<tr>
<td>Median household income for patient’s zip code (US dollars)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1–$35,999</td>
<td>35,198 (16.8)</td>
<td>8,343 (30.6)</td>
<td>54,948 (40.7)</td>
<td>58,786 (39.2)</td>
<td>106,026 (26.6)</td>
</tr>
<tr>
<td>$36,000–$44,999</td>
<td>46,785 (22.3)</td>
<td>7,694 (28.3)</td>
<td>37,694 (27.9)</td>
<td>41,992 (28.0)</td>
<td>99,389 (25.0)</td>
</tr>
<tr>
<td>$45,000–$59,999</td>
<td>56,651 (27.1)</td>
<td>5,923 (21.8)</td>
<td>26,960 (20.0)</td>
<td>31,002 (20.7)</td>
<td>95,875 (24.1)</td>
</tr>
<tr>
<td>$60,000 or higher</td>
<td>65,387 (31.2)</td>
<td>4,135 (15.2)</td>
<td>12,453 (9.3)</td>
<td>14,848 (9.9)</td>
<td>86,124 (21.6)</td>
</tr>
<tr>
<td>Admission source</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency department</td>
<td>128,005 (61.1)</td>
<td>21,327 (78.3)</td>
<td>82,179 (60.8)</td>
<td>90,512 (60.3)</td>
<td>247,278 (62.1)</td>
</tr>
<tr>
<td>Another hospital</td>
<td>14,162 (6.8)</td>
<td>1,225 (4.5)</td>
<td>10,735 (8.0)</td>
<td>11,712 (7.8)</td>
<td>27,607 (6.9)</td>
</tr>
<tr>
<td>Other</td>
<td>65,423 (31.2)</td>
<td>4,519 (16.6)</td>
<td>41,121 (30.4)</td>
<td>46,780 (31.2)</td>
<td>119,671 (30.1)</td>
</tr>
<tr>
<td>Admission type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergent</td>
<td>109,850 (52.4)</td>
<td>18,070 (66.4)</td>
<td>66,745 (49.4)</td>
<td>72,255 (48.1)</td>
<td>207,010 (52.0)</td>
</tr>
<tr>
<td>Urgent</td>
<td>34,671 (16.6)</td>
<td>3,402 (12.5)</td>
<td>23,293 (17.2)</td>
<td>25,456 (17.0)</td>
<td>65,349 (16.4)</td>
</tr>
<tr>
<td>Other</td>
<td>30,064 (14.4)</td>
<td>2,662 (9.8)</td>
<td>17,400 (12.9)</td>
<td>18,974 (12.6)</td>
<td>53,202 (13.4)</td>
</tr>
<tr>
<td>Discharge status</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Routine</td>
<td>186,067 (88.8)</td>
<td>24,365 (89.5)</td>
<td>118,303 (87.6)</td>
<td>131,573 (87.6)</td>
<td>351,688 (88.4)</td>
</tr>
<tr>
<td>Another facility for inpatient care</td>
<td>10,366 (5.0)</td>
<td>1,382 (5.1)</td>
<td>7,025 (5.2)</td>
<td>7,776 (5.2)</td>
<td>20,188 (5.1)</td>
</tr>
<tr>
<td>Home health</td>
<td>9,551 (4.6)</td>
<td>477 (1.8)</td>
<td>6,826 (5.1)</td>
<td>7,431 (5.0)</td>
<td>17,897 (4.5)</td>
</tr>
<tr>
<td>Against medical advice</td>
<td>577 (0.3)</td>
<td>493 (1.8)</td>
<td>703 (0.5)</td>
<td>775 (0.5)</td>
<td>1,919 (0.5)</td>
</tr>
<tr>
<td>Died</td>
<td>2,393 (1.1)</td>
<td>460 (1.7)</td>
<td>1,947 (1.4)</td>
<td>2,250 (1.5)</td>
<td>5,285 (1.3)</td>
</tr>
<tr>
<td>Length of stay (mean ± SD)</td>
<td>4.8 (10.4)</td>
<td>3.4 (6.8)</td>
<td>6.5 (14.9)</td>
<td>6.5 (14.6)</td>
<td>5.4 (12.2)</td>
</tr>
</tbody>
</table>

¹ Percents for those with reported race. Six states report race/ethnicity as other/unknown (Georgia, Kentucky, Maine, Oregon, Washington and West Virginia). Not reported or missing race was: Private insurance 66,936 (32.0); Self-pay 9,150 (33.6); Medicaid 40,514 (30.0); Total public cost 44,678 (29.8); Total 125,133 (31.4).
Table 2 Injury-Related Hospitalizations by Payor for the U.S. Population Aged 0 to 19 yr Calculated from Weighted KID-HCUP Data (2003)

<table>
<thead>
<tr>
<th>Population Characteristics</th>
<th>Primary Payor, n (%)</th>
<th>Total Public Cost (includes Medicaid/Medicare)</th>
<th>Total (includes all payors and other or unspecified)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Private Insurance</td>
<td>Self-Pay</td>
<td>Medicaid</td>
</tr>
<tr>
<td>Population (n, %)</td>
<td>209,468 (52.6)</td>
<td>27,235 (6.8)</td>
<td>135,108 (34.0)</td>
</tr>
<tr>
<td>E-codes reported (n, %)</td>
<td>161,627 (77.2)</td>
<td>23,259 (85.4)</td>
<td>99,993 (74.0)</td>
</tr>
<tr>
<td>Distribution of unintentional injury mechanisms (n,% for those with reported e-codes)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Falls</td>
<td>32,644 (20.2)</td>
<td>3,394 (14.6)</td>
<td>17,716 (17.7)</td>
</tr>
<tr>
<td>Burns, total</td>
<td>5,374 (3.3)</td>
<td>720 (3.1)</td>
<td>5,730 (5.7)</td>
</tr>
<tr>
<td>Fire/burn</td>
<td>3,827 (2.4)</td>
<td>594 (2.6)</td>
<td>4,828 (4.8)</td>
</tr>
<tr>
<td>Residential fire</td>
<td>1,980 (1.2)</td>
<td>241 (1.0)</td>
<td>2,338 (2.3)</td>
</tr>
<tr>
<td>Motor vehicle traffic§</td>
<td>32,812 (20.3)</td>
<td>5,341 (22.9)</td>
<td>12,857 (12.9)</td>
</tr>
<tr>
<td>Driver</td>
<td>23,652 (14.6)</td>
<td>3,807 (16.3)</td>
<td>8,020 (8.0)</td>
</tr>
<tr>
<td>Passenger</td>
<td>10,517 (6.5)</td>
<td>1,649 (7.1)</td>
<td>2,315 (2.3)</td>
</tr>
<tr>
<td>Pedestrian, all</td>
<td>4,732 (2.9)</td>
<td>811 (3.5)</td>
<td>3,201 (3.2)</td>
</tr>
<tr>
<td>Poisoning</td>
<td>20,508 (12.7)</td>
<td>4,136 (17.8)</td>
<td>14,407 (14.4)</td>
</tr>
<tr>
<td>Cut, Pierced</td>
<td>6,280 (3.9)</td>
<td>1,928 (8.3)</td>
<td>5,152 (5.2)</td>
</tr>
<tr>
<td>Pedal cyclist</td>
<td>4,354 (2.7)</td>
<td>536 (2.3)</td>
<td>2,211 (2.2)</td>
</tr>
<tr>
<td>Adverse effects</td>
<td>14,276 (8.6)</td>
<td>545 (2.3)</td>
<td>10,355 (10.4)</td>
</tr>
<tr>
<td>Drugs</td>
<td>7,522 (4.7)</td>
<td>334 (1.4)</td>
<td>5,903 (5.8)</td>
</tr>
<tr>
<td>Medical care</td>
<td>7,607 (4.7)</td>
<td>254 (1.0)</td>
<td>5,001 (5.0)</td>
</tr>
<tr>
<td>Drowning</td>
<td>1,073 (0.7)</td>
<td>182 (0.8)</td>
<td>860 (0.9)</td>
</tr>
<tr>
<td>Struck by/against</td>
<td>12,480 (7.7)</td>
<td>1,726 (7.4)</td>
<td>6,083 (6.1)</td>
</tr>
<tr>
<td>Suffocation</td>
<td>1,379 (0.9)</td>
<td>169 (0.7)</td>
<td>1,480 (1.5)</td>
</tr>
<tr>
<td>Firearm, all intents</td>
<td>2,036 (1.3)</td>
<td>1,221 (5.3)</td>
<td>2,897 (2.9)</td>
</tr>
<tr>
<td>§ For purposes of total cost analysis, there were 85 (self pay), 510 (Medicaid), 530 (other government) 383 (private insurance) and 1,040 (total) additional cases of total burns identified from condition codes where e-codes were not reported. These additional cases are not included in the cell counts above.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

§ Includes occupant, pedestrian, unspecified, and other categories.

Fig. 1. a. Total expenditures (in billion U.S. dollars) for patients aged 0–19 years hospitalized for injury and non-injury diagnoses by payor (2003). Payor categories included private (private insurance) self-pay (self), Medicaid, and total public cost. Figure 1b. Mean and median expenditures per patient hospitalization by payor for injured and non-injured patients. Payor categories included private (private insurance) self-pay (self), and Medicaid.
sessions (Fig. 1b). Within each payor, males accounted for a higher proportion of all injuries and had slightly higher charges per admission. Self-pay patients had lower mean and median charges for injuries than other payor categories.

**Expenditures by Injury Severity and Patient Discharge Status**

Median charges are approximately 5 fold higher in persons who died versus those discharged alive (Fig. 2a and 2b). This is partially explained by the higher charges associated with increasing injury severity and longer length of stays (Fig. 3). There were significant differences in the proportion of patients with severe ISS scores 25 and above who died versus lived (75% versus 2%, $p < 0.0001$) and in the charges by injury severity.

Among patients who lived, increasing injury severity is associated with gradually increasing median charges at lower levels of injury (ISS < 25) and exponential increases at higher ISS levels. At the highest severity categories, median charges more than double between ISS categories 16–24 compared with ISS category 25–40 and increase five fold between ISS category 16–24 compared with the highest severity ISS category 41–75 (Fig. 2a, 2b).

Among those who died, the lowest injury severity category had the lowest charges and the highest injury severity category had highest, but median charges among those who died before discharge are less striking than in those who lived. Median length of hospital stay is 1 day for all injury severity categories who died, but the mean length of stay in low injury severity categories indicates stays that are nearly 3 times longer for those who died versus lived (Fig. 3).

**Mean/Median Expenditures by Payor and Mechanism of Injury**

The highest per person costs of injury are for firearms, motor vehicle (occupant, driver, or pedestrian), and burns. With few exceptions, both mean and median Medicaid charges tended to exceed those of private and self-pay categories across the most common mechanisms of injury (Fig. 4a, 4b). The relative rank of injury mechanism by expenditure per injury is comparable whether mean or median charges are examined despite the near doubling of mean compared with median charges (Fig. 4a, 4b).

**National Expenditures for Hospitalization of Injury by Mechanism, Payor and Age Group**

Total national expenditures are shown for major injury mechanisms by payor in Figure 5a and by age group in Figure 5b. Motor vehicle occupant injury (which includes drivers) occurred at a relatively high frequency with high charges per case and contributes the largest portion of expenditures. This
is followed by falls which had lower expenditures per case, but higher frequency of occurrence.

Although very young children account for relatively smaller portion of expenditures than adolescents and teenagers, injury expenditures in this age group are disproportionately paid by Medicaid. Burn-related injury was notable for its relative concentration in very young children where the age group 0–4 years accounted for 59.2% of all burn-related expenditures. Among those aged 0 to 4 years hospitalized for poisoning, Medicaid covered 58.4% of expenditures and 46.4% of motor vehicle occupant injury in this age group.

DISCUSSION

Several injury mechanisms with known best practices for prevention continue to contribute significantly to the total injury burden, from both a financial and population health perspective. Medical treatment for injury accounts for a significant portion of the U.S. health dollar with direct costs previously noted to be $80 billion dollars for the U.S. population in 2000. Our study suggests that just under 20% of this is for hospital-related care of infants, children, adolescents, and teenagers.

This study provides clues to areas where more universal application of effective injury prevention interventions—such as fire, burn, poisoning, and occupant restraints in very young children and motor vehicle driver interventions for teens—might be used to lower the hospitalization costs associated with injury. In particular, burn and firearm-related injuries were more costly per case and occurred with greater frequency among public versus private payors. Among very young children, the age group 0–4 years, burn-related expenditures were 59.2% of all burn-related expenditures. Among those aged 0 to 4 years hospitalized for poisoning, Medicaid covered 58.4% of expenditures and 46.4% of motor vehicle occupant injury in this age group.
young children, Medicaid covered more than half of expenditures for burns and poisoning, and nearly half of all motor vehicle occupant injuries.

Injury prevention generally impacts the cost burden through either decreasing incidence of a particular injury mechanism (primary prevention) or through decreasing severity (secondary or tertiary prevention) or a combination of the two.36–37 These findings suggest that one might impact total public expenditures for injury by identifying and targeting mechanisms that contribute significantly to public expenditures through more universal application of proven interventions in resource-limited communities. Interventions that lower either incidence and/or severity of injury could impact admissions, length of stay, intensity of care and charges associated with hospitalization.

The implementation of effective prevention measures has been shown to decrease the incidence of injuries or related hospitalizations across multiple mechanisms including burns, poisonings, and motor vehicle injuries.1,8,10 Specifically, a successful smoke alarm give-away program resulted in an 80% decrease in annual rates of fire-related injury in an Oklahoma community.38 Injuries are 50% more likely to result from fires in homes without smoke alarms that work properly, but functional alarms greatly reduce both fatal and non-fatal burn injuries.8,39 Smoking rates are reported to be higher in persons of lower educational attainment and to contribute significantly to burn-related injuries in young children. Child-safe cigarette lighters have been shown to reduce the number of fires started by young children by 70%.8,40–41 These results suggest that smoking cessation programs, generally initiated for cancer prevention, could benefit communities through lowering burn and fire injury.

