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ARTICLE

Home Safety in Inner Cities: Prevalence and Feasibility of Home Safety-Product Use in Inner-City Housing

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ABSTRACT

OBJECTIVES. Residential injuries cause significant morbidity and mortality in infants and young children. The American Academy of Pediatrics recommends initiating injury-prevention counseling during health supervision visits in the first 6 months of life. The objectives of this study were to describe and compare self-reported and observed home safety practices in urban, low-income families who were expecting or had a child <12 months old and to assess the feasibility of using safety products depending on the design and repair of urban homes.

PARTICIPANTS AND METHODS. Women who were pregnant or had an infant <12 months old and who were enrolled in East Baltimore's Healthy Start home-visiting program were eligible for the study. For this pilot project, we used a prospective predesign/postdesign. Maternal self-report and investigator home observations documented the use of working smoke alarms on each level of the home, stair gates or doors blocking the top and bottom of all staircases, adult medication storage in locked cabinets, and the environmental feasibility of safety-product use.

RESULTS. Home safety practices were higher by maternal self-report than by investigator observation. Fifty-five percent of families who reported a working smoke alarm on every level of the home had nonworking or absent smoke alarms noted during investigator observation. Of assessed staircases, 67% could not accommodate a wall-mounted gate at the top of the stairs, and 38% could not accommodate a pressure-mounted gate at the bottom of the stairs. Although most families reported locked storage of medications, 77% had unlocked medication storage documented during home observation.

CONCLUSIONS. In this sample of urban families, implementation of American Academy of Pediatrics-recommended safety practices is low. The structural design of urban homes may be a significant barrier to home safety-product use. The Amer-

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Key Words
home accidents, home injuries, injury prevention, accident prevention, home visits, residential injuries, home safety products

Abbreviation
AAP—American Academy of Pediatrics

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ican Academy of Pediatrics Injury Prevention Program sheets, manufacturers of safety products, and legislators need to address injury-prevention issues unique to urban, low-income families.

INJURIES OCCURRING IN the home are common. Recent epidemiologic studies on residential injuries report significant morbidity and mortality in infants and young children.[1,2] Data from the National Vital Statistics System 1985–1997 indicate that the highest residential injury mortality rates are in infants <1 year of age (12.6 per 100 000); >90% of injury deaths in children <1 year of age occurred in the home.[2] Residential injury morbidity is also high. In 1993–1999, data from the National Hospital Ambulatory Medical Care Survey reported >50% of unintentional injury emergency visits for children <20 years of age were because of residential injuries.[1] The highest rates were in infants <1 year (6.22 per 100) and children ages 1 to 4 years (9.58 per 100).[1]

Many residential injuries can be prevented using recommended home safety products such as smoke alarms, stair gates, and cabinet locks.[3] However, studies have shown low rates of home safety-product use, especially among low-income families, whose children are at increased risk of unintentional injuries.[4–6] In a previous study in urban Baltimore, 55% of families with infants 12 to 18 months of age had ≥1 working smoke alarm, 25% of families had stairs blocked by gates or doors, and 6% had poisons stored in a locked area.[7] Previous studies have found that the prevalence of home safety behaviors was lower by self-report than by observation, but these studies focused on families with older infants and young children.[8,9] Although the American Academy of Pediatrics (AAP) recommends instituting anticipatory guidance in the first 6 months of life, and most injuries to infants occur in the home, little is known regarding the prevalence of home safety practices in families with children <1 year of age.[1,2,10] To our knowledge, no study has assessed the prevalence of home safety practices in families with infants <12 months of age in the context of the structural design and environmental state of repair of low-income, urban homes. Because the Centers for Disease Control and Prevention Injury Research Agenda places high priority on evaluating the dissemination of home safety practices in low-income populations,[11] it is crucial to closely examine these relationships to inform policy and practice.

Our objectives were to describe self-reported and observed home safety practices in low-income families who were expecting or had a child <12 months of age and to assess the feasibility of using safety products depending on the structural design and state of repair of urban homes. Previous research has demonstrated that general housing and neighborhood conditions at both the individual household[12] and census tract level[13] have been associated with parent safety practices and child injury risk. We hypothesized that the presence of home safety products, such as working smoke alarms, stair gates, and cabinet locks, is low in this urban population, that self-report is higher than observed home safety practices,[7] and that the structural design and the state of repair of low-income urban homes are barriers to the appropriate use of home safety products.

