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Evaluated Community Fire Safety Interventions in the United States: A Review of Current Literature

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Evaluated Community Fire Safety Interventions In The United States: A Review of Current Literature

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Abstract

The purpose of the study was to assess the state of fire prevention research, provide an updated synthesis of evaluated fire prevention programs, and discuss the role of fire fighters and data systems in prevention efforts. The review included all evaluations of U.S. based fire prevention interventions published between January 1998 and September 2004 and any earlier articles about U.S. fire prevention interventions not included in two prior review articles. We retrieved information from each identified study including evaluation findings, involvement of fire service personnel and use of existing data systems. We identified twelve articles: seven reported on *smoke alarm* interventions, three on *multi-faceted* programs, and two *other* programs. Five programs involved fire service personnel in the design, implementation, and/or evaluation, and three used existing data systems. Studies reviewed suggest that canvassing and smoke alarm installations are the most effective means of distributing alarms and increasing the functional status of distributed alarms. The functionality of smoke alarms, an issue noted in earlier reviews, remains a problem. Programs involving partnerships with fire departments have indicated success in preventing fires and deaths, improving smoke alarm ownership and functional status, and improving children's fire safety knowledge. Using existing data systems to target and to evaluate interventions was effective. In the years since prior reviews, some improvements in the rigor of evaluation designs have been made, but there is still a need for high quality evaluations that will inform fire injury prevention efforts.

Key Words: Smoke alarms; Residential fires; Program evaluation; Fire data systems; Fire service personnel

INTRODUCTION

Fire is a major cause of injury and death in the United States. In 2001, the death rate of 13 per million population is half the rate that it was in the late 1970's, and residential fire deaths have declined by 8.8% over the last decade.[1] Nevertheless, fire remains a major problem in the U.S. In 2003, there were approximately 1.6 million fires, resulting in 3,925 civilian fire fatalities. While a minority (25%) of these fires occurred in homes, the vast majority (80%) of the civilian fire victims died in residential fires.[2] The large injury burden associated with residential fires is a driving factor behind U.S. fire prevention activities, and influences the local nature of most fire prevention interventions.

To assess the state of fire prevention research, we conducted a review of the fire prevention literature. This literature review is part of an ongoing case study of fire prevention programs in the State of Delaware, and, therefore, provides an understanding of the context in which to consider the Delaware experience. We were particularly interested in researching the literature on evaluated fire prevention programs that involved fire-service related personnel in the design, implementation and/or evaluation aspects of the programs. Preliminary findings of this ongoing case study have indicated a strong involvement of fire service personnel at the community level.[3] It also provides an updated synthesis of evaluated fire prevention programs since the publication of two previous review articles on fire injury prevention that were conducted by DiGuiseppi and Higgins[4] and Warda, Tenenbein, and Moffatt [5].

DiGuiseppi and Higgins conducted a systematic review of smoke alarm interventions which included various clinical, home and school-based settings. They found some evidence that smoke alarm giveaway programs reduced the incidence of fire-related injuries, although this finding is compromised by a lack of rigor in the evaluation designs of the studies reviewed. The

authors concluded that smoke alarm promotion during routine child health visits may be an effective strategy for disseminating smoke detectors, and emphasized the need for injury-related outcome evaluations to inform this hypothesis.[4]

The Warda review consisted of an evaluation and summary of the literature on house fire injury prevention that included school and community-based education programs, clinic-based interventions, home inspection programs, smoke alarm distribution programs, and smoke alarm legislation. With regard to clinic-based interventions, the authors focused on the many unanswered questions associated with this approach, and urged additional investigation. Their review of smoke alarm studies highlighted the value of door-to-door canvassing that included installation, while also pointing to the challenges associated with maintenance of installed alarms. Like DiGuiseppi and Higgins, Warda and colleagues concluded that high quality evaluations of fire prevention programs are lacking, and emphasized the value of empirical evidence for programmatic decision-making around fire prevention.[5]

In this review, we add new information that will be useful to injury and fire service professionals who are planning or implementing fire prevention programs. We are especially interested in highlighting the role of fire fighters in prevention efforts, an issue that has not received much attention in the community prevention literature in the past, despite their longstanding commitment to public education and prevention and the U.S. Fire Administration's priority of identifying fire, public and private partnerships in this area.[6] Because the two previous reviews emphasized the need for better quality evaluations that include injury outcomes, we specifically consider the use of fire surveillance data in this review as a method to help address this need. In our discussion, we describe fire service personnel as promoters of health behavior

change in the context of behavioral theory, and update the conclusions reached in the prior two reviews.