A 12% decrease in hospitalizations due to poisonings has been reported with the advent of poison control centers.17 Graduated licensing and zero-tolerance alcohol laws have been shown to effectively reduce motor vehicle crashes involving young drivers. A median decrease of more than 30% in rates of motor vehicle crashes has been reported following initiation of graduated licensing laws, while the number of crashes related to alcohol fell by 20%.11,42 A 20% reduction in rates of fatal crashes in which 16 year old drivers are involved has been reported in the presence of broad graduated licensing laws.43

Increasing injury severity was associated with higher expenditures among those who lived and died, although this was more pronounced in persons who survived to discharge. Two separate injury severity scoring methods yielded similar findings in the relation between expenditures and injury severity among persons who survived with increasing injury severity derived from both the ISS and the ICISS demonstrating significant positive association between injury severity and increasing expenditures for non-fatal injuries. The relation between recorded injury severity was weaker among patients who subsequently died than those who survived to discharge with the ISS exhibiting a stronger relation between injury severity and expenditures among those who subsequently died.

Fatal injuries are reported to account for less than 1% of all injury but 17% of all costs.8 Our study suggests that several factors contribute to higher costs among those who die including a more severely injured case mix, higher intensity of care, and longer lengths of stay among patients with lower severity scores who subsequently died. In addition, higher incidence of costly mechanisms with greater fatality rates may contribute to the increased expenditures in those who die in-hospital.

Injury in children has been previously noted to comprise a significant portion of the direct medical expenditures accounting for 11% of all-cause hospital stays, 39% of emergency department visits, and 9% of all physician visits.8 Our finding that Medicaid insurance status is associated with longer hospital stays has been previously reported.44,45 We did not find differences in injury severity or in number of procedures that would account for the increased length of stay between public and private payors. Longer hospital stays contribute to higher per case charges and may reflect the lag in penetration of managed care into public payors or greater difficulty in planning for post-discharge care in a resource-limited population.

Since the introduction of national child health insurance in the late 1990s, there have been significant developments in injury prevention, in the financing and delivery of health services, and in the proportion of U.S. children with hospitalization data available for analysis. Before the widespread expansion of the child health insurance program, Medicaid was noted to cover 29% of all injury-related hospital days among children.8 Post-implementation of child health insurance, this had increased slightly with Medicaid covering 41.1% of all injury-related hospital days and 34% of all injury-related hospitalizations. The Medicaid population has been reported to have higher injury rates with one study noting twice the rate of injury of other populations with medical costs for injuries accounting for about half of the capitated reimbursement for young children.7,45

This study had limitations. Although the dataset was designed for such purposes, we made national estimates based on data from 36 states. Bias may have been introduced if these represented states differ from the U.S. population. Within the injury mechanism categorizations, we were unable to include calculations for injury-related expenditures in persons who did not receive an appropriate e-code. Lack of e-codes on a significant proportion of the population is likely to produce underestimates of expenditures associated with those mechanisms. This occurred in approximately 20% of injuries. This study includes direct hospitalization expenditures. It was not possible to include all professional fees, post discharge care, emergency department visits, outpatient care, or non-medical costs such as lost work days. Data completeness and quality varied by state as did the willingness of states to contribute data uniformly to the sampling frame.
Several states did not provide data on race/ethnicity and at least 2 states withheld age when alcohol, substance abuse, or HIV/AIDS were present. Weights are based on a hospital sampling frame. Although not included in public expenditures for injury, the self-pay category frequently ends up being uncollected funds and gets written off as bad debt or charity care. When these hospitals are local or state government funded, these patients may become public expenditures, but are not included in our public expenditure category. To the extent this happens, our estimates of public expenditures are likely underestimates of the true public cost burden of injuries.

In summary, periodic re-evaluation of where public injury dollars are being spent may be useful to injury prevention advocates who frequently note the disproportionately low funding levels for prevention relative to the injury-related mortality, morbidity, and disability burden. As the largest public payor, Medicaid spent a significant portion of their health care dollar on injury. Our study demonstrates that several mechanisms for which effective prevention measures exist continue to be significant contributors to injury-related hospital expenditures and call into question whether the current allocation of resources is optimal. Further use of non-injury related resources, such as legislation and enforcement of that legislation, has been shown to have added impact over education and product distribution alone. Thus, implementation and enforcement of a variety of preventive measures are strategies to reduce not only the burden of injury in the population, but also the excessive public and private costs of such injuries.

ACKNOWLEDGMENTS

This work was supported by NIH grant 1P60MD000206 and by the Robert Wood Johnson Foundation of Princeton, NJ. We are deeply grateful to the University of Florida at Jacksonville for providing access and technical assistance in the use of ICISS injury severity scoring. Invaluable research assistance was provided by Lisa Trieu in computer injury severity scoring for KID-HCUP using two separate scoring mechanisms and from Tiffany Kendig in SAS and SUDAAN computer work. This work was presented at the Annual Conference of the Injury Free Coalition for Kids, December 2006.

REFERENCES


Developing the Miami-Dade County Injury Surveillance System: Using Surveillance to Build Community Capacity for Injury Prevention

Judy Schaechter, MD, Stephen Dearwater, MS, and Susan B. Uhlhorn, PhD

The Miami-Dade County Injury Surveillance System was created as part of a hospital-based injury prevention program associated with the Injury Free Coalition for Kids. Initially the program utilized trauma center and mortality data to describe injury. However, as community programming and coalition-building developed, so did the demands on the surveillance system. Coalition partners and potential partners desired a more comprehensive and population-based system. As a result of the county-wide approach and open access to results, the surveillance system has engaged new partners and leveraged additional resources to injury prevention.


Public health begins with the description of a problem, its magnitude, and the identification of contributing risk factors. Prevention strategies are designed to diminish exposure to risk factors. The effectiveness of these strategies is most meaningfully measured by a change in the magnitude of the problem. Surveillance systems are useful at each link, to describe injury, its risk factors, design interventions and to evaluate interventions. Indeed, accurate data acquisition is the central purpose of injury surveillance. Thus, injury surveillance systems are usually built by and for researchers, planners and health professionals.

Yet, surveillance has multiple purposes, some of which extend beyond this central purpose. Surveillance can educate community stakeholders and policy makers, build awareness, guide in-depth research and evaluate change over time. To do so, surveillance systems must be designed for a wider audience than only those familiar with data. If done well, additional benefits of surveillance include cooperation and resource procurement.

The Miami-Dade County Injury Surveillance System was designed to assist researchers, pubic health workers and injury prevention community outreach workers with a more accurate understanding of injury in Miami-Dade County. The system began as a necessary component of the four component model of the Injury Free Coalition for Kids: local data, work in coalition, community and environmental programming and evaluation. The model has been shown to be effective in reducing childhood injury. Consistent with Injury Free’s commitment to work in coalitions, the development of the Miami-Dade County Injury Surveillance System has meant that its purpose and utilization have extended beyond those for whom it was originally conceived.

Surveillance System Development

The Injury Free Coalition for Kids national office requires that all participating sites engage in injury surveillance. How sites do this is decided locally. The national office does not specify data sources, covered ages, geographic units, severity or type of injury to be included. At the inception of Injury Free-Miami in 2001, the Miami site investigators utilized its hospital’s trauma data system and county medical examiner records to describe severe child injury in the proximity of the county’s largest, and only public, hospital. The Ryder Trauma Center at Jackson Memorial Hospital is the only Level I combined adult and pediatric trauma center in Miami-Dade and Monroe Counties, serving a population of 2.4 million persons. The Ryder Trauma Center data system identified violence, motor vehicle crashes, pedestrian injuries and falls as the leading causes of pediatric trauma admission. This information guided the first years of Injury Free–Miami programming.

Thereafter, the Miami site, its community partners and county decision makers recognized the limits of this trauma-based surveillance for purposes beyond a prevention program serving a single hospital. Investigators wanted more information concerning the larger scope of injuries, those that resulted in an emergency department visit or hospital admission, but did not warrant a trauma admission. The hospital had a non-contiguous catchment area that did not correspond to natural or municipal boundaries, and made little sense to policy makers or community workers. As the coalition grew, partnerships with individuals employed by competing hospitals, or with agencies whose affiliations crossed hospital and municipal boundaries were desired. Thus, prevention partners were requesting data for the county as a whole, and analyzed by...
commission district, and by neighborhood. Further, in a community of rapid growth and in migration, all concerned wanted to follow trends with population-based rates rather than simple admission numbers.

**Injury Free**

The Miami site proposed to build a countywide, population-based all-injury surveillance system using CDC and STIPDA guidelines. To maximize both the detail of information and the rapidity with which data could be obtained and reported, the primary data sources sought were a newly-developed electronic medical examiner database for the reporting of injury deaths and electronic hospital admission data obtained directly from all Miami-Dade County hospitals. Updates from these electronic data sources would be requested every 1–3 months. Death certificate data would be added for case validation and additional demographics annually.

Data obtained directly from the hospitals instead of that reported to the state in aggregate was considered advantageous for several reasons, including exact residence variables, more diagnosis code fields, inclusion of emergency department visits, and rapidity of direct reporting. However, some participating hospitals were reluctant to provide data, and even those willing to provide such data soon recognized that the quality of residence address data were poor. While other data were of high quality address completion rates were low. Data storage and safety was assured by the county health department, which mitigated much hospital and legal concerns regarding data privacy and security. Nine hospitals seeing the majority of injuries in the county participated in the surveillance system, but several others resisted, complicating aims at a population-based system. In 2005 the state mandated the reporting of emergency department data in a format similar to inpatient discharge data. For all these reasons, Injury-Free Miami adjusted the surveillance system design to rely on state acquired hospital and emergency department data. This resulted in full inclusion of all hospitals for a population-based system, but meant that residence data were limited to zip codes, and there would be a delay in data acquisition (data reported by state annually).

**System Utility in Meeting Goals of Injury Free**

An immediate benefit of changing to an all-hospital, countywide surveillance system was the recognition that though our public hospital saw more patients and more trauma than any other hospital in the county, it did not see the majority of pediatric injury admissions. (Table 1) Public recognition of the dispersion of injury admissions has been useful in engaging additional partners and resources. There is a greater willingness across the county and between hospitals, particularly the children’s hospitals, to collaborate on injury prevention events and programming.

Development of the Miami-Dade County Injury Surveillance System has enhanced injury prevention at the county health department in several ways. Before the system, the county health department had no staff dedicated to injury prevention, and little information available to residents. As the Injury Surveillance System has grown, new resources have been identified and applied to injury prevention. First, start up funding for the system included coverage for a half-time injury epidemiologist. The health department matched that funding to create a full time position, which is now continuing in its third year. Second, injury prevention now has a central role in the work of several county organizations. Injury-Free staff worked with the county health department to create for the first time an injury section on their website (http://www.dadehealth.org/injury/INJURYintro.asp). The web pages include local injury facts, prevention fact sheets, programming and resources, speakers and contacts. The pages also hold a number of injury data reports, both original to the Miami-Dade County Injury Surveillance System, and from other cited sources. Placing the data on the health department website makes it widely available to others, without concern of putting off present and future partners who may not have searched on the website of a competing hospital. Third, the county health department utilized drowning prevention data from the system to compete for state funding for a drowning prevention research project and awareness campaign. The Injury Surveillance System was able to identify drowning “hot spots,” water body types and risk factors for the region covered. (Fig. 1, Table 2 and Fig. 2) The data provided the county health department with a focus on pool drowning and the most affected zip codes.

The Miami-Dade County Police Department provides another example of use of the surveillance system to energize prevention partners and bring new resources to injury prevention. The Miami-Dade County Police Department has

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Ages 0–17 Years</th>
<th>All Ages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discharges</td>
<td>Percent</td>
</tr>
<tr>
<td>Miami Children’s</td>
<td>533</td>
<td>38.5</td>
</tr>
<tr>
<td>Jackson Memorial</td>
<td>411</td>
<td>29.7</td>
</tr>
<tr>
<td>Baptist</td>
<td>299</td>
<td>21.6</td>
</tr>
<tr>
<td>Palmetto General</td>
<td>60</td>
<td>4.3</td>
</tr>
<tr>
<td>Parkway Regional</td>
<td>56</td>
<td>4.0</td>
</tr>
<tr>
<td>Mercy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kendall Regional</td>
<td>707</td>
<td>5.2</td>
</tr>
<tr>
<td>Aventura</td>
<td>703</td>
<td>5.2</td>
</tr>
<tr>
<td>Mount Sinai</td>
<td>694</td>
<td>5.1</td>
</tr>
<tr>
<td>South Miami</td>
<td>549</td>
<td>4.1</td>
</tr>
<tr>
<td>Pan American</td>
<td>458</td>
<td>3.4</td>
</tr>
<tr>
<td>Hialeah</td>
<td>445</td>
<td>3.3</td>
</tr>
<tr>
<td>Coral Gables</td>
<td>419</td>
<td>3.1</td>
</tr>
<tr>
<td>Other hospitals</td>
<td>27*</td>
<td>1.9</td>
</tr>
<tr>
<td>Total</td>
<td>1,386</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* The remaining 11 hospitals each represented <2% of the total pediatric discharges.