PARTICIPANTS AND METHODS

Study Design

The Healthy Start Home Safety Project combined the resources of the Baltimore City Health Department, East Baltimore Healthy Start, the Hopkins CARES (Children Are Safe) Mobile Safety Center, the Johns Hopkins University School of Medicine, and the Bloomberg School of Public Health Center for Injury Research and Policy. Success by 6, a Baltimore city collaborative focusing on children's health outcomes in low-income, vulnerable populations, set forth the goal of reducing unintentional injuries in infants and young children. This project's home safety protocol was designed to address this goal. We chose to focus the intervention on the top 3 causes of childhood residential injuries in Baltimore: fires, falls, and poisonings. We implemented a pilot test of a home safety protocol within the existing home visitation curriculum to be used by paraprofessional neighborhood health advocates at East Baltimore Healthy Start. The East Baltimore Healthy Start Program serves a 1-mile-square area in a low-income neighborhood. The protocol provided information on fire safety, fall prevention, and medication storage. Recommendations included installation of smoke alarms on every floor, changing smoke alarm batteries every 6 months, using stair gates or closed doors at the top and bottom of all staircases, and securing all adult medications in locked storage areas.

The present study was one portion of a larger trial that used a prospective 1-group predesign/postdesign, where each participant served as her own control subject. The home safety protocol intervention consisted of providing home safety information and coupons for home safety products, preintervention and postintervention self-report safety questionnaires, and home observations. This report will focus on data from postintervention data collection. Recruitment and enrollment began in April 2005, and data collection was completed in January 2006. Enrollment took place at the Healthy Start Neighborhood Center or in the participants' homes. Informed consent was obtained from all of the participants. The study was approved by the Johns Hopkins School of Medicine Institutional Review Board and the Baltimore City Health Department Human Subjects Review Committee.