METHODS

We included in our review all evaluations of U.S. based fire prevention interventions ***published*** between January 1998 and September 2004 and any earlier articles about U.S. fire prevention interventions not included in the DiGuiseppi and Warda review articles. We limited the scope of this review to the U.S. because its primary purpose was to inform the evaluation of community-based fire prevention efforts in one U.S. state, as previously described, and because of our interest in the use of the U.S. national fire surveillance system.

Search Strategy. We used the following key words: fire, burns, smoke alarm, and smoke detector to search *PubMed* (no limits made), *PsycINFO* (limit English, human), *PsycARTICLES* and *Eric* (limit English, federal). The following key words were also used in conjunction with "fire" and "burns" to assist in identifying relevant studies: prevention, education, injury, program, evaluation, and United States. To identify relevant studies, we first reviewed the title of every article, and if the title suggested that the corresponding article reported on a fire prevention intervention in the U.S., we reviewed the abstract. Once we confirmed the abstract to be appropriate, we obtained a copy of the article. All obtained articles were subsequently reviewed, and those that described an evaluated fire prevention program were included in this review.

We complemented the database search with a hand search of *Injury Prevention* and *Journal of Burn Care and Rehabilitation,* applying the same year limitation (1998-2004). Finally, the authors used their knowledge of the field to identify additional relevant articles that were not revealed through the search strategy previously described, which included personal

communication with fire prevention researchers as well as the authors' awareness of relevant articles published.

Originally, our search strategy included efforts to investigate whether there were additional unpublished evaluations of fire prevention interventions. Such efforts involved the review of all fire prevention programs listed in the Centers for Disease Control and Prevention (CDC), *Efforts to Increase Smoke Detector Use in U.S. Households: An Inventory of Programs, 1996*, as well as phone and email contacts to those programs listed. Efforts were made to contact those programs that were not already included in our review. Such efforts were unsuccessful for two major reasons: 1) those reached reported that their programs did not include an evaluation component, or 2) the contacts listed were no longer valid (e.g. disconnected number). After consulting with the CDC on other search strategies for locating unpublished reports of evaluated fire programs and having no success with finding additional reports, we decided that our search would have to be restricted to fire prevention programs that were both published and evaluated.

Final Sample of Studies. We extracted a standard set of information from each study included in the final sample and include those data in Tables 1-3. These tables present summary information, including: author; year of the project; study sample (including location, sample size, and unit of analysis); description of intervention group and control (or comparison) group, if any; evaluation aims; measures used; and outcomes.

RESULTS

We identified twelve articles through our search strategy.[7-18] A summary of each study is presented in Tables 1-3 and categorized into three areas based on the type of interventions evaluated.* Of the twelve articles, seven reported on *smoke alarm* interventions (Table 1); three

* The term, "significant" for study results is used in this review if the authors of the identified studies concluded significant results using their studies' criteria.

evaluated programs with multiple injury topics which we labeled *multi-faceted* (Table 2)*;* and two described *other* programs that were not applicable to be included in Tables 1 or 2 (Table 3). The articles are classified according to the Cook and Campbell [19] experimental and quasi-experimental nomenclature, where O stands for observations and X for interventions. Most of the studies used pre- experimental or quasi- experimental designs; we identified two randomized controlled trials (RCTs).

Smoke Alarms. The seven *smoke alarm* evaluations we identified analyzed data from five different programs in 14 locations throughout the United States. Three studies reported exclusively on the Lifesavers Residential Fire and Injury Prevention Program of Oklahoma City, Oklahoma [8,11,18]; two analyzed data collected from the Get Alarmed campaign implemented in two Georgia counties.[7,10] One study reported on a Safe Kids program in 10 locales,[12] and the seventh used data from three programs in three states, one of which was the Oklahoma program [9]. Two of the Oklahoma evaluations included a comparison group in the design, [8,11] while the remaining five studies did not.