** The remaining 11 hospitals each represented <3% of the total discharges.

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Table 1 Hospital Discharges for Injury by Age Group, Miami-Dade Co. Hospitals, 2005

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collaborated with Injury Free-Miami on a number of violence and injury prevention programs over many years, supplying data, permitting program evaluation, and teaming up for programs on violence prevention and child passenger safety. When the Department’s Homicide Bureau became concerned about a perceived increase in the number of infant crib death investigations, they asked Injury Free-Miami to validate their perception. The Injury Surveillance System did not show an increase in such deaths, but rather a steady average of a dozen infant deaths a year due to SIDS or suffocation while sleeping. Injury Free examined records of those deaths in detail, presenting its findings, prevention recommendations and an educational brochure to the officers. The officers were motivated to alter what they considered to be a largely preventable problem, and they enlisted Injury Free to help with an awareness campaign. Injury Free found no PSA on the dangers of co-sleeping, and so the police department’s first steps in the campaign were the production of a PSA in three languages and a press conference to launch the campaign. The police department covered all costs associated with the production of the PSA (http://www.mdpd training.com/Infant_Suffocation.htm). The police department plans further awareness campaign initiatives.

The Surveillance System has helped many other local organizations to get information they need to expand their focus to include injury prevention. The Children’s Trust, a county-based child services council and funding agency includes injury prevention in its strategic plan and programming in its resource guide. The Children’s Trust requested injury surveillance data in drafting a call for proposals regarding violence prevention. A cluster of school health clinics have utilized the information in their grant writing. A local help line has added an entire section on injury prevention. Findings have been shared with the Miami-Dade League of Cities, which has lead to prevention partnerships with specific municipalities, such as requests for health fairs and community planning.

**CONCLUSION**

Quality injury surveillance is essential to meaningful injury prevention programming. Used correctly, it guides relative injury prioritization, resource allotment, risk factor identification, program design and evaluation. Yet the utility of a population-based, regional injury surveillance system can go well beyond the uses of its creators, in this case a dedicated, hospital-based injury prevention site. A surveillance system that is open to the public encourages partners beyond the research team and health professionals to utilize, and hopefully, to effect the data. The surveillance system educates and involves others, thus attracting new partners to injury prevention. The system, and its proper dissemination, communicate the relevance of injury and its prevention to individuals and agencies not traditionally or primarily dedicated to injury. This step is essential to building a broad

**Table 2** Drowning Incidents Occurring in Miami-Dade Co. to Residents Aged 0–4 Years, 2000–2005

<table>
<thead>
<tr>
<th>Drowning Body of Water</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swimming Pool</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>Bathtub</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Hot Tub, Spa</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Lake, River</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Ocean, Bay</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Neighborhood Canal</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Unspecified Location*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>7</td>
<td>40</td>
</tr>
</tbody>
</table>

* Unable to locate medical examiner chart.
coalition, securing additional resources, and making new injury advocates of persons previously uninvolved.

The Miami-Dade County Surveillance System has several limitations. Reliance on hospital data reported to the state result can in a certain amount of duplicate records for the same injury seen at multiple hospitals. Some data may be non-specific regarding how injuries occurred. Trauma registry data does provide more detail on injuries that result in trauma admissions. However, this is off-set by the loss of an unknown number of serious injuries that may be undertriaged, treated at non-trauma center hospitals, and by the information to be gained from the much larger number of injuries appropriately treated in emergency departments and non-trauma center hospitals. Further, limited to state-acquired data, the system’s timeliness is less than that hoped for by many community partners and the media.

The success of the Miami-Dade County Surveillance System in building community capacity for injury preven-

![Fig. 2. Drowning and Near Drowning Incidence in Swimming Pools by Zip Code, Miami-Dade County Residence age 0–4, 2000–2004.](image)
tion relates partly to the comprehensive nature of the system—all emergency room visits, hospital and trauma admissions and deaths for all ages—and partly to the decision to expand to a population-based system. That expansion may not be necessary in every community, but is quite important in Miami-Dade, a large county with overlapping jurisdictions, competing hospitals, and children’s services that span the entire county. It has also been our experience that making the data easily available on a neutral site has enhanced system utilization. Local data systems are best not “owned;” those establishing the system must be willing to forgo much credit due for their own resource investment. In time, however, that can encourage others to bring forward new resources. In the experience of Injury Free – Miami, that is how local injury surveillance works for the local community, and the local community works for injury prevention.

ACKNOWLEDGEMENTS

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REFERENCES

Motor vehicle crashes (MVC) are the leading cause of death and disability for children in the United States and thus represent an important child health issue. Nationwide efforts have promoted the importance of the appropriate use of child restraint systems. Effectively increasing and sustaining appropriate restraint use remains challenging. Nationally, over a period of several years, the National Highway Traffic Safety Administration directed a series of state incentive grants that were designed to improve state child passenger safety. These incentive grants encouraged states to 1) include occupant safety education; 2) improve existing seat belt and child restraint legislation; and 3) provide training and services designed to improve appropriate use of child restraint systems. The availability of these funds led to the creation of a multifaceted, interventional approach to improve child passenger safety in Alabama. This model approach was designed to enhance caregiver education, increase public awareness, and improve existing seat belt and child restraint legislation. The purpose of this outreach was also to build the capacity to serve Alabama child caregivers with locally based, certified child passenger safety technicians, instructors, and car seat fitting services. The model approach began in late 1999 and continued through 2005.

The statewide effort was based upon the popular model known as the Four E’s approach, an intervention designed to improve appropriate use of child restraint systems. These incentive grants encouraged states to 1) include occupant safety education; 2) improve existing seat belt and child restraint legislation; and 3) provide training and services designed to improve appropriate use of child restraint systems. The availability of these funds led to the creation of a multifaceted, interventional approach to improve child passenger safety in Alabama. This model approach was designed to enhance caregiver education, increase public awareness, and improve existing seat belt and child restraint legislation. The purpose of this outreach was also to build the capacity to serve Alabama child caregivers with locally based, certified child passenger safety technicians, instructors, and car seat fitting services. The model approach began in late 1999 and continued through 2005.

The impact of the state incentive grants was intended to maximize favorable impact on child restraint use, MVC death and serious injury. To accomplish this task, we utilized educational, community services, and legislative interventions working in tandem. We hypothesized that over time the combination of these interventions would result in significant increases in child restraint use with resultant decreases in child passenger death and serious injury in Alabama. The purpose of this study was two-fold: 1) to prospectively evaluate the effect of the model approach in the intermediate outcomes of child restraint usage (CRU) and improved legislation; and 2) to prospectively evaluate changes in child passenger death and serious injury in child passengers less than 10 years of age.

**METHODS**

The model approach consisted of three main components: education, legislation, and services.

**Education**

The first component—education—included statewide print and mass media information which promoted correct child restraint use. Billboard and radio campaigns designed and implemented by the Children’s Hospital of Alabama advertised that “80% of loving caring parents put their child at risk by not having their car seat properly installed.” The call to action was clear and simple: call a statewide toll free hotline to find out how to get car seats checked. This hotline, staffed by certified RN child passenger safety technicians and instructors, provided information on proper child restraint use as well as personal consultation (callers could ask specific questions relating to their child, vehicle, and/or child restraint system). A statewide Child Passenger Safety (CPS) training and certification program was also designed to create an infrastructure of certified technicians, instructors, and permanent fitting stations.

**Legislation**

Alabama Safe Kids served as co-chair of a task force which supported the passage of the Alabama Primary Seat Belt Law. The Primary Seat Belt Law was enacted in December of 1999. Although this legislation focused upon adult passengers, previous research cites that adult seat belt use is
a strong correlate to child restraint use. Alabama Safe Kids also worked with Voices for Alabama’s Children to improve the state child passenger safety law by clarifying the need for infants to remain rear-facing until 1 year of age and 20 pounds as well as requiring booster seat use for appropriate age and size children.

**Services**

Twenty-two car seat fitting stations were established throughout the state. Classes were established to train child passenger safety technicians and instructors which then served families in their respective areas and throughout Alabama. The toll free number mentioned above was utilized to assist families in locating car seat fitting stations, technicians, instructors, and planned area events for CPS services. The toll free number also provided scheduling of appointments for local area events and fitting station visits.

**Study Design**

A pre- and post-intervention study design was utilized in which the pre-intervention period was defined as 1994–1999 and the post-intervention period was from 2000–2005. Initial work on model implementation began in 1999 with all model components being in place by year 2000. The data on CRU was provided by the Alabama Department of Public Health’s Division of Primary Prevention. MVC death and injury data were provided by the CARE Research and Development Laboratory of the Department of Computer Science, University of Alabama. CARE (Critical Analysis Reporting Environment) is an on-line tool used to analyze the state’s Fatality Analysis Reporting System (FARS) data. MVC injury was defined through CARE as those injuries serious enough for the victim to be transported from the crash scene to a health-care site. Cost savings for MVC injuries and deaths averted were estimated using Federal Highway Administration estimates and average annual reductions. The model was designed and implemented by Alabama Safe Kids and was funded by TEA-21 state grants from the National Highway Traffic Safety Administration. These grants were administered and allocated by the Alabama Department of Economic and Community Affairs Law Enforcement and Traffic Safety Division.

**Statistical Analysis**

The Mann-Whitney U statistical test was utilized for analysis of median differences in pre- and post-intervention child restraint use, numbers of deaths and serious injury. Comprehensive cost savings were calculated using methods described by the Federal Highway Administration (FHWA) which include eleven variables (emergency services costs, rehabilitation costs, quality of life lost, years of productive life costs, administrative costs, costs of medical care and others) in their estimation. The resultant estimate of savings to society used in our cost savings analysis included: $3 million for each death averted and $66,720 for each injury averted. The pre- and post-intervention median comparisons provided the median numbers of deaths and serious injuries averted. Thus, the decreases in the median deaths and serious injury were multiplied times the savings estimates of death and injury provided by FHWA. The final estimate of cost savings represents the median annual savings based on the pre- and post-intervention periods.

**RESULTS**

The implementation of the model approach beginning in late 1999 and ending through the end of 2005 resulted in over 26,549 child passenger safety calls to the 800 number, which included both informational and fitting station appointment requests. During the post-intervention time period, a total of 870 technicians and 8 instructors were trained and certified. Three individuals also were trained to provide special medical needs child restraint consultations. A total of 22 fitting stations were established, which routinely provided area fitting services and consultation. A conservative estimate of more than 20,000 individuals received child restraint information and/or fitting services over the post-intervention time period.

During the pre-intervention years (1994–1999) the median child restraint usage (CRU) was 58.5% and the median number of child passenger deaths and serious injury were 36.5 and 1,522, respectively. During the post-intervention period (2000–2005), the median CRU was 85.8% with a peak of 92% occurring in 2005. The median number of child passenger deaths and serious injury was 32.0 and 1,329, respectively. The increase from 58.5% to 85.8% in the median CRU was statistically significant (U = 30.0, p = 0.004), as was the decline in the median number of serious injury from 1,522 to 1,329 (U = 26.0, p = 0.05). Although median MVC deaths had declined from 36.5 to 32.0, the decline failed to reach statistical significance (U = 22.5, p = 0.17) (Table 1). For the yearly trends, please see figures 1–3.

The median savings in annual comprehensive costs to Alabama represented by 4.5 fewer child passenger deaths/year and 193 fewer injuries/year (median pre-intervention values versus median post-intervention values) using FHWA estimates is $26,376,960. Based on total grant funds expended, the median cost savings from deaths and injuries averted provided an estimated return of $75.00 for every $1.00 spent on the program.

| Table 1 Results for Alabama CRU, MVC Injury and MVC Deaths Pre and Post Model |
|-------------------------------|-------------------------------|-----------------------------|
|                               | “Pre”                         | “Post”                      | Statistical Analysis       |
| CRU                            | 58.5%                         | 85.8%                       | U = 30, p = 0.004          |
| MVC death                      | 36.5                          | 32                          | U = 22.5, p = 0.17         |
| MVC injury                     | 1522                          | 1329                        | U = 26, p = 0.05           |

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DISCUSSION

Motor vehicle crash death and injury is a leading child health problem in the United States. A challenging, yet supremely important intermediate step in preventing MVC morbidity and mortality is increasing the proper use of child restraint systems. Every 90 seconds a child is killed or injured in an MVC in the United States. One-half of children under the age of 5 years old who died in MVCs in the United States were riding without any child passenger restraint. Among children in car seats, as many as 80% may be used incorrectly (e.g. improper installation, wrong position, wrong seat). CRUs have been shown to reduce serious and fatal injuries by more than 50% with rates as high as 70% for infants. Appropriate information and fitting station services support the proper use of child restraints.

MVCs account for one-half of all unintentional fatalities in the state of Alabama with MVCs being the number one cause of death by injury statewide. The national age adjusted fatality rates for MVCs are 14.82 per 100,000 persons as of 2001 while Alabama’s rate is 52% higher at 22.56 per 100,000 persons. Age adjusted fatality rates for children (under the age of 14) between 1997 and 2001 were 9 per 100,000 versus national rates for the same age group of 4 per 100,000.

Injury prevention is best achieved by staging different types of interventions working in tandem and sustained over the long term. While education, legislation, and services are all key components, any singular approach would not be sufficient. Recently, one study indicated enforcement alone did not improve booster seat use in a population and education alone was not as successful as education with distribution. Despite child safety restraint legislation in all fifty states, restraints are used in only about 85% of infants. Additionally, many children are incorrectly restrained or car seats are often installed incorrectly in vehicles. We incorporated education, legislation, and services in an attempt to take advantage of the synergy created from the key elements working together. The educational component and service element allowed parents access to correct information on CRU and access to experts at car seat fitting stations to ensure proper installation of car seats. Prior to this study, Alabama did not have a primary seat belt usage law. The legislative component supported parental perception of the importance of appropriate car seat selection, installation and use. Our cost savings estimates and return on investment are similar to what others have found for educational with fitting service program.

Nationally many efforts to improve child restraint usage were conducted in the 1990s and early 2000s. These efforts did result in improved awareness and more children being restrained while riding in motor vehicles. In our Alabama experience, specifically looking at children under the age of 10, we found child restraint usage increased from 58.5% to 85.8% after our interventions. Nationally during a similar time frame (1998 until 2002), child restraint usage did increase in those children less than 9 years of age however, not to the extent we experienced. In a study looking at a cross section of children under the age of 9 who were involved in motor vehicle crashes, the child restraint usage rose from 49% in 1999 to 63% in 2002.