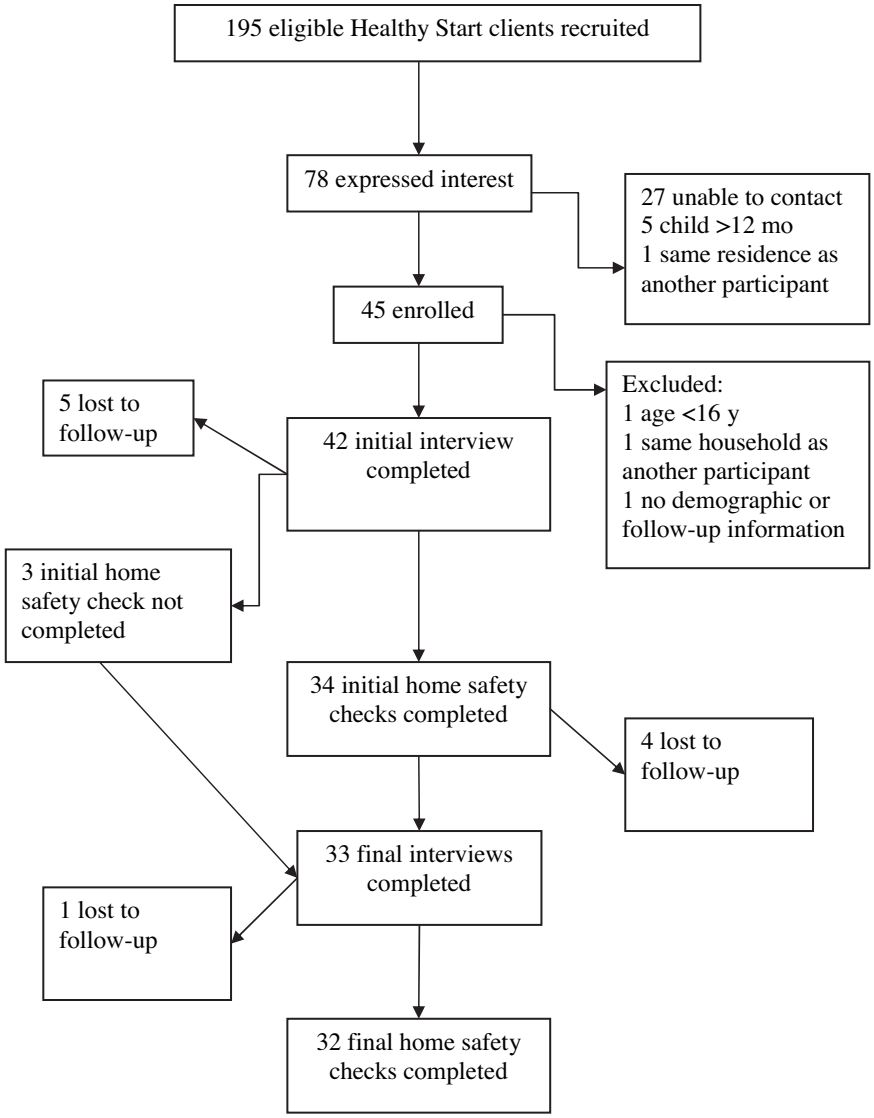

FIGURE 1
Summary of recruitment, enrollment, and follow-up.

Study Participants

Women who were pregnant or who had an infant <12 months old and were current East Baltimore Healthy Start clients were eligible for the study. All of the participants were biological mothers. Recruitment occurred by neighborhood health advocates' invitation, mass mailing to all eligible Healthy Start clients, and fliers posted in the East Baltimore Healthy Start Neighborhood Center. We excluded women who were not the primary caretaker of their infant, those <16 years old, and those who lived with another study participant. Participants received electric outlet covers and $15 remuneration for each of 2 interviews completed during the study.

Data Collection

Demographic information was gathered during enrollment and from Healthy Start records. Home safety information was obtained first by a parent self-report questionnaire, and then the investigator home observation was scheduled and completed. We attempted to have <1 week between the completion of the questionnaire and the home observation. The self-report questionnaire was administered in the home or by telephone by either the principal investigator or a trained research assistant. The questionnaire was piloted previously and used in the same population (S. Tandon, PhD, written communication, 2005). The investigator observation checklist was modified from the home safety assessments of Gielen et al[9] and Johnston et al[14] by choosing existing questions pertaining to fire, fall, and poisoning prevention, and items on staircase width and design were added. The staircase-design observations were piloted on Healthy Start clients who were not study participants. The principal investigator (Dr Stone) completed each home observation by directly observing home safety practices, home structural design, and home environment state of repair. Data were double entered into a database by the principal investigator and a

TABLE 1 **Comparison of Demographics for Study Participants and All Eligible Healthy Start Clients**

Demographic	Study Participants ($N = 42$)	Eligible Healthy Start Clients ($N = 195$)[a]	Statistic
Maternal age, mean (SD), y	23 (6.2)	22 (6.1)	0.03 (−2.0 to 2.1)[b]
Years of education, mean (SD), y	10.6 (1.7)	10.5 (1.8)	0.07 (−0.52 to 0.66)[b]
Maternal race, *n* (%)			$P < .25$[c]
Black	39 (93)	178 (91)	
White	3 (7)	6 (3)	
Marital status, *n* (%)		$N = 190$	$P < .79$[c]
Single	40 (95)	179 (94)	
Married	2 (5)	11 (6)	
Health insurance, *n* (%)			$P < .30$[c]
State medical assistance/uninsured	39 (93)	176 (96)	
Private insurance	3 (7)	7 (4)	
No. of children, *n* (%)		$N = 178$	$P < .006$[c]
0	9 (21)	83 (47)	
1	18 (36)	42 (29)	
2 or more	15 (43)	53 (24)	
Age of index child, *n* (%)			$P < .28$[c]
Pregnant	19 (45)	63 (32)	
Infant <6 mo old	14 (33)	49 (25)	
Infant 6–12 mo old	9 (21)	83 (43)	

[a] The total number does not equal 195 for all because of missing data.
[b] Data are mean difference (95% confidence interval) by *t* test.
[c] Data are χ^2/Fisher's exact test.

trained assistant. All of the analyses were conducted using SPSS 11.0 (SPSS Inc, Chicago, IL) and Stata 8 (Stata Corp, College Station, TX).