Based on these study findings, the canvassing method of distributing smoke alarms directly to homes was the most effective and efficient distribution method tested, resulting in almost one-third of targeted households in Oklahoma receiving a smoke alarm [8,11] and 94% of the target homes in Georgia [7]. In Oklahoma, distributing flyers to promote fire station giveaways used more volunteer and financial resources than canvassing, yet these efforts reached a significantly lower proportion of targeted households (approximately 5%).[8,11] Canvassing programs varied in their implementation, and may involve publicly announcing the giveaway block by block and inviting interested residents to receive a smoke alarm curbside[8,11,18] or visiting households to deliver the program one-on-one. In addition, some canvassing programs

included installation as part of the distribution, [7,10,12] while others installed the alarms upon request. [8,9,11,18] Two programs offered installation and measured the response. When offered to all program participants, 6% requested installation with older people and the physically disabled more likely to accept.[8] In contrast, a North Carolina program that encouraged seniors to contact their local fire departments and request smoke alarm installation as one distribution method resulted in 67% of the distributed alarms being installed through the program.[9] Canvassing programs that included installation appeared to result in higher rates of working smoke alarms at one year follow up (92% and 79%),[10] compared to those programs that installed the alarms for the minority of participants who request this service (53%).[11] After 3-4 years, a separate study also demonstrated a higher proportion of working smoke alarms among those households participating in programs with higher installation rates.[9] At three months follow-up, Mallonee reported that 27% of Oklahoma program participants had not yet installed or no longer had their alarms.[11]

Missing batteries are the main reason that installed smoke alarms do not work. Seventy-six and 66% of the non-working alarms in Minnesota and North Carolina, respectively, had missing or disconnected batteries three to four years after distribution.[9] Mallonee found that the rates of missing batteries in Oklahoma increased from 50% of non-working alarms to 73% over a 48 month follow up period. This program included battery distribution during year two, and a postcard reminder to change the batteries during year three.[11]

One study assessed the impact of smoke alarm distribution on fire-related morbidity and mortality and demonstrated an 81% reduction in residential fire-related injuries among the target population compared to a 7% reduction in the control population. The authors attributed the

difference to providing free smoke alarms and to the education, publicity, and increased awareness that accompanied the smoke alarm distribution.[11]

A cost-benefit analysis of the Oklahoma program over a five year period provides estimates of lives saved and injuries prevented in the context of economic impact. Researchers estimated that the program prevented 20 fatal and 24 non-fatal injuries, and attributed approximately $15 million dollars in cost-savings to the program. Of that total, the authors associated $14 million with the prevention of lost productivity and $1 million to medical costs averted.[18]

Notable findings regarding correlates of smoke alarm ownership are also evident in the studies we reviewed. Non-smoking households, higher income and home ownership were significantly and positively related to smoke alarm ownership.[7-9] The Georgia study found that the homes without smoke alarms were also the homes most likely to be without a phone so that residents of these homes, in addition to no alarm, had no way to notify the fire department in case of fire.[7] Warda also mentions no telephone as a risk factor for fire injury RR 3.2 (2.0,3.1).[20])

Multi-faceted. The three *multi-faceted* program evaluations we identified were all educational injury prevention interventions that included a fire safety component. All three evaluations included control groups – two through a RCT design.[14-16]

One study assessed differences in injury prevention knowledge, attitudes and behaviors (KAB) following delivery of a multi-faceted injury prevention program in six elementary schools. In addition to the curriculum, all participating families were eligible to receive smoke alarms installed by the fire department free of charge. This component of the program resulted in 250 installed alarms. The authors report significant differences in fire safety knowledge

measures between the intervention and control schools for grades 2-5, and in the pre- and post-test results within the intervention schools for grades K-5.[14]

An evaluation of an injury prevention anticipatory guidance training program for pediatric residents demonstrated a significant difference between patients of residents randomly assigned to receive the training (intervention) compared to patients of residents in the control.[15] Patients of the intervention residents reported higher levels of satisfaction with the injury prevention counseling they received from their residents. However, there were no significant differences found on two patient knowledge and behavior measures related to smoke alarms. The difference between the two groups' awareness of the need to change smoke alarm batteries at least twice a year was not significant, and on home visit, researchers observed a working smoke alarm in 59% in the intervention group and 50% in the control group.