Study Limitations

As a quasi-experimental study design, historical effects are an important risk to the validity of our study estimates of change in CRU, death, and serious injury. Indeed, the primary seat belt law was enacted at the end of the pre-intervention period and significant educational activities designed to educate the public of the importance of seat belt use were ongoing throughout the years of 1998 and 1999. However, these activities would influence our study estimates toward the null (no median differences in CRU, death or injury) and we did, in fact detect significant uptrends in CRU and downtrends in injury. Only the failure to reach significant decreases in deaths would represent a potential false negative result in this study. Other important state educational influences during both pre- and post-intervention periods were the Click It or Ticket program, educational messages, media, and

Vol. 63 No. 3
activities sponsored by the State of Alabama’s Department of Public Health, Department of Transportation, Chapter of the American Academy of Pediatrics and other agencies. These activities probably did influence CRU, but did so in both pre- and post-intervention time periods. Potential influences leading to false positive results would include nationwide increases in CRU and subsequent downtrends in death and injury over the study post-intervention period. We did not control for nationwide changes during the pre or post time periods although in the discussion above we do address the national trends during the same time period. Although the static nature of CRU, deaths, and injury in Alabama during the ten years preceding our post-intervention time period should attest to the lack of, or minimal national influence on Alabama child passenger safety estimates.

We also did not control for other variables (e.g. state population, vehicle miles traveled, state speed limits or other traffic safety legislation), but feel these had a minimal, if any effect. The state population numbers were relatively stable between the years of 1998 and 2005 increasing only 2.5% while national population increased 5.3%. Vehicle miles traveled changed only minimally from 1999 until 2001. The Alabama speed limit for travel on interstates was increased from 65 mph to 70 mph in May of 1996 and was therefore in place prior to the beginning of our study. The only change in traffic safety legislation other than the primary seat belt law was the enactment of a graduated driver’s license rule for adolescents which took effect after 2000.

CONCLUSION

A model intervention approach utilizing education, legislation, and services has resulted in significant improvements in Alabama CRU and MVC death and injury. Subsequent to declines in MVC death and injury, annualized median comprehensive cost savings are estimated to be over $26 million. When compared to annual grant funds expended, an estimated return on investment is $75.00 for each dollar used to support the model approach. We believe this model approach represents a vital, necessary, and fiscally responsible component to child health and well-being in Alabama.

ACKNOWLEDGMENTS

Specific funding for the statewide child passenger safety model approach was provided by Alabama Department of Economic and Community Affairs through NHTSA state incentive grants for occupant safety. Significant funding and support of the state model approach was also provided by the Children’s Hospital of Alabama. Significant public educational campaign support and guidance was provided by the Corporate Communications and Marketing division and the Child Safety Institute of The Children’s Hospital of Alabama.

REFERENCES

Identifying Interventions That Promote Belt-Positioning Booster Seat Use For Parents With Low Educational Attainment

Faura K. Winston, MD, PhD, Danielle Erkoboni, BA, and Dawei Xie, PhD

Background: Many parents with low educational attainment prematurely graduate their children to seat belt restraint rather than use belt-positioning booster seats. This study aimed to identify interventions that promoted booster seat use among this population.

Methods: This multi-site study used focus groups to elicit contributing factors to booster seat non-use, which informed subsequent intervention development. A first phase (10 focus groups, N = 117) identified parents’ perceived barriers, benefits, and threats relating to belt-positioning booster seats. These findings were used to identify existing and create new interventions. A second phase (20 focus groups, n = 171) elicited parent’s reactions to these interventions and provided parents with belt-positioning booster seats and education on their use. Follow-up interviews were conducted six weeks later.

Results: Lack of education and fear of injury were the primary barriers to belt-positioning booster seat use. Parents were motivated by interventions that provided them with clear, concrete messaging relating to use. Parents favored the intervention that presented a real story detailing a child’s severe injury that could have been prevented with appropriate restraint. At follow-up, parents credited this intervention with motivating booster seat use most often. Although parents cited their child’s lack of comfort and non-compliance as barriers to use, they were not as motivated by interventions that addressed these barriers.

Conclusions: Effective intervention programs can be created by identifying and addressing factors that contribute to a population’s intention to use belt-positioning booster seats. In addition, successful programs must utilize messages that motivate the target population by addressing their perceived threats to booster seat non-use.

Key Words: motor vehicle safety, child safety seat, booster seat, qualitative research, focus groups.


Motor vehicle crashes (MVCs) remain a leading cause of injury among children in the United States. Use of appropriate restraints in motor vehicles is an effective strategy for reducing the risk of injury and death to child passengers in a MVC. Although child restraint use for children under 8 years in the United States has increased since 1998, children between the ages of 4 and 8 years continue to be at highest risk for inappropriate restraint by seat belts alone. Among this age group, children of parents which a high school education or less were 27% more likely to be inappropriately restrained than those of parents with higher educational attainment. The reasons for low appropriate restraint use among these at-risk populations were unclear.

To inform future efforts to increase belt-positioning booster seat (BPB) use, this study focused on identifying reasons for BPB non-use for children, ages 4 through 8 years, of parents with a high school education or less. Parents were recruited with the support of an existing injury prevention network, the Injury Free Coalition for Kids (IFCK), allowing for the dissemination of study results and proven interventions through an existing infrastructure.

The Theory of Planned Behavior formed the theoretical foundation for the study. According to Ajzen and Fishbein, behavior is preceded by a positive intention to perform the behavior, which, in turn, is informed by the perceived benefits, barriers, and threats to performing that behavior. (Fig. 1) According to this theory, to promote BPB use it is necessary to encourage positive intentions toward BPB use. This can be done by overcoming the parents’ perceived barriers to BPB use, highlighting parents’ perceived benefits to BPB use, and reducing parents’ perceived threats to BPB use (Fig. 1). Therefore, this research aimed to:

1. identify factors that influence parents’ current child restraint use behaviors and intentions for future use, and
2. test interventions that address these factors as a means to promote appropriate restraint use behaviors, particularly the use of PBPs.
MATERIALS AND METHODS

Study Design

This study was conducted in three phases, the Formative Phase, the Development Phase and the Evaluative Phase. Through focus group discussions, the Formative Phase defined a range of perceived barriers, benefits, and threats to current BPB non-use among a diverse population of parents with a high school education or less. The Development Phase utilized these findings to identify existing interventions and develop new ones that aimed to reduce perceived barriers and threats, and enhance perceived benefits of BPB use in the target populations.

The Evaluative Phase utilized focus groups within the target population to acquire feedback on these interventions. Participants’ intentions to use BPBs were monitored through a series of questionnaires administered throughout this phase. At the conclusion of the focus groups, participants were provided with a free belt-positioning booster seat. Follow-up telephone calls were made six weeks later to measure participants’ change in intention to use and actual use of BPBs.

Inclusion Criteria: Formative and Evaluative Phases

Study participants were recruited in both phases using telephone calls and printed flyers, through the framework of the IFCK network. Parents of children between the ages of 3 and 8 years who never or rarely used appropriate restraints for their children were invited to participate. Parents of children as young as age 3 were included, as this age is often a transitional period where children move out of a child safety seat. Additional inclusion criteria included: educational attainment of, at most, at most a high school diploma, and travel with children in motor vehicles at least once a week. Individuals of both African American and White races, as well as of Hispanic American and non-Hispanic ethnicity were recruited.

All participants were offered reading assistance and/or Spanish language translation, according to the participants’ preference. The Institutional Review Board at The Children’s Hospital of Philadelphia approved all recruitment and consent procedures, as well as all study protocols and surveys.

Data Collection Instruments: Formative and Evaluative Phases

Structured focus group moderator’s guides were developed for both the Formative and Evaluative Phases based on a theoretical foundation (Fig. 1), and were pilot-tested before use in framing both phases of focus group discussions. To ensure that each group explored the issues that were most relevant to their lifestyle, discussions were not limited to topics in the guide. For example, threats were treated as all perceived threats on the road as opposed to simply threats to BPB use.

To characterize participants’ baseline knowledge, perceptions, attitudes, and intentions, a short, self-completed survey instrument was administered in both the Formative and Evaluative Phases. In the Evaluative Phase, additional instruments were administered throughout the Phase to measure changes in perceptions, attitudes, and intentions resulting from the study. Instruments measuring immediate change were administered after participants viewed and discussed the interventions and after they received a free BPB; longer term changes in perceptions and attitudes as well as adoption of and adherence to BPB use behavior and recall of interventions was measured by a standard telephone follow-up assessment six weeks after the focus group.

Adoption of and adherence to BPB use behavior was measured according to the Prochaska’s Stages of Change: precontemplation, contemplation, preparation, action, and maintenance of use, and termination of non-use. A five-item, progressive, non-threatening algorithm was used. Participants were first asked whether they thought about using the BPB; if so, whether they tried it; if so, whether they use it regularly; and if so, whether they have told others to use it (a measure of extinguishing of the non-use behavior). Questions were modeled after previously validated question wording developed by Littell and Girven based on Stages of Change.

All survey instruments were pilot-tested by parent volunteers before use and were available in both English and Spanish, depending on the participant’s preference.

Data Collection Procedures: The Formative Phase

Participants were asked to complete a brief questionnaire to document general demographic information along with more detailed information pertaining to their knowledge, perceptions, attitudes, and intentions relating to BPB use. Discussion topics focused on the factors that affected participants’ intention to use BPBs: their perceived barriers, benefits, and threats relating to the behavior.
Data Collection Procedures: The Development Phase

A literature search identified existing interventions designed to increase BPB use. This search was supplemented with a review of BPB use promotion interventions collected through informal surveys of injury prevention list-serves, Internet searches, and personal contact with experts in the field. The research team selected interventions for evaluation after determining whether the interventions targeted the benefits, barriers, and threats most relevant to the target populations. Interventions that had unclear or non-relevant messages were eliminated. Interventions utilizing a medium that the participants in the Formative Phase cited as being ineffective, such as flyers, were also eliminated.

Four existing interventions or intervention programs were selected. Three of these targeted BPB-aged children: the IFCK of Austin’s “The Bucketeers,” the US Department of Transportation’s National Highway Traffic Safety Administration’s “Cinderella” public safety announcement (PSA), and Weiner and Seamen Production’s “The Big Green Snake.” A fourth intervention, the “Abrocha Tu Vida” campaign, created by the University of Washington’s Harborview Injury Center, targeted Latino parents (Table 1).

Three newly created pilot interventions were designed (to supplement the four existing interventions) with messages identified as being relevant to the target populations but not clearly addressed by previously existing interventions. These messages were: importance of booster seat laws, education around injuries that are prevented by BPB, and use of BPB as part of good parenting in the car (Table 2).

Data Collection Procedures: The Evaluative Phase

After consent was obtained for the Evaluative Phase, participants completed the baseline survey and were asked to prioritize lists of benefits, barriers, and influential people/media generated from the Formative Phase focus group discussions (Table 3). This activity highlighted the issues of greatest importance to the target population, which informed the conduct of the study, as well as future interventions developed by the IFCK. The most highly ranked items in each group were used to determine which interventions that group would review. By selecting interventions that specifically addressed the issues important to the participants, the study was able to address the presentation of the message without discussion of the message’s relevance.

Each focus group reviewed 4 of the 7 interventions. Based on the results of the prioritization exercise for each group, 2 interventions were selected for review from the 4 existing interventions (Table 1) and the newly designed booster seat laws radio PSA in English (Table 2). All groups reviewed the remaining two newly created interventions (Table 2).

The same series of questions were used when discussing each intervention. These questions assessed whether the intervention engaged the participants, addressed their barriers and threats, and promoted positive booster seat use intention. (Figure 1) Participants then provided recommendations for improvement to the intervention.

Following the groups’ discussion of the 4 interventions, participants were asked to complete a post-discussion survey (to measure changes in intention), and were offered a free BPB. Participation in this portion of the study was optional, and the giveaway was not announced until the all surveys were completed. Each participant electing to receive a BPB was required to listen to a 15-minute educational presentation detailing how to properly use the BPB. Certified Child Passenger Safety Technicians from the IFCK site local to the focus group location provided all education. Following the presentation, participants were allowed time to ask questions of the technician.

This BPB giveaway eliminated the barriers of access to BPB that the participants might have faced, including cost and lack of knowledge about where to buy a seat. By eliminating these barriers, the research team was able to examine the effectiveness of the intervention messages, as none of the interventions shown in the group were able to overcome the cost or inaccessibility barriers alone.

Six weeks after receipt of the BPB, each participant was contacted for a 20-minute follow-up phone interview. This interview assessed participants’ progression through the Stages of Change, elucidated participants’ intentions toward BPB use, and measured their retention of the messages heard in the focus group.

Analysis: Formative Phase

All focus group discussions were taped and transcribed. Transcripts were coded, using N6 software (QSR International, Doncaster, Victoria, Australia), by two research assistants under the supervision of the study coordinator. Coding was based on the themes of participants’ perceived barriers, benefits, and threats relating to BPB use. All researchers who observed the focus groups reviewed the transcript summaries. The researchers and the moderator discussed all comments to reach consensus. In situations in which consensus could not be reached, all possible interpretations were included in the summary document.

Analysis: Evaluative Phase

The Formative and Evaluative Phases utilized the same method for focus group analysis; however, in the Evaluative Phase, analyses included additional in-depth components, combining both quantitative and qualitative methods. These analyses focused on identifying themes pertaining to the interventions under study. The overall goals of the analyses in the Evaluative Phase were to:

1. summarize participants’ rankings of barriers, benefits, and threats to BPB use and the reasons for the rankings;
2. evaluate reactions to the proposed interventions using discussion and reported change in attitude toward BPB; and
3. assess participants’ awareness and retention of the messages heard.

