

Smoke Alarm Maintenance in Low-Income Families

Residential fire is the third leading cause of unintentional injury-related death among children aged 14 years and younger, killing nearly 800 and injuring another 47 000 annually (1996 mortality data, National Center for Health Statistics, Hyattsville, Md; T.R. Miller, Children's Safety Network, oral communication, September 2, 1997). Children from low-income families are at greatest risk because of substandard housing, use of alternative heating sources, lack of working smoke alarms, and economic constraints on providing adequate adult supervision.¹⁻⁴

Smoke alarms are extremely effective in preventing fire-related deaths and injuries. Nearly half of all home fires and three fifths of home fire-related deaths occur in the 7% of homes that do not have smoke alarms.⁵ Previous research has concentrated on smoke alarm giveaway programs,⁶⁻⁸ which may be less effective than installation programs because proper placement and quantity of alarms cannot be ensured. We examined the effectiveness of a smoke alarm installation initiative in low-income homes across America.

The National SAFE KIDS Campaign, through the generosity of the US Fire Administration and First Alert, provided grants of \$2500, free smoke alarms, and free batteries to 10 grassroots SAFE KIDS Coalitions. These volunteers installed, not merely distributed, smoke alarms in low-income homes (e.g., homes that were eligible for Aid to Families With Dependent Children or the Special Supplemental Nutrition Program for Women, Infants, and Children) in late 1992 and early 1993. Six months later, coalition volunteers returned to assess whether the alarms were still functioning, replace batteries if necessary, and administer a brief questionnaire. All data were forwarded to the national SAFE KIDS office for tabulation and comparison across coalition sites.

Of the original 541 homes visited, 413 completed the follow-up questionnaire (76% response rate). The average annual income of participants was \$5323. The total number of children in the households ranged from 0 to 8; the majority (60%) of the households had 1 or 2 children.

A total of 595 smoke alarms were installed in homes at baseline. Of the 500 alarms tested 6 months later, 416 (83%) were still working (Table 1). Of the alarms not working, most had missing or dead batteries or had been disabled. None were malfunctioning because of dirt, dust, or insects.

During the 6 months between installation and the follow-up visit, 124 smoke alarms had sounded for non-fire-related reasons. The most common cause was moisture from the shower, followed by alarm malfunction, smoke from cooking, and smoke from cigarettes. Most families ventilated their homes if a nuisance alarm occurred. Only a few changed the batteries or disabled the alarm.

The batteries of 63% of the smoke alarms had been checked within the study period. Of alarms checked, 42% had been tested once a month, consistent with fire safety recommendations. Furthermore, 46% of the respondents knew that batteries should be changed once a year.

This study suggests that smoke alarms will be sufficiently maintained by low-income families if alarms are installed by safety experts. This finding is consistent with Gielen and colleagues' finding that mothers uniformly support childhood safety practices but are hampered in implementing them by low income levels and

substandard housing environments.⁹ Distribution of smoke alarms that do not require new batteries annually could further enhance the effectiveness of installation programs.¹⁰

The limitations of this study include a high loss to follow-up, the lack of control groups, a relatively brief intervention period, and several conditional questions on the follow-up questionnaire that resulted in missing or nonapplicable data. Further research is warranted to examine long-term maintenance of installed smoke alarms and concomitant reductions in fire-related deaths and injuries in low-income families. □

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TABLE 1—Results of 6-Month Follow-Up on Smoke Alarms (n = 595) Installed in Low-Income Households by the National SAFE KIDS Campaign, 1993

	%
Alarms tested (n = 500)	84.04
Alarms found working (n = 416)	83.2
Reason alarm not working (n = 64) ^a	
Batteries missing	43.8
Batteries dead	40.6
Alarm disabled	7.8
Dirt/dust/insects in alarm	0.0
Other	7.8
Reason alarm sounded during the follow-up period (n = 124) ^b	
Moisture from shower	38.7
Malfunction	8.1
Cooking smoke	4.8
Cigarette smoke	2.4
Other	46.0
Action taken when alarm sounded (n = 80) ^b	
Ventilated home	68.8
Disabled alarm	2.5
Changed batteries	2.5
Other	26.2
How often were batteries checked? (n = 379) ^b	
Once per month	41.2
Once per week	19.0
Less than once per month	15.8
Don't know	24.0
How often should batteries be changed? (n = 403) ^b	
Every year	46.1
Every few months	31.0
Every few years	4.5
Don't know	18.4

^aData were missing for 20 alarms.

^bFrom the questionnaire administered to household residents at follow-up; not all respondents answered all questions.

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