One randomized study tested the effects of two interventions on parents' home safety behaviors: a randomly assigned home safety visit by a community health worker, and access to low cost safety products and safety education through a hospital-based children's safety center (CSC).[16] The prevalence of reported safety practices (including having a working smoke alarm) did not differ between the intervention and control groups, nor was there a measurable impact of a CSC visit on reported prevalence of working smoke alarms which was over 80%.[16]

Other. Of the two *other* evaluations we identified, neither included a comparison group. The state of Maine underwent major changes in its burn care system during the 1970s. These changes were accompanied by increases in fire prevention initiatives.[17] Following these initiatives, burn-related mortality and morbidity decreased: between 1960 and 1979 the burn-related death rate decreased from 5.1/100,000 to 1.4/100,000 from 1993-96. The burn-related hospitalization rate declined from 34.8/100,000 between 1973-76 to 10.6/100,000 during 1995-

98.[17] The authors attribute these declines to the increases in preventive measures, including increased use of smoke alarms and safer building standards.

A three-day citywide arson prevention campaign in Detroit, Michigan organized city personnel and community volunteers to counter arson activity related to the Halloween holiday. The number of Halloween-related fires dropped from 810 in 1984 to 142 in 1996; the number of Halloween fire deaths declined from 107 in 1979 to 44 in 1996.[13] The campaign included the use of fire surveillance data to identify the high risk arson sites where prevention resources would be most effectively deployed. Educational efforts, organized youth activities, and youth curfews complemented the efforts to reduce the risk of arson at high risk sites.[13]

Role of Fire Personnel. Five of the ten programs evaluated in the twelve articles included in our review involved fire service personnel [7-11,13,14,18]; in two interventions, the presence of fire personnel was not specified.[12,17] Fire service personnel were involved in the design[13], implementation [7-11,13,14,18], and/or evaluation phases of the fire prevention programs.[9,10,18] Fire service personnel were important in establishing the validity and legitimacy of the program in the community.[7,8] Two programs [7,8] took fire engines to the community to attract attention to their smoke alarm giveaway program. In Oklahoma City, fire service personnel drove fire engines through the community sounding the siren and announcing the smoke alarm giveaway. They were followed by volunteers with smoke alarms. This type of canvassing, as stated earlier, proved to be the most effective method of distributing smoke alarms.[8] In three of the programs that the fire department was involved in they worked with members from the community to implement the program. [7,8,13]

Role of Data Systems. Data systems played an important role in designing interventions, targeting areas for intervention, and evaluating interventions. Detroit used data from the Detroit

Fire Incident Reporting System on the location of fires by type and census tract to create a map of the areas of the city most likely to have arson on Halloween.[13] This information was used in determining how to distribute fire and police personnel and to prioritize areas for destroying vacant buildings.[13] The Oklahoma State Department of Health started statewide surveillance of burn injuries that led to hospitalization or death in the late 1980s. For Oklahoma City, these data were linked to fire department data, and then mapped to identify an intervention area that accounted for 45% of fire injuries even though it had only 16% of the population.[11,18] In Maine, morbidity and mortality data from hospital discharge abstracts and hospital burn registries along with mortality data from death certificates were used to evaluate fire prevention and burn treatment efforts in the state.[17]

DISCUSSION

There are both similar and different conclusions reached in our review in comparison with those in DiGuiseppi's and Warda's. Similar conclusions include: Smoke alarm giveaway programs reduce the incidence of fire-related injuries; door-to-door canvassing is an effective method for distribution of smoke alarms to communities; and, the need for more rigor in the design of evaluations. Our findings differ from the two previous reviews primarily because some of our specific aims are different themselves – namely, the examination of the role of fire service professionals and consideration of the use of existing fire surveillance systems in the U.S. We begin our discussion with an update of evaluated and published fire prevention programs in the U.S. followed by the role of fire service personnel and fire surveillance data systems.

The studies reviewed suggest that canvassing and smoke alarm installations are the most effective means of distributing alarms and increasing the functional status of distributed alarms. Our findings highlight the variety that exists among distribution programs, and emphasize that

these differences persist among similarly labeled programs, such as canvassing. Not surprisingly, the details of program design and implementation appear to affect the ultimate impact of these programs. While the more intensive programs often yield greater impact, as evidenced by the value of installation and canvassing, one study also suggests that these intensive efforts are also a more efficient use of resources.[8] This is good news for program planners faced with limited resources.