Interventions That Promote Booster Seat Use

Volume 63 • Number 3

S31

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Table 1 Interventions were Chosen that Addressed the Perceived Barriers and Threats Expressed by Parents in the Formative Phase. These Interventions Addressed both Parents and Children Through a Variety of Distribution Methods

<table>
<thead>
<tr>
<th>Campaign Title</th>
<th>Sponsor(s)</th>
<th>Materials</th>
<th>Target Population</th>
<th>Mode of Distribution</th>
<th>Targeted Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Abrocha Tu Vida”</td>
<td>Harborview Injury Prevention and Research Center, Latino Kids Safety Coalition, and State Farm Insurance</td>
<td>● Four radio commercials in Spanish</td>
<td>Spanish-speaking parents and their children, 4 to 8-yr-old</td>
<td>Regional radio</td>
<td>● Resistance of family members</td>
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<tr>
<td>(Buckle up your life)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● No one enforcing law</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● Lack of info</td>
</tr>
<tr>
<td></td>
<td>The Bucketeers Injury Free Coalition for Kids of Austin</td>
<td>● DVD</td>
<td>English and Spanish speaking children, 4 to 8-yr-old</td>
<td>Childcare centers</td>
<td>● Child resists restraint</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Membership card</td>
<td></td>
<td>School health classes</td>
<td>● Booster is a “baby seat”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Sticker</td>
<td></td>
<td>Educational programs</td>
<td></td>
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<td></td>
<td></td>
<td>● Poster</td>
<td></td>
<td>Community centers</td>
<td></td>
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<td></td>
<td></td>
<td>● Height chart</td>
<td></td>
<td>Doctor’s offices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Big Green Snake Weiner and Seiman Productions</td>
<td>● Video Tape</td>
<td>English and Spanish speaking children, 4 to 8-yr-old</td>
<td>Childcare centers</td>
<td>● Child resists restraint</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Posters</td>
<td></td>
<td>School health classes</td>
<td>● Booster is a “baby seat”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Coloring/Story Book</td>
<td></td>
<td>Educational programs</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>● Stickers</td>
<td></td>
<td>Community centers</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>● Board Game</td>
<td></td>
<td>Doctor’s offices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cinderella Interventions National Highway Traffic Safety Administration</td>
<td>● Website</td>
<td>English and Spanish speaking children, 4 to 8-yr-old</td>
<td>National television</td>
<td>● Child resists restraint</td>
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<tr>
<td></td>
<td></td>
<td>● PSA</td>
<td></td>
<td>Previews to movies</td>
<td>● Booster is a “baby seat”</td>
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<tr>
<td></td>
<td></td>
<td>● Activity Guide</td>
<td></td>
<td></td>
<td>● Lack of info</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● Resistance of family members</td>
</tr>
</tbody>
</table>
Table 2: These Interventions were Designed to Address Barriers and Threats that Remained Unaddressed by the Selected Existing Interventions. Each Intervention was Designed as a Draft by the Research Team at The Children’s Hospital of Philadelphia.

<table>
<thead>
<tr>
<th>Campaign Title</th>
<th>Designer</th>
<th>Materials</th>
<th>Target Population</th>
<th>Mode of Distribution</th>
<th>Targeted Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>“It’s the law”</td>
<td>The Center for Injury Research and Prevention at The Children’s Hospital of Philadelphia</td>
<td>● Two radio PSAs in English</td>
<td>English-speaking parents and their children, 4 to 8-yr-old</td>
<td>● Regional radio</td>
<td>● Resistance of family members</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● No one enforcing law</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● Lack of info</td>
</tr>
<tr>
<td>“Safer for kids, easier for you”</td>
<td>The Center for Injury Research and Prevention at The Children’s Hospital of Philadelphia</td>
<td>● Four-minute video</td>
<td>English-speaking parents and their children, 4 to 8-yr-old</td>
<td>● Childcare centers</td>
<td>● Child resists restraint</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● Booster is a “baby seat”</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● Lack of info</td>
</tr>
<tr>
<td>“Avoid regret”</td>
<td>The Center for Injury Research and Prevention at The Children’s Hospital of Philadelphia</td>
<td>● Five-minute video</td>
<td>English-speaking parents and their children, 4 to 8-yr-old</td>
<td>● Childcare centers</td>
<td>● Lack of info</td>
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<td></td>
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</tbody>
</table>

Table 3: The Perceived Barriers, Benefits, Threats and People whom Matter, Derived from Participant Responses in the Formative Phase, and Ranked by Participants in the Evaluative Phase.

**Bad things that I worry about when I drive my children in the car:**
- I might get pulled over by the cops.
- I might have to pay for a ticket.
- I might go to jail if I do not restrain my child correctly.
- Other people might think I am a bad parent if I do something wrong.
- My child might bother or distract me.
- I might get into a crash.
- My child might get seriously hurt in an accident.
- My child might get hurt by the airbag.
- My child might get out of her seat belt.
- My children might fight.

**Good things that might happen if my child is in a booster seat:**
- My child will feel snug and safe in a booster seat.
- My child will feel special in her “own seat”.
- My child can see out the window when he is in a booster seat.
- My child will feel like a “big kid” in a booster seat.
- My child will be comfortable in a booster seat.
- My child will not bother me because she might behave better.
- I will know that my child is safe when he is in a booster seat.
- I will have a place to put the child’s food/cups/toys in the booster seat.

**People or places whose opinions about booster seats matter to me:**
- I trust my own opinions.
- My child
- My child’s doctor or other healthcare provider
- My child’s teacher or school
- Groups in my neighborhood or community
- My minister or other church leader
- My friends, neighbors, or other parents
- My spouse, partner, or child’s parent
- Other members of my family
- Hospitals or ambulance workers
- Auto dealers
- Government officials (mayor, governor, president)
- Police
- Things on the Internet
- Signs or flyers in neighborhood stores
- TV
- Radio
- Newspapers
- Magazines

**Things that might make it hard for me to use a booster seat for my child:**
- My child will complain if I make him use a booster seat.
- My child will complain if I make him use a booster seat.
- My child will be uncomfortable in a booster seat.
- My child will think I am punishing him if I put him in a booster seat.
- Other children might make fun of my child if he is in a booster seat.
- I do not think a booster is safe.
- People I care about told me not to use a booster seat.
- I do not have room in the car for the booster seat.
- I think that it is too hard to use a booster seat.
- I do not know where to get a booster seat.
- I cannot afford a booster seat.
3. summarize participant suggestions for improvements in content and distribution of the interventions.

The most highly ranked perceived barriers, benefits and threats were found by summarizing the top five items chosen from each list in the list ranking exercise by each focus group.

Participants’ reactions to the selected interventions were analyzed by coding sections of the focus group discussion and tracking changes shown in the participant information collection forms. Coded transcripts were analyzed for recurring themes, as was done in the Formative Phase. Changes in attitudes and intention to use BPB were assessed quantitatively through the information collection forms. For descriptive analyses of interval scale variables (e.g. participant age and number of children, the mean) median, mode, and range were obtained. These variables were also categorized for later cross-tabulation analysis. Frequencies were calculated for categorical variables. To compare the distribution of categorical variables among groups, cross-tabulation analysis was performed and Pearson’s Chi-square statistics were used to determine significance. Some of the categorical variables were regrouped to increase the expected numbers in the cells of the cross-tabulation table and thereby ensuring the validity of Chi-square statistics.

RESULTS

Description of Study Population: The Formative Phase

A total of 107 participants from one pilot group and eleven focus groups were included in the Formative Phase of this study (Table 4). The pilot data were included in the analysis as no substantial changes were made to the focus group moderator guides or procedures after the pilot. The majority of parent drivers who participated in the Formative Phase were African American (46.7%), female (86.9%), ages 26 to 30 (35.5%), and married (51.4%). Most participants were employed outside of the home (45.8%), with 63.3% of those employed working full time, and 44.9% working in a service-oriented position.

Description of Study Population: The Evaluative Phase

Participants for the Evaluative Phase were recruited using criteria similar to those used in the Formative Phase. As a result, the study population for the Evaluative Phase was similar to that of the Formative Phase. A total of 176 participants from four pilot groups and sixteen focus groups (6–10 participants/group) were included in the Evaluative Phase of this study (Table 5). As in the Formative Phase, the majority of parent drivers who participated in this Phase were African American (56.2%), and female (89.8%). The Evaluative Phase participants were slightly younger than those in the Formative Phase, with a majority of participants between ages 21 and 25 (27.8%). In addition, the majority of participants in the Evaluative Phase was single and had never been married (45.5%), which differed from those in the Formative Phase. The majority of participants were employed outside of the home (56.8%), with 68% of those employed working full time, and 44% working in a service oriented position.

Table 4 The Formative Phase Study Population (N = 107)

<table>
<thead>
<tr>
<th>Demographic</th>
<th>n</th>
<th>% of Sample</th>
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<tbody>
<tr>
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<td>21 to 25</td>
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Barriers, Threats, and Benefits to BPB use: The Formative and Evaluative Phases

Focus group discussions in both the Formative and Evaluative Phases sought to define factors that contribute to BPB use or intention toward BPB use in the targeted populations. Several themes emerged across all targeted populations in both phases. Other themes were more relevant for particular groups. Differences based on focus group location, race, gender or ethnicity were noted where applicable.

Threats—Bad Things that I Worry About when I Drive My Children in the Car

Threats of similar type were ranked highly among all groups. Every group ranked “my child might get seriously hurt in an accident” within their top five perceived threats.
Participants in each group identified this as something they worried about often when they drove with their children. Most groups rated either “I will get pulled over by the cops”, or “I might have to pay a ticket” highly. These concerns stemmed primarily from hearing stories from other parents or having been pulled over themselves. Participants in each group saw the resultant fine as strong motivation to restrain their children to keep them safe; however, many also cited that money should not be a primary factor in their behavior, repeatedly stating that they restrain their children to keep them safe.

Benefits—Good Things that Might Happen if I Use a Booster Seat

Parents in each group ranked items relating to their child’s safety highly. Benefits such as “my child will feel safe and snug in a booster seat” or “I will know that my child is safe when he is in a booster seat” were ranked among the top five perceived benefits in all groups.

Participants emphasized safety of their children as paramount when commenting on these selections. As a result, parents considered any other benefits, such as their child liking the restraint, as a “bonus.”

Perceived benefits of BPB use relating to the child (My child will feel like a “big kid” in a booster seat and My child can see out the window when he is in a booster seat), were highly ranked in many groups. Parents stated that these benefits were important to them, as they increased their children’s willingness to use a BPB. These benefits were crucial to many parents, especially White parents, who struggled to get their children to use proper restraint. In contrast, African American participants noted that their child’s approval or disapproval had no effect on their choice of child restraint.

Barriers—Things that Might Make it Hard to Use a Booster Seat

Participants in most groups were hesitant to select items on this list, noting that there were no factors that barred them from keeping their child safe. As a result, less than half of the participants in The Evaluative Phase ranked the items on this chart. Discussions showed that parents felt strongly that nothing would stop them from keeping their children safe; however, they did note several things that made it harder to use a BPB for their children.

Of the barriers discussed in the groups, the most commonly identified was the effect of the child’s behavior due to restraint use. Several participants in each group noted that their children, although comfortable in a BPB, did not want to be restrained at all. In many groups, a subset of participants disagreed with this, stating that their children often reminded them to put on their safety belts too. As a result, the effect of the child passenger’s opinion was divided between those parents whose children liked their BPB, and those parents whose children did not.

Another factor that made using BPB hard for many parents was lack of room in their vehicle. African American participants, as well as those participants in Little Rock, Arkansas noted this most often. The participants agreed that the BPB took up a lot of room in their cars, and made it difficult to restrain multiple children properly.

Information Sources—People and Places Whose Opinions I Trust

Participants across all sites, sexes and racial and ethnic groups agreed that they trusted their own opinions about BPB the most. Parents emphasized that although they may accept advice from other sources, their own feelings about what keeps their child safe superseded all outside advice. The most highly ranked outside sources included government officials, physicians and the police. Family members and friends were also ranked highly, with participants noting that most of their information on CPS is received by word of mouth.
consistent across all locations, while others were only relevant to a particular subset.

**Television and Video Programs Targeted Toward Children**

Participants in all groups felt that the right viewers were not targeted by the intervention programs designed for a child audience (The Buckleitters, the Big Green Snake and the Cinderella ad campaign). Parents emphasized that they alone made decisions about the restraint habits of their children; therefore, interventions should be aimed at educating and motivating adults. Although participants found each of these interventions entertaining (and felt that the interventions would engage their children), they felt that they would not motivate them toward proper restraint use.

**Radio Commercials Emphasizing “The Law”**

Parents were also opposed to messaging utilizing booster seat laws and potential fines to motivate parents. The participants noted that concern for their child’s safety should be enough of a motivation without the added consequence of a ticket.

This message was presented as a pair of radio commercials. African American and White participants felt messages on the radio would not reach as large of an audience as interventions aired on television. In contrast, Hispanic participants were very receptive to the information presented through the radio.

**Video Programs Educating Parents**

Parents were motivated by concrete educational messages that reinforced the injury prevention benefits of BPB. As a result, parents were motivated by the pilot intervention designed for this study that provided education around injuries that are prevented by BPB (see Table 2; “Avoid Regret”). This intervention utilized an actionable emotion, regret, coupled with education to correct participant’s previous misconceptions and promote BPB use. The message was delivered in the form of a true, instructive story told by a parent, the preferred spokesperson by the participants.

During the focus groups, participants were visibly moved by the story and described it as both educational and motivational. They requested that the intervention be made available through email and other channels so that they could share it with others. At the 6-week followup call, parents felt that this intervention alone had changed their intention to use a BPB, as it provided them with the knowledge necessary to use a BPB properly, and the motivation to overcome their additional barriers.