Outcome Measures

The self-report questionnaire assessed the following home safety practices: part 1: (*a*) presence of a smoke alarm, (*b*) presence of a working smoke alarm on every level of the home, and (*c*) the number of months since smoke alarm batteries were changed; part 2: (*a*) presence of staircases and (*b*) the use of gates or doors to block the top and bottom of each staircase; and part 3: (*a*) presence of adult medications and (*b*) locked storage of all adult medications. The investigator observation assessed the following home safety practices: (*a*) number and location of smoke alarms and demonstration of whether each worked; (*b*) presence of staircases and presence and use of gates or doors to block the top and bottom of all staircases, and (*c*) presence of adult medicines, location of medication storage, and storage in a locked area.

We assessed staircase structural design issues including the width of top and bottom of staircases and banister design to determine feasibility of stair gate installation. To use a stair gate correctly, the width of the opening at the top of the stairs must be ≥28 inches to accommodate a wall-anchored stair gate, and the width at the opening at the bottom of the stairs must be ≥26 inches wide to use a pressure-mounted gate. The staircase must have a flat surface on both sides to which the gate can be anchored.

The environmental state of repair was observed for the 3 risk areas: (1) fire risk (exposed wires or outlets and use of alternative heat or light sources such as candles, gas stoves, or space heaters); (2) fall risk (broken stairs, railings, and banisters); and (3) ingestion risk (broken cabinet hinges and doors). We chose these outcomes on the basis of input from the neighborhood health advocates and their first-hand observation of environmental disrepair, the history of fires in this community resulting from inappropriate use of alternative heat and light sources in homes with no gas or electricity, and personal observation by the principal investigator (Dr Stone) during previous home visits conducted during clinical care.

RESULTS

Enrollment and Demographics

Of 195 available Healthy Start clients, 78 (40%) expressed interest and 42 (54%) participants enrolled and completed the baseline interview. Overall, 32 (76%) of 42 completed the final interview and home observation and form the sample for the analyses (Fig 1). Thirty one of the home observations were completed within 10 days of the final interview (median time: 2 days).

Baseline demographic characteristics are outlined in Table 1. Enrolled participants were primarily black, had medical assistance, and had not completed high school. Overall, 87% (36) were unemployed, and 93% had less than $1000 monthly income. The study participants differed significantly from all of the Healthy Start clients only by the age of index child, with enrolled participants more likely to be pregnant or have an infant <6 months old. Overall, 73% of participants lived with a friend or

TABLE 2 **Self-Reported and Observed Home Safety Practices in Urban, Low-Income Homes ($N = 32$)**

Variable	Self-Report Safety Questionnaire, *n/N* (%)	Home Safety Checklist, *n/N* (%)	McNemar's Difference (95% CI)	*P*
Fire safety				
Smoke detectors present	32/32 (100)	31/32 (96.9)	.03 (−.06 to .12)	<.98
Working smoke detector on each level of home	29/32 (87.5)	13/32 (40.6)	.50 (.30 to .70)	<.0001
Batteries changed within past 6 mo	26/32 (81.3)	Not assessed	—	—
Fall safety				
Presence of stairs	29/32 (90.6)	29/32 (90.6)	.03 (−.06 to .12)	<.99
Presence of gates/doors at the top of staircase	5/29 (17.2)	0/29 (0)	.17 (.06 to .34)	<.03
Presence of gates/doors at the bottom of staircase	2/29 (6.9)	0/29 (0)	.07 (−.06 to .19)	<.15
Poison safety				
Presence of medications in home	24/32 (75.0)	30/32 (93.8)	.19 (.02 to .36)	<.03
Medications stored in a locked place	17/24 (70.8)	4/30 (16.7)	.56 (.32 to .81)	<.0001

CI indicates confidence interval; —, no data.

TABLE 3 **Structural Design of Staircases in Urban Baltimore Homes ($N = 29$)**

Variable	Top of Main Staircase, *n* (%)	Bottom of Main Staircase, *n* (%)
Width too narrow for recommended gate	16 (55)	2 (7)
Banister design		
Curved	4 (14)	6 (21)
Angled	3 (10)	1 (3)
No wall to anchor gate	1 (3)	0 (0)
Homes unable to accommodate recommended stair gates	19 (67)	11 (38)

relative, 25% rented, and 2% owned their home. There were no differences between all of the participants and those completing the final interview and home safety checklist in regard to maternal age, mean years of education, race, marital status, health insurance, number of children, or infant age.