The functionality of smoke alarms, an issue noted in earlier reviews[5] remains a problem.[7,9,11] Effective strategies for addressing the documented challenges associated with long-term maintenance of a power supply are needed in order to advance the science of fire injury prevention. Perhaps surprisingly, missing (not dead) batteries were the most frequently cited reason for a non-working smoke alarm.[9] Thus a non-working smoke alarm is most often the result of deliberate human action (as opposed to inaction). Additional research to explore engineering and behavioral strategies to address this issue are needed, as our findings revealed no promising approaches to addressing this important barrier to realizing the full potential of smoke alarms in injury prevention. Smoke alarms with 10 year batteries are available, but are expensive. CDC has recently funded research on strategies to keep traditional battery operated alarms functional, which should yield new information on this issue.

Few studies report changes in morbidity and mortality, but statistically speaking, this may be difficult to show because these outcomes require large samples and extended follow-up. This is a worthwhile investment, given the large toll that fire-related injuries exact worldwide.

Some studies reviewed, in addition to the DiGuiseppi and Warda conclusions, suggest that home fire safety can effectively be taught as part of a comprehensive injury prevention program. Results from the studies we reviewed indicated knowledge gains for school based

education of elementary age children [14], but no effect of clinic based education of adults in randomized controlled trials [15,16]. The latter results may be due in part to the already high rates working smoke alarms among the families participating in the latter of these two trials. Interestingly, that study took place in a city where the fire department widely promotes its free installation program, which may help explain the high rates of working alarms that were observed.

Of particular interest for this study was to examine fire prevention activities that involved a partnership with the fire departments. Our findings indicate that programs involving partnerships with fire departments have been successful in preventing fires and deaths [11,13,18], improving smoke alarm ownership and functional status [7,9-11], and improving children's fire safety knowledge.[14] The literature demonstrates the many roles of fire service personnel in fire prevention efforts. While the evaluations we reviewed do not attribute program success to fire service personnel participation due to the use of non-randomized designs, the authority of acknowledged experts is a powerful educational tool that is part of established behavioral theory.[21] In three of the programs in which fire personnel were involved, they worked in partnership with community members to implement effective interventions. [7,8,13] French and Ravens theory of bases of power describes six types of power in the communicator that lead to effective communications. Expert power is when the subject sees the communicator as being more knowledgeable about the subject.[21] Legitimate power is when the communicator is viewed as having a right to tell others how to behave. These powers are effective in producing short-term behavior change. Referent power, considered the most effective type of power, is when the subject views the communicator as being similar in some way. It is especially effective when combined with another source of power. The fire personnel/community member partnerships

combine expert, legitimate, and referent power to make their communications about smoke alarms effective.

We are particularly encouraged by the use of fire surveillance data in Detroit and Oklahoma City to inform program planning. The successes of these interventions offer evidence of the value of fire surveillance data for prevention purposes. A national fire surveillance program, called National Fire Incident Reporting System (NFIRS) is in place in the United States [22], and has the potential to inform fire prevention efforts nationwide, as well as provide a rich source of data for evaluation research. For instance, NFIRS collects data on variables such as fire incidents, civilian and firefighters injuries/deaths, and property loss.[23] This is a voluntary reporting system that relies on the participation of the fire service at the local and state levels. It is in the best interests of the public health community and the people we serve to advocate and support participation in this national surveillance effort. Where needed, we can provide technical assistance to this data collection effort, and be a voice in support of the resources needed to assure the quality and completeness of the fire data collected by state and local fire service personnel.

Both Warda and DiGuiseppi concluded their reviews with a call for more rigorous outcome-oriented research. In the years since these reviews, some improvements have been made, as evidenced by the use of randomized control designs,[15,16] and results that include morbidity, mortality and cost impacts. [7,11,13,17,18] However, despite this progress, we reiterate the need for evaluations that will inform fire injury prevention efforts, and ideally such evaluations will utilize randomized, controlled studies.

Also, unpublished results on evaluated fire prevention programs should be made accessible to the public health, injury prevention, and fire prevention communities; this will help

guide program planners dedicated to fire service to have a better understanding of what "works" and what "does not work." Because there is an apparent need for evaluation to be conducted on fire prevention programs, a suggestion is the use of fire surveillance data systems. The use of such surveillance systems has a great potential in providing valuable data prior to and after the implementation of interventions, thus, improving substantially the literature and science of fire prevention programs.