Participants had varied reactions to the intervention that coupled BPB education with parenting advice (see Table 2; “Safer for kids; easier for you”). Participants felt this intervention lacked a strong motivational message. Although they were concerned about their children misbehaving in the car, their primary concern was preventing their child from being injured in a crash.

**Changes in Attitudes and Intentions: The Evaluative Phase**

Quantitative analysis of changes in intention to use and attitudes toward BPB (using the participant questionnaires) revealed a positive shift as a result of the interventions and focus group discussions. The ability of the Evaluative Phase focus groups to change intention was evident in the percentage of participants that became more likely to use a BPB by the conclusion of the groups. (Table 6) The majority of participants who were somewhat unlikely or unlikely to use a BPB initially became more likely to use a BPB. For example, 15.5% of participants who were originally somewhat likely to use a BPB became very likely to use a BPB; only 1.4% did not change their opinion or decreased their likelihood of using one.

**Changes in Booster Seat Use Behavior: The Evaluative Phase**

Of the 176 participants in Evaluative Phase, 94.8% completed the 6-week follow-up telephone interview. This population comprised a representative sample of the study population. Of those who complete the interview, 98.9% reported using the BPBs on all trips, and 74.6% reported telling others about BPBs.

**DISCUSSION**

This study was the first to review BPB use perceptions, attitudes, and knowledge among parents with limited educational attainment, a known population at high risk for inappropriate restraint of their children in motor vehicles. For parents with limited educational attainment (high school education or less), lack of knowledge about the injury consequences of inappropriate restraint was the major barrier to BPB use. This barrier was the most prevalent barrier across

<table>
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<th>Participant response</th>
<th>Became More Likely</th>
<th>No Change</th>
<th>Became Less Likely</th>
<th>Total</th>
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</thead>
<tbody>
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<td>Very Likely</td>
<td>15.5</td>
<td>0.7</td>
<td>0.0</td>
<td>16.9</td>
</tr>
<tr>
<td>Somewhat Likely</td>
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<td>0.7</td>
</tr>
<tr>
<td>Very Unlikely</td>
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</tr>
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<td>TOTAL</td>
<td>26.8</td>
<td>53.5</td>
<td>2.1</td>
<td>82.4</td>
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</tbody>
</table>

* The remaining 17.6% of participants did not respond to this question.
gender, race and ethnicity differences. As a result, all participants endorsed a simple direct message that reinforced the life-saving benefits of seat belts and described the injuries that could be prevented with BPB use. These parents reported positive changes in attitudes and intentions, as well as adoption of and adherence to BPB use a result of the education acquired from this message.

These results demonstrate that effective interventions must include messages with relevant knowledge, that the target population deems strong and motivational. Social marketing research has shown that a strong motivator for behavior change is avoidance of an individual’s perceived threats, (i.e. the possibility of resulting death, injury, or illness).

In this study, parents with limited educational attainment cited the potential of their child being hurt in a crash as the primary threat they perceived relating to motor vehicle crashes. A clear educational message toward appropriate restraint use would therefore be strengthened by pairing it with a message confronting the possibility of injury resulting from a child being improperly restrained in a vehicle.

Individuals with a high school education or less represent 47.5% of United States citizens over the age of 25 years. Winston et al. demonstrated that previous intervention tactics have not served to fully educate these parents concerning appropriate child restraint. Research has shown that education, particularly health education, for these populations must be concrete and personal — it is important not to simply provide information to these populations, but to truly educate them. This education involves providing knowledge, coupled with messages that motivate the target parents, shown through channels and media that the parents trust and respect.

Study Limitations and Future Work

This study was limited by the use of focus groups. Although this format allowed for a thorough discussion on a wide range of topics relating to BPB use, it restricted the ability of this study to reach saturation in each target population. While saturation was reached among populations on the east coast, as well as African American populations, a limited amount of data were collected from midwestern and Hispanic populations.

As a result, it would be beneficial for focus groups to be conducted until saturation is reached in all identified target populations. Further work could also expand the study population to include additional cities, such as those in the northwestern or southern regions of the United States. The study could also be expanded to include other at-risk groups, or at-risk safety behaviors (such as partial belt use).

In addition, randomized control trials could further test the effectiveness of the injury intervention alone, with discussion groups, and in combination with a BPB giveaway.

Implications

Behavioral science theory and research methods are important in the development of interventions to promote and sustain pro-health behaviors. Until recently, little scholarly attention has been paid to behavioral science and injury prevention promotion. This study demonstrates the positive impact of applying behavioral science approaches to educational intervention development around the adoption of and adherence to BPB use for their children by an at-risk population, parents with low educational attainment. Future intervention development around injury prevention for a target population, including BPB use, should begin with the study of perceptions, intentions, knowledge, and degree of adoption of the prevention behavior to address the determinants of the population’s behavior. As in this study, evaluation of the success of the intervention should measure changes in behavioral intentions, knowledge, and then adoption and sustainability of the behavior. Once effectiveness has been established, distribution and packaging methods should be employed to encourage widespread dissemination.

ACKNOWLEDGMENTS

This research was supported by the National Highway Traffic Safety Administration, US Department of Transportation, under Contract No. DTNH22-01-C-05845. The opinions, findings, and recommendations contained herein are those of the authors and do not necessarily represent those of the National Highway Traffic Safety Administration. We acknowledge Debra Dean and Teresa Koenig of Westat, Inc. for expert conduct of the focus groups, and May Aiken of the Little Rock Injury Free Coalition for Kids (IFCK), Michael Gittelman of the Cincinnati IFCK, and Benjamin Selassie of the Baltimore IFCK for their tireless efforts in recruiting for the focus groups. The authors would also like to acknowledge Alexandra Winski for diligence in executing the follow up interviews and analyzing data for this project.

REFERENCES


"Cubs Click It for Safety": A School-Based Intervention for Tween Passenger Safety

Mary E. Aitken, MD, MPH, Samantha H. Mullins, Virginia E. Lancaster, and Beverly K. Miller, MEd

Background: Children ages 8–12 years, also called “Twins,” demonstrate a number of risk factors for motor vehicle injury, including lack of restraint use and front seating position, yet few interventions have targeted this group. We implemented a school-based educational intervention designed to increase awareness and encourage safer transportation of these children.

Materials: A local school collaborated with the study team to develop educational materials based on the school mascot and allowed use of school-based media (bulletin boards, closed circuit TV, and newsletters) to deliver key messages about restraint use and back seating position. Selected students participated in delivering the message and in evaluation activities, increasing peer support for the program. Evaluation consisted of surveys of reported and observed restraint use and rear seating for children and restraint use for parents before and after the educational intervention.

Results: School support for the program was excellent and student enthusiasm was high. Parent awareness of safe positioning for children improved, with parents endorsing seat belts alone versus seat belts with a booster seat for children ages 5–8 falling from 37% to 25% ($p < 0.004$). Child report of restraint use increased from 78% to 89% ($p < 0.001$). Reported exposure to the campaign messages was high with 77% of parents and 89% of students recalling the campaign at the end of the year. Observed restraint use for both adults and children was somewhat lower than reported use. Restraint use by parents was about 80% both before and after the intervention. Restraint use by children increased from 71% to 91% (0.001). No changes were noted in front seating position for children.

Discussion: Short term positive changes in observed restraint use and knowledge about safer transportation of children were encouraging. Further study of the program, including a controlled study of the intervention, are needed to demonstrate longer term effectiveness.

Motor vehicle safety interventions have traditionally focused on increasing correct restraint of infants and young children in car seats or modifying the risks of novice teen drivers. Recent efforts to encourage booster seat use in children ages 4–8 years of age have resulted in increased, but still inadequate, use of appropriate restraint in this age group.1,2 Children in the “Twen” age group—approximately 8–12 years of age—have been a relatively neglected subpopulation, despite data that indicate they may be at substantial risk for injury and death due to modifiable behaviors. In recent national surveys, 10.9% of ninth graders reported that they rarely buckled their seatbelts when riding with another driver, a proportion higher than that of driving-aged adolescents.3 A number of studies have shown that many children in the Tween age group sit in the front seat of the car, despite evidence that rear seating is safest for all children under age 13 years.4,5,6 Recently, increased awareness of these risky behaviors has led to calls and efforts to improve safety awareness in this age group and to seek interventions that may be helpful in increasing both appropriate restraint and seating position in these children.7

 Tween children present unique challenges for prevention interventions. Research into the factors influencing Tween risk-taking behavior has been somewhat limited. A recent review, however, demonstrated a multi-dimensional complex of factors that can influence children in this age group.8 Developmentally, this group is beginning to develop the independent decision-making of adolescence, but is still strongly tied to parents and family. Interventions must therefore include a strong parental component while factoring in the emerging importance of peers and social pressures. While younger children are frequently exposed to medical settings for immunization or other health maintenance issues, the older, school-aged child may only occasionally interact with medical professionals during episodes of illness, making clinic based interventions potentially less effective. Cognitively, Tweens are engaged in developing independent reasoning and decision making skills. They can articulate potential outcomes of a specific example, such as what might happen during a crash if they are
not wearing a seat belt. Further, they are beginning to understand the interaction between behavior and consequence and can make deliberate changes in behavior to obtain a desired consequence. Evidence exists that children begin to develop skills in identifying risks during this period and take responsibility for decisions around injury risk. Harnessing this evolving independence may therefore be a viable strategy in the development of prevention interventions.

As a result of these transitions, schools emerge as an ideal location to facilitate exposure to health promotion messages. School-aged children spend more than half of the calendar year in the school setting, with a typical day lasting a minimum of seven hours. To fully capitalize on the strengths of school settings, an understanding of the increasing importance of peer influences, individually and collectively, on behavior change is critical. School is often a key place where friendships are formed. The dual roles of family and peers in the lives of children in this age group require further study to be fully understood; however, it is clear that children spend the most time and experience the most socialization with peers. Influence among peers can be further enhanced by the use of students to deliver messages.

As summarized by the CDC in its targeted media campaign for Tweens, effective messages must start with the child instead of the parent, endorse realistic and factual benefits, utilize a spokesperson whose identity reinforces the core message, and deliver multi-channeled messages in a consistent manner. The purpose of this project was to pilot such an intervention targeting Tween-aged children in a school with substantial risk factors for motor vehicle injury.

**MATERIALS AND METHODS**

**Setting**

An inner city elementary school, in the target community for the Injury Free Coalition for Kids of Little Rock at Arkansas Children’s Hospital, was the site for the Cubs Click-It for Safety campaign. The school principal and staff agreed to participate in the project for an entire school year. Although the target group for the intervention were the 8–12 year olds, all children within the school were exposed to educational messages and observed for restraint changes. During the year studied, 616 pre-kindergarten through fifth grade students attended the school, representing 473 separate families. Of these children, 436 (70.8%) were in grades 1–5, the major focus of the intervention. Half of the student body was from inner city neighborhoods. Seventy percent of the students were African American and 61% of the students in the school qualified for free or reduced lunch based on economic need. Females accounted for 52.2% of the student body.

**Project Team and Staffing**

Staff from the Injury Free Coalition for Kids at Arkansas Children’s Hospital developed and administered the project. Selected fifth grade students became part of the project team after receiving brief training on motor vehicle safety. These student team members assisted in material development, process evaluation, and survey administration. The students also acted as role models for their peers and participated in educational activities throughout the year.

**Intervention Activities**

During the 5-month intervention period educational activities included morning and afternoon announcements via closed circuit television, school assemblies, a prominently placed bulletin board, and poster distribution. All educational materials utilized the Cubs Click It for Safety logo and message, which was based on the school’s tiger cub mascot. Video and voice messages in the daily morning announcements included a visual image of buckling a seat belt around the school mascot, with the admonition: “Remember, Cubs Click It for Safety.” Afternoon public address announcements included a verbal message reinforced with a “clicker” sound for buckling up.

Safety messages were reinforced with parents throughout the school year by distributing educational brochures during family-centered activities, such as back-to-school picnics and the school’s annual festival. Brochures on motor vehicle safety were distributed during the pre-intervention observational surveys. Wrist bands and other novelty items with safety messages were given to appropriately restrained and positioned passengers and drivers during the interim and post-intervention observational surveys.

**Evaluation Tools and Data Analysis**

Voluntary surveys were administered before and after the intervention to parents of students attending the school as well as students in first through fifth grades. These instruments assessed parent and student reported safety behaviors in motor vehicles, including restraint use and seating position. Three times over the five month period, observations were conducted to document seat belt use and seating position in the vehicle. These observational surveys, conducted by study staff and the student peer assistants during morning student drop-off near the school, were brief, anonymous, and non-invasive. Observational survey forms were modified from those used in other child passenger safety interventions. Observations were conducted in two parking lot areas, including an area dedicated for pre-K students and older students whose parents park for an extended period to enter the building and another area for the remaining student body.

SPSS 12.0 (SPSS, Chicago, IL) statistical software was used to tabulate and analyze data. Descriptive summaries of data were developed to characterize survey responses. The \( \chi^2 \) test was used to compare populations before and after the intervention. The study protocol was reviewed and approved by the University of Arkansas for Medical Sciences Institutional Review Board.
RESULTS

Staff Education

The project was conducted during the 2005–2006 school year. At the beginning of the school year, during a regularly scheduled staff meeting, a brief 15 minute in-service was conducted for teachers and staff. The goals and plans for the project were introduced, and general principles of safe child transportation were reviewed. A 4 question assessment of staff knowledge was administered to 39 staff members before the presentation and again at the end of the school year. Before the intervention, 35 (90%) of the staff were aware that motor vehicle crashes are the leading cause of death for children under 14; however, only 14 (36%) knew that the subgroup of children aged 8–14 years had the highest rates of motor vehicle fatalities. Twenty staff members (51%) were aware of Arkansas’ booster seat law but only nine (23%) knew that less than 14% of Arkansas’ 4 to 8 year olds currently utilize booster seats. Following the intervention, knowledge increased substantially, with correct response rates between 95–100% for each question.