Self-Reported and Observed Home Safety Practices

The percentage of home safety practices reported was higher by self-report than by investigator observation (Table 2). Congruence with smoke alarm presence was high, with 98% of families reporting the presence of a smoke alarm having one noted during the investigator observation. However, 55% of those who reported having a working smoke alarm on every level of the home were found to have nonworking smoke alarms during the home visit observation. Of 32 homes, 6 (19%) had ≥1 beeping smoke alarm at the time of the visit, indicating an ineffective battery.

Stair gate use was low in this sample of the population (Table 2). Although 5 (17%) families indicated that their stairs were blocked at the top, and 2 (7%) stated that their staircases were blocked at the bottom, no participants had staircases blocked appropriately. Of the 6 families (21%) who were observed to have a stair gate in their home, none were protective: 2 were in their original packaging, 3 were not installed, and 1 was installed incorrectly. The incorrectly installed gate was placed 3 steps from the bottom, turned at a slant, and could easily be dislodged.

Self-report of the presence of adult medications in the home was lower than was noted during the investigator home observation (Table 2). In addition, whereas 71% of families reported storing medications in a locked area, only 17% had locked medication cabinets found during the home observation. Medication storage areas observed during the home visit included unlocked medicine cabinets, purses, and the top of the refrigerator or high shelves.

Home Structural Design

When the width of staircases and banister design were considered together, only 35% of homes had staircases that could accommodate a wall-mounted gate at the top of the stairs, and 62% of homes had staircases that could accommodate a pressure-mounted gate at the bottom of the stairs (Table 3).

Environmental State of Repair

Overall, 6 (19%) of 32 homes had recognized environmental hazards. All of the homes had working electricity; 2 homes had exposed wires in walls, and 1 home used a gas range for heat because of a broken furnace. One home had a staircase with broken steps; 2 homes had broken banisters or railings. One home had a broken cabinet in which adult medications were stored.

DISCUSSION

Our study demonstrated that home safety practices of working smoke detectors on every level of the home, stair gates blocking the top of the stairs, and locked medication storage were higher by self-report than by investigator home observation. Overall we found a low prevalence of stair gates and cabinet locks and a high prevalence of smoke detectors, although 60% of the families had nonworking smoke detectors. The struc-

tural design and environmental state of repair of urban homes may contribute to the low prevalence of home safety-product use.

In this pilot project, the prevalence of appropriate home safety-product use was low, indicating that these children were inadequately protected against fires, falls, and poisonings. Families had received injury-prevention information as a part of the home safety protocol. It is possible that the families did not read this information, were unable to implement the recommendations, or this anticipatory guidance is ineffective in low-income, urban populations. Although not specifically studied, mothers may believe that their children are not at risk of injury, or financial constraints may limit families' abilities to purchase tools to install safety supplies. Because many families live with friends or relatives, they may be unable to make changes to improve the safety of their homes.

Although a smoke alarm was found in 97% of the homes, only half of the participants had a working smoke alarm on each level of the home. Previous studies in Baltimore found a similar prevalence of working smoke alarms,[12] which suggests that urban Baltimore families have difficulty maintaining smoke alarms after they are installed. These findings support those of the randomized, controlled smoke detector giveaway program by DiGuiseppi et al[15,16] in Great Britain, in which few of the smoke detectors had been installed or maintained at follow-up visits. Our findings indicate that there are barriers to smoke detector use beyond the purchase of smoke alarms. The high ceilings of many homes may make changing smoke alarm batteries impossible without a ladder, or the cost of batteries may be a barrier to maintaining smoke alarms. To address these issues, advocating for the inclusion of long-life lithium batteries in new smoke alarm installations or requiring landlords to test and maintain smoke alarms may increase appropriate smoke alarm use.

Our rate of appropriately protected staircases was lower than previous studies in urban Baltimore families.[7,9,12] This pilot study provides the first descriptive data regarding the feasibility of stair gate use in urban homes. Despite the small sample size, it is likely that this is a problem in much of urban Baltimore, given the uniformity of row-home housing, and may be relevant in other parts of the country. Current strategies to address ill-fitting gates, such as nailing plywood across banisters or using play yards, which confine the child to one spot in a room, may not be feasible for many families. One study in Philadelphia, Pennsylvania, found that 21% of homes had staircases with broken or loose railings.[17] Improved housing codes and the manufacture of gates designed to fit narrow staircases are needed.