A limitation to consider in interpreting the results of this review is that we did not intend to complete a meta-analysis or an exhaustive systematic review, but rather to update the existing reviews and learn more about the role of firefighters in fire prevention programming. We imposed no specific standards on the quality of the evidence from the articles reviewed. However, we are careful not to draw conclusive inferences from the generally weaker study designs and methods that make up this body of literature. We were also limited in the resources we could devote to trying to find the grey literature.

In conclusion, our review strongly suggests the use of fire surveillance data systems in contributing to the rigor of future fire prevention program evaluations. Fire departments may be interested in serving as advocates for the use of such systems, especially if community programs partner with them in the design, implementation and evaluation phases of their programs.

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Table 1

Summary of Articles Reviewed, Smoke Alarms (SA)

Citation, Project Years[†]	Study Design, Sample Size, Location	Interventions & Comparison or Control Group[‡]	Evaluation Aims	Outcomes
(8) 1990-95	O X_1 O O X_2 O O X_3 O O X_4 O 34,945 HH Oklahoma City, OK	X_{1-4}: 4 strategies for promoting SA giveaways in 4 geographic areas: direct mail; residential flyer distribution; public place flyer distribution; and canvassing. The 3 flyer distribution strategies advertised SA giveaways at fire stations. SA installation available to all	Determine effectiveness of four SA giveaway promotion methods.	Canvassing was the most effective and efficient method, reaching 31% of the target homes compared with 5% for the other methods ($p<0.00001$). Canvassing cost $1.96/SA distributed vs. $3.95 for the other methods; 1 volunteer hour distributed 5.9 SA vs. 3.1 for the

[†] Years of the program/project, not necessarily the evaluation.
[‡] X: Intervention; C: Comparison/Control; O: Observations
Abbreviations: HH: households; SA: smoke alarms; R: randomized

		program participants upon request.		other methods.
(9) 1990-91	X O 436 HH randomly sampled from pool of SA recipients from MN, NC, and OK.	X: SAs delivered through various methods to English speaking HH without working SA. In MN home visits to HH with young children or older adults (n=338 HH), SA installed. In OK canvassing and SA giveaway (n=9291 HH), SA installed upon request. In NC seniors encouraged to call to have a SA installed, and all residents encouraged to visit SA	Determine % of HH with at least one working SA 3-4 years after distribution. Describe condition of non-working SAs. Describe association between having a working SA and a reported battery replacement.	64% had at least one working SA. Reasons for non-working SA: battery-related, AC disconnected, cover missing or broken, chamber clogged. HH that replaced batteries were more likely to have a working SA (RR = 2.1 [1.6, 2.8]).

		giveaway sites (n=702 HH).		
(7) 1998-99	X O 252 HH Schley CO, GA (SC) 202 HH Henry CO, GA (HC)	X: Canvassing, including installation and battery replacement. Targeted HH had residents in one of the following groups: <5 or >64 years, low SES, minority.	Determine prevalence of SA use in high-risk HH and predictors of SA ownership. Measure residents' knowledge and behaviors regarding fire safety and SA use. Assess effectiveness of canvassing in high-risk HH.	59% of SC & 67% of HC HH reported having at least one SA at baseline. SA ownership positively associated with home ownership (owners vs. renters: 84% vs. 16% in SC; 82% vs. 16% in HC). HH with a SA at baseline were more likely to have a fire escape plan than those HH without a SA (78% vs. 36% in SC; 56% vs.16% in HC). 94% of targeted HH received at least one SA.

(10) 1998-99	O X O 235 HH Schley CO, GA (SC) 113 HH Henry CO, GA (HC)	X: Canvassing, including installation and battery replacement.	Determine whether the installed SA was functioning at one year.	92% of SC SA worked. 79% of HC SA worked.
(11) 1987-96	O_1 X_1 O_2 O_3 O_4 O_1 X_2 O_2 O_3 O_4 Process: 3433 HH Impact O_2: 875 SA Impact O_3: 5617 SA Impact O_4: 749 SA Outcome:	$X_{1\text{-}2}$: 2 methods of SA distribution: canvassing and fire station giveaway. SA installation available to all program participants upon request.	Process: determine most effective SA distribution method. Impact: determine whether the distributed SA was installed and functioning at 3, 12, and 48 months. Outcome: assess impact on fatal	Process: Canvassing method was more effective. 31% of canvassed HH received a SA vs. 6% in fire station giveaway areas. Impact: 65% of SA distributed was functioning at 3 months; 53% at 12 months; and 46% at 48 months.