Parent/Student Surveys

An anonymous 7 question parent survey, designed to examine parent perception and parent/child restraint use over time, was administered at the beginning and the end of the five-month intervention period. Parents were offered an entry into a drawing for a $20 gift card as incentive for completing and returning the parent survey. Each family was asked to complete one survey only, regardless of the number of children currently attending the school. Students in grades 1–5 completed a short six question survey, examining recent motor vehicle safety practices as well as restraint use over time. Teachers administered student surveys as classroom time permitted.

Results of the parent and student knowledge surveys are found in Table 1. Surveys were returned by 269 parents (57% of families) before the intervention and by 213 (45% of families) after the intervention. Gender was the only demographic data collected; 89% (N = 240) of respondents were female. At pre-test 37% (N = 100) of parents considered a seat belt without a booster seat to be an appropriate restraint for a child 5–8 years old. Following the intervention, attitudes changed significantly; only 25% (N = 53) of parents felt a seat belt alone was adequate (p = 0.004). Parents also reported a change in attitude surrounding seating position for children; pre-intervention 10% (N = 26) and post-intervention 5% (N = 11) of parents agreed with a child age 5–8 riding in the front seat of a motor vehicle. Parent-reported restraint use remained fairly stable over the target time frame, with about 95% (N = 254 pre-intervention, N = 205 post-intervention) reporting seat belt use on last outing. Following the campaign, 77% (N = 163) of parents reported seeing or hearing information about seating position and restraint use for children under 13.

Students in grades 1–5 completed a 6 question survey; a total of 380 (87% of 1st–5th grade students) pre-intervention

<table>
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<td>Appropriate for a child 5–8 to restrained by seatbelt only</td>
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<td>53 25%</td>
<td>0.004</td>
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<td></td>
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<tr>
<td>Appropriate for a child 5–8-yr-old to ride in the front seat</td>
<td>26 10%</td>
<td>11 5%</td>
<td>0.06</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you wear your seatbelt on your last trip in a motor vehicle</td>
<td>254 95%</td>
<td>205 96%</td>
<td>0.443</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seen/Heard info last 6 mo*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>NA</td>
<td>163 77%</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>240 89%</td>
<td>185 87%</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>27 10%</td>
<td>26 12%</td>
<td></td>
</tr>
<tr>
<td><strong>Student survey</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you ever ridden in the front seat?</td>
<td>250 66%</td>
<td>163 67%</td>
<td>0.675</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you wear your seatbelt on your last trip in a motor vehicle?</td>
<td>297 78%</td>
<td>219 89%</td>
<td>0.001</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you ride in the front on your last trip in a motor vehicle?</td>
<td>156 41%</td>
<td>101 41%</td>
<td>0.846</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seen/Heard info last 6 mo*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>NA</td>
<td>200 82%</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>182 48%</td>
<td>111 45%</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>198 52%</td>
<td>134 55%</td>
<td></td>
</tr>
</tbody>
</table>
surveys and 245 (56%) post-intervention surveys were returned. Respondents were 53% male and 47% female. There was little change in student-reported behavior during the intervention period. Overall 413 (66%) of responding students age 7–12 years reported having ever ridden in the front seat while 257 (41%) rode in the front on their most recent trip in a motor vehicle. There was a significant change in the proportion of students reporting seat belt use on last trip, increasing from 78% of responding students before the intervention to 89% of students after the intervention (p < 0.001). At campaign end, 82% of the reporting students remembered hearing or seeing information about appropriate restraint use and seating location during previous 5 months.

### Observational Surveys

Fifth grade students at the school helped collect observational data at three separate time points over the 5 month period. School administrators estimate that approximately 60% of students arrive at school via motor vehicle. A total of 253 cars were observed with a total of 411 passengers, 357 (87%) of whom were elementary school aged children. Observation data showed steady increase between intervals. Data presented in Table 2 represents change between the two end points of observations. Driver demographics closely mirrored those of the school population with African Americans accounting for 63% of observed drivers and Caucasians 34%. Female drivers were observed in 179 (71%) of vehicles surveyed.

Restraint use of the driver remained relatively constant throughout the intervention, with observed use approximately 80% at each observation. Front seating for young children did not demonstrate a significant change, with 29 (20%) sitting in front at pre-observation and 20 (18%) post-observation. Overall restraint use, however, increased dramatically. Pre-observation data showed child passenger restraint use at 71%, increasing to 91% post-observation (p < 0.001).

### DISCUSSION

Our study describes a simple, low cost intervention that used existing school media, peer role models, and repetitive messages to influence safety behavior in school-aged children. Our positive short term results are encouraging, and demonstrate that, with careful evaluation, changes in both knowledge and behavior are achievable. This reflects recent studies that have shown that targeting groups of children, rather than individuals, may be beneficial, since children in this age group are heavily influenced by their peers, siblings, and group culture in decision-making about risk behaviors.8,12 The program did not factor in other differences between children in sex, cognitive ability, or temperament) that may influence risk taking, but attempted to influence the culture of an entire school regarding norms of safe transportation.

By using school-based media, students are exposed to a safety message endorsed by their peer group. This intervention capitalized on several media methods, including closed circuit TV, public announcement systems, newsletters, and bulletin boards, to maximize exposure and reach children in a variety of venues. The messaging also utilized the school mascot to further reinforce the group identity of the school in making safer choices.

The developers of Cubs Click It for Safety quickly recognized the need for a very streamlined program. While the initial plan for the program was promotion of an age-specific matrix of “best practice” messages, it was clear early in the school year that very focused messages that were generalizable across age groups would be more realistic in the busy school setting. The two key messages of rear seating for children and seat belt use were then selected as the most constructive focus areas for the program. Parents and students alike appeared to be more receptive to direct and succinct messages. We also found that parents were appreciative of the content of the messages and they were often surprised at the rear seating recommendation up to 13 years of age.

Another consideration in the development of the intervention was the use of low-cost but highly visible delivery methods. Schools have numerous competing interests for non-academic activities and limited financial resources to produce materials. For the most part, ready-to-use materials were provided to the school by the Injury Free Coalition for Kids. As the pilot progressed, students began to develop their own materials through an instructional computer lab. The effectiveness of peer/student-developed materials may be considerable and will require separate evaluation.

The availability of closed-circuit television at the school meant that integrating daily safety messages into existing activities was feasible and delivered in a way acceptable to target children. Fifth-graders at the school ended daily morning announcements with “Remember, Cubs Click It for Safety” to the remaining student body. The strategy automatically put students in role-model positions among their peers and younger students. A stuffed mascot cub wearing a seat belt was also used in the announcement, providing group identity sought by age group. Auditory afternoon announcements over the school’s PA system by school staff was less consistent; however, we learned that some teachers supple-

### Table 2 Observed Restraint Use and Seat Position

<table>
<thead>
<tr>
<th></th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Driver Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>69</td>
<td>61%</td>
<td>49</td>
</tr>
<tr>
<td>Caucasian</td>
<td>41</td>
<td>36%</td>
<td>23</td>
</tr>
<tr>
<td>Female</td>
<td>81</td>
<td>71%</td>
<td>48</td>
</tr>
<tr>
<td>Male</td>
<td>33</td>
<td>29%</td>
<td>26</td>
</tr>
<tr>
<td>Restraint Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver Restraint</td>
<td>91</td>
<td>80%</td>
<td>59</td>
</tr>
<tr>
<td>Child in front seat</td>
<td>29</td>
<td>20%</td>
<td>20</td>
</tr>
<tr>
<td>Child restrained</td>
<td>105</td>
<td>71%</td>
<td>103</td>
</tr>
</tbody>
</table>

8,12 The program did not factor in other differences between children (in sex, cognitive ability, or temperament) that may influence risk taking, but attempted to influence the culture of an entire school regarding norms of safe transportation.
mented the announcement by using “clickers” distributed as an incentive at a school event.

The study has a number of limitations that should be acknowledged. The results reflect only short term response to the educational intervention; sustained change in knowledge and behavior must be evaluated in further study. The study also benefited from a positive pre-existing relationship with the school staff and a strong school tradition of participation in public health education and research projects, easing the implementation of the program. It is therefore likely that replicating the program in other settings would take more time and perhaps more staff energy than we experienced. Further, there is the risk of response bias in our survey results, because families with more interest or knowledge on this topic may have been more likely to respond to the parent and student knowledge surveys. The likelihood of response bias is much less for the observational surveys, since presumably a similar population would be driving children to school throughout the academic year and these surveys were conducted by staff rather than turned in at will by parents. The importance using direct observational surveys to document actual change in behavior, rather than just reported change, is illustrated in the somewhat lower observed restraint use, especially among parents, compared with the reported use in the surveys.

CONCLUSIONS

An elementary school-based child passenger safety education program targeting Tweens was well received by students, parents, and faculty. Low-cost materials and infusion of targeted safety messages into existing school activities were an important features. Short term improvement in both knowledge and some targeted safety behaviors was noted, but much further study of the long term impacts of such interventions are needed. A controlled study comparing outcomes with another school is underway.

ACKNOWLEDGMENTS

We thank the staff at Martin Luther King, Jr. Elementary School, and especially Tyrone Harris, Principal, for their cooperation. Support for the project was also provided by the Child Passenger Safety Education program at the University of Arkansas for Medical Sciences via a grant from the Highway Safety Office of the Arkansas State Police.

REFERENCES

Reductions in injury rates using a community-based approach

Michael A. Gittelman, MD, Wendy J. Pomerantz, MD, MS, and Talicia McNealy, MBA

**Background:** Injuries are the number one cause of morbidity and mortality to persons aged 1–44 years in the United States. Community-based interventions offer one approach to reducing injuries.

**Objective:** To determine whether injuries could be reduced over a 5-year period by at least 20% in a midwestern community using a proven community-based model compared with three control communities.

**Materials/Methods:** The Injury Free Coalition for Kids of Greater Cincinnati began its injury-reducing efforts within one Intervention Community (IC) in 2000. After reviewing injury data, engaging community members, and holding focus groups to assess community needs, specific structural and social alterations were made to engage youth in safe, supervised activities and provide them with safe play places. Data were obtained from the Hamilton County Injury Surveillance System from 1999–2004 for deaths, hospitalizations, and emergency department visits. Data in our IC were compared with three control communities in the city with similar demographics and socioeconomic characteristics. 2000 Census data were used to calculate injury rates.

**Results:** During study period, 5065 IC youth sustained 3796 injuries, while 9297 youth from the control settings sustained 5445 injuries. Injury rate in the IC decreased 42% from 1999 to 2004, 17551.83 to 10187.56 injuries/100,000 children/year, respectively, compared with the mean rate among the three control sites, which decreased 25.7%, 12950.41 to 9626.76 injuries/100,000 children/year. This difference was statistically significant, \( p < 0.001 \).

**Conclusions:** Community prevention efforts that engage youth in supervised activities and provide safe play areas can help to reduce youth injuries within specific high-risk communities.

**Keywords:** Community-based, Injury prevention, Injury Free Coalition.

J Trauma. 2007;63:S44–S49.
ents and children about risky behaviors, changing the physical environment of the community to provide safe places for children to play, and implementing social changes to provide activities which revolve around sports and cultural learning to engage youth during high injury times. Each of these efforts is driven by surveillance data which determine how and where children are injured, in conjunction with the individual community’s concerns about their children. By utilizing these techniques, Dr. Barlow and her associates successfully decreased injuries among Harlem children by greater than 60%. Because of their success, IFCK, funded by the Robert Wood Johnson Foundation and other private supporters, disseminated its strategies to other cities across the United States. Cincinnati Children’s Hospital Medical Center’s (CCHMC) IFCK chapter was officially established in October of 2000 with the goal of reducing injuries to youth in Cincinnati, OH. The objective of this study was to determine whether injuries could be reduced over a five year period by at least 20% in a Cincinnati community, using the IFCK model, compared with three control Cincinnati communities with similar demographics.

**MATERIALS AND METHODS**

This is a case control study designed to examine the effects of the Injury Free Coalition for Kids of Greater Cincinnati’s (IFCK-C) injury prevention program on reduction of injuries in one Cincinnati community. Children from birth through 18 years of age were included. The study took place from January 1, 2000 through December 31, 2004. A multifaceted intervention was put into place in one community; three other communities of similar demographics and socioeconomic statuses were chosen to serve as control communities. Injury rates were examined in all 4 communities before and after the intervention to determine changes.

IFCK-C is a multi-disciplinary group composed of hospital personnel (physicians, nurses, paramedics, etc.) and community leaders, with representation from organizations such as the poison control center, the Cincinnati Recreation Commission (CRC), the community council, and business owners. Utilizing the Harlem Hospital IFCK model, injury prevention reforms in lower socioeconomic communities were chosen to serve as control communities. Injury rates were examined in all 4 communities before and after the intervention to determine changes.

IFCK-C chose to concentrate on reducing injuries to youth within one intervention community (IC) within Cincinnati, OH. This community was chosen for its injury prevention interventions because it has one of the highest youth injury rates in the city, and it is adjacent to CCHMC. It is one of the largest communities within the city with almost 17,000 residents, of which more than 5,000 are children under 18 years of age. Ninety-one percent of the population is African-American, making it the largest African-American community in the city. The median family income is $22,500 per year, and more than 33% of families live at or below poverty level. Guided by the injury data and local community concerns, several social and physical environmental alterations were implemented to make the community a safer place for children.

The IFCK-C program and data tracking for this study were approved by the Cincinnati Children’s Hospital Medical Center’s institutional review board (IRB). Individual programs that were implemented and evaluated separately within the IC were also approved by the CCHMC IRB.