Consistent with other studies, few families stored medications locked.[7,9,12] This may be because of the young age of the index child, but this is also concerning, because most families had an older child. In addition, the AAP Injury Prevention Program guidelines recommend instituting poisoning prevention practices in the first 6 months of an infant's life. It is also possible that because most participants rented or lived in the home of a friend or relative, they were unable to install cabinet locks or they perceived existing, unlockable medicine cabinets as appropriate storage areas.

It is concerning that families tend to overestimate their adoption of recommended home safety practices. Parents may overreport safety-product use because of lack of knowledge, fear of neglect charges, or social desirability. Because of the current emphasis on patient-centered primary care, where discussions are tailored to the concerns and needs of the family, certain injury-prevention issues may be omitted if the family confidently asserts that their home is "infant proofed."[18] Recommending review of certain core "safety practices" at all visits will ensure families have needed injury-prevention information. Tailoring anticipatory guidance about injury prevention to specifically address the possible housing and safety issues prevalent in low-income, urban areas is needed. The AAP recommends initiating injury-prevention counseling in the first 6 months of life to promote home safety practices and prevent injuries.[7,19,20] The Injury Prevention Program handouts for children ages 0 to 4 years of age target fire safety, falls, and medication storage by promoting installation of smoke alarms, changing of smoke alarm batteries, and use of stair gates and cabinet locks.[7,19,20] Modifying the Injury Prevention Program sheets to sensitively address the housing and injury-prevention issues unique to low-income urban families would have the potential to reach many families.

There is increasing interest in the role of the built environment in children's health; thus, it is timely and crucial for child health advocates to continue the line of research started here. Lyons et al[21] reported recently about the differences in injuries found in different types of housing. This report found a higher prevalence of injuries in apartment buildings compared with single family homes. Although this report does not comment on the interior structural design or state of repair of housing, the importance of housing design on injury is apparent.

Although there had been progress in improving home safety for children in the past 40 years, there is still much work to be done.[22,23] In the 1970s, the success of New York's "Children Can't Fly" campaign in mandating window guards and the Poison Prevention Packaging Act mandating child-resistant medication caps were thought to herald a new era in passive, structural strategies for residential injury prevention.[23–26] Regulation, legislation, and policy changes have the potential to significantly

decrease injuries, and the Centers for Disease Control and Prevention call for assessing the impact of legislation and policy on residential injuries.[11] Requiring long-life lithium batteries in smoke alarms would decrease needed maintenance. Requiring manufacturers to design stair gates that are compatible with urban staircases and requiring installation in rental homes have the potential to decrease serious falls. Mandating landlords to provide medication lock boxes in homes with young children would decrease dependence on unlocked medicine cabinets. As primary care providers and public health professionals, we must continue to advocate for policy to improve home safety, especially in low-income, urban housing.

LIMITATIONS

Although this study had a small sample size, we found a high prevalence of homes in which the use of stair gates was impossible. It is likely that these and other structural design concerns contributed to the low prevalence of home safety-product use in these families. Our measure of environmental state of repair was constrained by our focus on home safety products and the time that we had available to inspect the homes. Other measures of housing quality (eg, US Department of Housing and Urban Development standards) have been associated with safety practices and demonstrated higher rates of substandard housing in communities similar to those in this study.[12] It is also possible that current stair gate construction may render available gates useless in urban housing in other large cities in the United States. Future research will need to determine whether this is the case.

Because these families were enrolled in a program that provided many resources, they may have had strong advocates that helped them to access improved housing. Possibly those living with friends or relatives had more stable housing situations. This may have resulted in fewer environmental hazards present in their homes but may have decreased the number of participants who were able to install stair gates and cabinet locks. Because consent was required, participants may have been more motivated to repair their homes, potentially causing an underestimation of environmental state of repair. It is likely that environmental hazards are common in this population, and disrepair in urban housing needs to be addressed by developing stricter US Department of Housing and Urban Development criteria and grassroots legislative action.

CONCLUSIONS

In this sample of urban families, implementation of AAP-recommended safety practices is low. The structural design of urban homes may be a significant barrier to home safety-product use. The researchers who design the AAP Injury Prevention Program sheets as injury-prevention anticipatory guidance, manufacturers of safety products, and legislators need to address injury-prevention issues unique to urban, low-income families.

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