	Population of target areas: Oklahoma City, OK		and non-fatal fire-related injury rates.	Outcome: Residential fire-related injuries declined in the target population by 81% (15.35/100,000 to 2.96) compared to 7% in the rest of Oklahoma City (3.63 to 3.37).
(12) 1992-93	X O 500 installed SA 10 communities throughout the U.S.	X: 10 Safe Kids grassroots coalitions' volunteers who installed SA in low-income homes.	Assess whether the installed SA were functioning at 6 months.	83% of the 500 SA were functioning at 6 months.
(18) 1990-95	O X O 73,000 people Oklahoma City, OK	X: Distribution of smoke alarms, fire prevention education materials and batteries. SA installation available to all	Conduct a cost effectiveness analysis of the program.	Intervention prevented an estimated 20 fatal and 24 non-fatal fire-related injuries, and resulted in an estimated savings of >$15 million.

		program participants upon request.		

Table 2

Summary of Articles Reviewed, Multi-Faceted Programs

Citation, Year of Project	Study Design & Study Sample	Interventions & Comparison or Control Group	Evaluation Aims	Outcomes
(14) 1992-93	O_1 X O_2 O_1 O_2 12 elementary schools State of Oklahoma	X: 6 schools received a multi-faceted injury prevention curriculum, including fire safety education, SA giveaway and installation. C: 6 schools where no intervention was delivered. All C schools had opportunity to receive SA installation.	Determine differences in knowledge, attitudes, and behaviors between intervention and control schools.	Significant differences in knowledge between intervention and control schools for home fire safety (grades 2-5), $p=0.04$. Significant differences between pre-and post-test results in intervention schools for fire safety in grades K-1, $p<0.01$ and grades 2-5, $p<0.01$.

				Firefighters installed 250 SA in students' homes. No information on SA use provided.
(15)	R X O R O 196 families with a child < 6 months seeking care at a pediatric clinic in a large urban hospital	X: 120 families seen by 18 residents randomly assigned to receive an injury prevention anticipatory guidance training program, which included fire safety. C: 76 families seen by 13 residents who did not receive the training.	Evaluate families' knowledge, attitudes, practices regarding injury prevention and their satisfaction with their physicians' anticipatory guidance counseling about injury prevention.	At 1 year follow-up: No significant difference between I and C families on knowledge that SA batteries should be changed at least twice a year 60% vs. 70% or on having a working SA during home observations: OR = 1.56 (95% CI: 0.70-1.37). Significant difference between I and C families on satisfaction with injury prevention counseling received (p=0.01).

(16)	R X_1 X_2 X_3 O R X_1 X_2 O 187 families with a child < 6 months seeking care at a pediatric clinic in a large urban hospital.	94 families received safety counseling (X_1), a referral to a clinic-based children's safety center (CSC) (X_2), and a home visit by a community health worker (X_3). C: 93 families received safety counseling(X_1), and a CSC referral. (X_2)	Determine whether home visits increased safety behaviors above what could have been achieved with counseling and CSC.	No significant difference in safety practices between I and C families, including having a working SA at 1 year; no difference in proportions of parents who had visited the CSC and had a working SA although their total number of safety practices was greater.

Table 3

Summary of Articles Reviewed, Other Interventions

Citation, Year of Project	Study Design & Study Sample	Interventions & Comparison or Control Group	Evaluation Aims	Outcomes
(17) 1970s	O X O State of Maine 1960: 920,000 pop. 1995: 1,241,000 pop.	X: Regionalization of burn care system and increase in fire prevention initiatives in 1970s.	Assess changes in burn injury incidence following burn care and fire prevention initiatives instituted in the 1970s.	Reduction in the incidence of death (from 5.1 during 1960-79 to 1.4 during 1993-96, per 100,000) and hospitalization due to burns (from 34.8 during 1973-76 to 10.6 during 1995-98, per 100,000).
(13) 1985-96	O X O Detroit, MI 1,028,000 pop.	X: Annual 3-day citywide Halloween arson prevention campaign that included: analysis of surveillance data to identify high risk arson spots and strategic	Determine if the campaign reduced fires and fire-related deaths.	Halloween fires declined from 810 in 1984 to 142 in 1996. Annual fire-related deaths declined from 107 in 1979 to 44 in 1996.

		assignment of city personnel and community volunteers to prevent arson incidents; educational messages; and activities for children.		