**Interventions Among Study Population**

IFCK-C’s approach to preventing injuries combines hospital expertise of knowing injury data with community recommendations and input for addressing concerns and developing interventions. The theory used to promote change within this community was to provide youth with safe play places and to engage them in supervised, coordinated activities during high injury times. After analyzing the data as to types of injuries seen, before the study period, it was noted there were many types of injuries occurring to the youth, and no one injury mechanism appeared more commonly than another. The most common injury mechanisms were falls, being struck by or against, cuts, bites/stings, sports-related injuries, motor-vehicle crashes, and poisonings. Sixty four percent of injuries occurred in males and 95% in African Americans. The most common places for injuries to occur were at home and in the street. As our primary goal was to engage youth in safe, supervised activities during times they were likely to be injured, times that injuries were occurring were examined. It was found that the majority of the injuries occurred during after school (4 pm–10 pm) and weekend hours.

At the beginning of our intervention period, our first initiative, building playgrounds, was aimed at altering the physical environment within the community and providing children safe places to play. Play spaces owned by the CRC, with few or no play structures, located in high injury regions of the community, were developed and redesigned to house state-of-the-art playgrounds. The location and structure for each playground was decided upon by members of the community and families with a vested interest in the play areas. The labor was supplied by IFCK-C volunteers and community members, especially those living near the play areas. Four community-built playgrounds were constructed across the IC between 2000 and 2003. Other structural alterations accomplished during the study period included: building a football stadium adjacent to one of the community’s elementary schools to accommodate local football teams practices and home games and spearheading construction of speed bumps strategically placed in high pedestrian-injury areas.

Institution of supervised, coordinated activities began with focus groups to determine the desires of the community. Focus groups were held with parents obtained from the local schools, youth in the elementary school system, and community resources (e.g. local churches, recreation centers, the city zoo located in the IC, etc.) to develop activities that would entice
youth to participate. From these focus groups and through discussions with community leaders, additional resources within the community joined the coalition and specific programs were developed. Activities developed and provided during the study period to engage youth on weekend, after school, and summer times consisted of: after-school programming for at least 50 students per day at each of the three elementary schools in the community, summer educational classes, and a Friday night basketball league for youth aged 12–18. Our coalition also assisted with a pre-existing football league that engaged more than 600 youth per year. In addition, educational endeavors to promote safety were provided for families at school and community fairs with prevention messages geared toward the population present. Finally, products such as booster seats and home safety kits, with instructions on their use, were given away free, when available, to promote safer behaviors.

Data Sources
Injury rates were documented before beginning the study. Information on injuries was obtained from the Hamilton County Injury Surveillance System (HC Iss) and the CCHMC trauma registry. HCISS is an ongoing database, established in 1996, housed at the Hamilton County Health Department, that contains data regarding deaths, hospitalizations, and emergency department visits for injured patients cared for at all of the hospitals in Hamilton County, OH. The CCHMC trauma registry is an ongoing database, established in 1991 and maintained by the trauma services department, which contains information about all patients sustaining injuries. Information for the CCHMC trauma registry is obtained by abstracting medical charts of all patients seen in the emergency department, admitted to the hospital, or reported deaths in the hospital as a result of injury (ICD-9 E-codes 800.00–995.09). Data from the CCHMC trauma registry contains more detailed information than that of the HCISS. Data from the CCHMC trauma registry is submitted to the HCISS. Aside from number of injuries, other information obtained from the data sources included: age, gender, and race of the child, where the child lived, whether the child lived or died as a result of the injury, whether the child was admitted to the hospital or discharged home, site where the injury took place, injury mechanism, time, day, and month in which the injury took place.

Control Populations
Three communities within the city of Cincinnati were chosen by an independent reviewer before the beginning of the study period to serve as control communities. The three control communities, Communities A, B, and C, were selected based on their similarity to the IC with regard to demographics and socioeconomic status. The 4 parameters used to determine their similarity were percent of the population less than 18 years of age, percent African American, median family income, and percent living in poverty. These demographical data points were chosen due to the fact that race and lower socioeconomic status are high risk factors for unintentional injuries.15

Data Analysis
Injury data from the HCISS for 1999 versus 2004 for deaths, hospitalizations, and emergency department visits were examined. Census data were queried for each community to calculate injury rates. Injury rates for the study and control communities were calculated using injured children as the numerator and 2000 United States Census statistics as the denominator. Numerator data from the HCISS are reported based on community boundaries, while the denominator data were calculated using the census tracts within the community boundaries. Injury rate for the study group was compared with the mean injury rate within the control communities. Chi-square test was used to determine significance of the change.

RESULTS
The demographics of the study and control communities are shown in Table 1. In the IC, during the study period, there were 3796 injuries: 6 deaths, 201 hospitalizations, and 3589 ED visits. Sixty percent of the injuries occurred in males and 92.9% in African Americans. The most common places for injuries to occur were at home and in the street. The most common mechanisms of injuries were falls, being struck by or against, cut/pierce, overexertion, bites/stings, and motor-vehicle occupant injuries.

The baseline injury rate of the IC before the study period, in 1999, was 17551.83 injuries/100,000 children/year. The baseline injury rate in the control communities was 12950.41 injuries/100,000 children/year. During the study period, 5065 IC youth sustained a total of 3796 injuries. The overall injury rate in the IC in 2004 was 10187.56 injuries/100,000 children/year. In the control communities, 9297 youth sustained 5445 injuries: 6 deaths, 201 hospitalizations, and 3589 ED visits. Sixty percent of the injuries occurred in males and 92.9% in African Americans. The most common places for injuries to occur were at home and in the street. The most common mechanisms of injuries were falls, being struck by or against, cut/pierce, overexertion, bites/stings, and motor-vehicle occupant injuries.

The baseline injury rate of the IC before the study period, in 1999, was 17551.83 injuries/100,000 children/year. The baseline injury rate in the control communities was 12950.41 injuries/100,000 children/year. During the study period, 5065 IC youth sustained a total of 3796 injuries. The overall injury rate in the IC in 2004 was 10187.56 injuries/100,000 children/year. In the control communities, 9297 youth sustained 5445 injuries. The overall injury rate in 2004 for these communities was 9626.76 injuries/100,000 children/year. Thus, the IC showed a 42% reduction in the injury rate compared with only a 25.7% reduction of the mean rate in the control communities.

Table 1 Comparison of Demographic Information between Study and Control Sites Based on 2000 Census Data

<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Total Population</th>
<th>Percent of Population Less Than 18-yr-old (n)</th>
<th>% African-American</th>
<th>Median Family Income</th>
<th>% Below Poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention Community</td>
<td>16,298</td>
<td>29% (5065)</td>
<td>91%</td>
<td>$22,500</td>
<td>33%</td>
</tr>
<tr>
<td>Community A</td>
<td>7928</td>
<td>31% (4577)</td>
<td>88%</td>
<td>$32,500</td>
<td>24%</td>
</tr>
<tr>
<td>Community B</td>
<td>6516</td>
<td>28% (2384)</td>
<td>73%</td>
<td>$27,500</td>
<td>26%</td>
</tr>
<tr>
<td>Community C</td>
<td>7790</td>
<td>27% (2336)</td>
<td>84%</td>
<td>$22,500</td>
<td>33%</td>
</tr>
</tbody>
</table>

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Communities. (Fig. 1) The reduction in the overall rate of injury was significantly less in the control communities compared with the study population ($p < 0.001$).

For the individual communities that made up the control sites, the injury rates were as follows: Community A had an injury rate of 8651.96/100,000 children/year in 1999 and a rate of 7799.87/100,000 children/year in 2004 (9.8% reduction); Community B had an injury rate of 14010.07/100,000 children/year in 1999 and a rate of 10360.74/100,000 children/year in 2004 (26.0% reduction), and Community C had an injury rate of 20291.10/100,000 children/year in 1999 and a rate of 12457.19/100,000 children/year in 2004 (38.6% reduction).

Injuries impacted by this community prevention technique were spread across nearly all injury mechanisms as shown in Figure 2. There was an 84.8% reduction in bites/stings, an 82.6% reduction in pedestrian injuries, a 58.8% reduction in bicycle-related injuries, a 53.8% reduction in overexertion injuries, a 50.0% reduction in poisonings, a 48.9% reduction in motor-vehicle occupant injuries, a 46.9% reduction in cut/pierce injuries, a 40.2% reduction in being struck by things, a 29.0% reduction in falls. However an increase of 275% (from 4 to 11 cases) was noted in firearm-related injuries. This increase in firearm-related injuries was similar in the control communities (from 1 to 8 cases).
DISCUSSION

Community-based injury prevention interventions have shown varying results in changing safety behaviors or reducing injury rates among children. The Safe Kids/Healthy Neighborhoods Coalition in Harlem, New York, has reported statistically significant decreases in outdoor injuries; however, it is questionable whether the decrease in injury rates was solely attributable to their intervention. Svanstrom, and colleagues, on the other hand, implemented community programs in Sweden to prevent unintentional injuries and showed minimal change in injury rate between the intervention and the control municipalities. General safety campaigns about the problems seen in the intervention community, mobilizing existing community organizations, and finding the right data sets to develop appropriate interventions and evaluate the effects of the interventions have been cited as important components of community-based injury prevention programs. IFCK has taken the community-based strategy for preventing injuries and shown that this model for prevention can be successful. IFCK-C has replicated the National IFCK model initiated in Harlem, NY, and shown it can be successful in a Midwestern community. By comparing communities in Cincinnati with populations of similar demographic make-up, reviewing data sets with outpatient, inpatient, and death records, and working with the community council and other existing community organizations to know other programs/changes within the IC, we have attempted to limit some of the potential confounding variables cited in other community-based interventions within the literature. With this approach, we have shown that a hospital and community coalition, with the common goal of preventing childhood injuries, can significantly reduce pediatric injuries.

In reviewing our successes in Cincinnati, some key concepts are essential to getting started to replicate this model in other communities. Utilizing accurate hospital data to determine the injury patterns and locations is an important way to determine where to begin injury prevention efforts. Once data has been gathered and a location is chosen to begin working on the injury problem, building a coalition with both community members and hospital personnel is essential. The coalition that is formed, along with community resources, can then develop interventions geared to solving the problems identified through the data and those identified by community members specific to the chosen community. Any intervention initiated must then be evaluated. Evaluation is essential to determine the effectiveness of the intervention. This model may sound uncomplicated; however, it takes several years and strong, consistent leadership to begin to see successful, sustained reductions in injuries.

IFCK-C was fortunate to already have the HCISS database and the CCHMC trauma registry established to obtain data to determine where to begin targeting injury reduction. By starting our interventions with community-built playgrounds, our IC was able to see a tangible change. This led to additional resources and people joining together within our coalition so that other interventions for the future could be discussed, planned, and implemented. We believe that starting with a tangible structural change allowed our coalition to obtain buy-in from community members more rapidly and for a longer duration.

Although our data shows a significant reduction in unintentional injury, it is important to compare these results with the control communities in more detail. In the IC there was a 42.0% reduction in overall injury, while there was a 25.7% reduction in the three control communities combined. In two of the control communities, Community A and Community B, the reduction in injury was only 9.8% and 26.0%, respectively; however, in Community C there was a 38.6% reduction. This reduction of injury in Community C may be somewhat inflated. This community is directly adjacent to the IC; therefore, some of the structural alterations in the IC and some of the programs provided for the youth may have positively affected the population in Community C. This effect might account for the greater reduction in injuries than in the other control populations.

Limitations

This study compares injury rates between our study population and three comparable control populations before and after structural and social interventions were implemented. During this time period, other programs or positive structural changes may have occurred within the study and/or the control regions that were not a part of IFCK-C; thus, we cannot say that the interventions from IFCK-C alone were the reasons for the reduction in injury rates in the IC. However, in working closely with the IC, we became aware of many of the other programs offered for youth. In addition, we canvassed the community in great depth to determine any new significant structural changes, few to none of which were found. During the study period, the local recreation commission revitalized some of their other play spaces within the county. Also, other programs for youth may have been implemented in the control communities that we were unaware of that may have led to the reduction of injuries in these locations.

Another potential limitation of our study was that census data are not updated yearly within the neighborhoods studied. As a result, the number used as the denominator to calculate injury rates may have changed during the study period for the study and control regions. Therefore, all rates might not be accurate in all areas. We did examine school enrollment within the study and control populations to gauge the change in the number of youth within the neighborhoods. Although there was a slight reduction in youth within the IC schools, there was a similar reduction in the control school neighborhoods. Thus, we feel that if the population data were different between 1999 and 2004, it was likely changed equally between our study and our control groups.
CONCLUSIONS

Community-based injury prevention initiatives can be a successful approach to reducing unintentional injuries within a specific region or community. IFCK-C utilized a community-based prevention model and sought to provide youth with safe places to play and engage them in supervised, structured activities during times of day when injuries were more likely to occur. In comparing injury rates seen in the IC to three control communities before and after our intervention, a significant reduction in injuries was seen. This model could potentially be replicable within other communities given time, data resources, and coalition building skills.

ACKNOWLEDGMENTS

We would like to thank several individuals and organizations for their assistance in making our research project and the IFCK-C a successful program: Cynthia Yund, PhD, Director of Epidemiology and Assessment, Hamilton County General Health District, and Margie Brunn, CCHMC Trauma Registry Coordinator for their assistance in collecting and providing data; Gayle Harden-Renfro, for being the IFCK-C original community coordinator; Katie Williams and Lauren Frey, for their work as research coordinators throughout the duration of the study; the intervention community council along with the many community organizations and members we partnered with to accomplish all of the structural and social modifications in the IC and helping to mobilize this community for change; and the Robert Wood Johnson Foundation and National Injury Free Coalition for Kids® for funding support and guidance throughout the development of our local IFCK-C program.

REFERENCES