

Smoke Alarm Installation and Maintenance Behaviors: What do we know from Community Intervention Trials?

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Door-to-door canvassing programs can increase the number of homes with smoke alarms

The Centers for Disease Control and Prevention Smoke Alarm Installation and Fire Safety Education (SAIFE) program has been found to increase smoke alarm coverage in high-risk communities. The program recommends installing 10-year lithium battery smoke alarms on each level of a home, educating the resident about smoke alarm maintenance and fire safety, and community promotion.¹ Many fire departments conduct home visits and smoke alarm installations via door-to-door canvassing. In our study in Baltimore, residents that received notification of the fire department home visit before the visit were more likely to let fire fighters into their homes (75% vs 62%), were more likely to agree to have smoke alarms installed (95% vs 92%), to be left with a working smoke alarm on every level of the home (84% vs 78%), and to have more smoke alarms installed per home visited (1.89 vs 1.74) than those who had not received notification.² Other methods of smoke alarm installation include referral programs and requests via a non-emergency dispatch.

Canvassing programs are cost-effective

A cost-effectiveness analysis of our home visiting intervention trial in Baltimore showed that the program increased the number of homes that went from having no working smoke alarms to having any working smoke alarms by 10%. Extrapolating from this effect, we determined that the fire department's standard home visiting program would result in an additional 0.24 lives saved per 10,000 homes over 10 years compared to a control area without the program. The incremental cost of each life saved by the program compared to the control area was \$28,252 per death averted.³ The study also highlighted the need for better data on the benefits of current smoke alarm recommendations and their impact on injury, death, and property damage.

Residents have various reasons for having nonworking smoke alarms

Our survey of more than 600 households in Baltimore showed that while 70% of respondents reported having a working smoke alarm on every level of their home, only 41% of the sample actually did.⁴ In follow-up interviews with 23 residents who over-reported their smoke alarm coverage, we found that 52% assumed that the smoke alarms were still working because they were still up or were not beeping, and

¹ Ballesteros MF, Jackson ML, Martin MW. Working toward the elimination of residential fire deaths: the Centers for Disease Control and Prevention's Smoke Alarm Installation and Fire Safety Education (SAIFE) program. *J Burn Care Rehabil.* 26 (2005):434–9.

² Gielen AC, Shields W, Frattaroli S, et al. Enhancing fire department home visiting programs: results of a community intervention trial. *J Burn Care Res* 34.4 (2013):e250–6.

³ Diamond-Smith N, Bishai D, Perry E, Shields W, Gielen A. Economic evaluation of smoke alarm distribution methods in Baltimore, Maryland. *Inj Prev* 20.4(2014): 251-257.

⁴ Stepnitz R, Shields W, McDonald E, Gielen A. Validity of smoke alarm self-report measures and reasons for over-reporting. *Inj Prev* 18.5 (2012): 298-302.

22% thought their homes were safe despite not having a smoke alarm on every level of the home (e.g., no alarm in the basement). Others forgot to put their alarms back up.

Knowledge and beliefs about smoke alarms related to their use

Our survey of more than 600 households in Baltimore showed that although smoke alarms were widely thought to be protective and not too much trouble to use, only 57% of residents could correctly answer nine questions about smoke alarms and home fire safety (causes and consequences of house fires, how smoke alarms should be used, what is required for escape planning). On average, residents thought it was not very likely they would experience a fire, but they believed that house fires were a serious problem with potentially severe consequences. Residents who reported feeling confident that they could maintain smoke alarms in good working order (keep your alarms working, no one takes out the batteries, can use hush feature) were twice as likely to have working smoke alarms observed in their homes. Other studies have found that low perceived risk and high perceived barriers explain why individuals do not have working smoke alarms in their homes.⁵

Lithium battery smoke alarms last longer than 9V battery alarms

Smoke alarms with sealed, long-life lithium batteries are said to last up to ten years. Lithium battery alarms have been found to last significantly longer than carbon-zinc battery alarms after installation⁶ indicating that it's easier for people to keep them working. Evaluations of lithium battery alarms show that installed alarms may not remain functional for ten years.

- An evaluation conducted on over 600 installed lithium battery alarms 8-10 years after installation showed that 33% were still functional, 37% were missing, and 30% were nonfunctional.⁷
- Another study on the lithium battery smoke alarms showed that 62% of alarms were nonfunctional 6-10 years after installation. About three-quarters of these nonfunctional alarms were the result of a battery issue, where the battery was missing, disconnected, or nonfunctional. The data also showed that lithium batteries degrade over time, as an alarm installed 2 years ago is more likely to be functional than one 4 years ago.⁸
- A follow up survey of 1385 lithium battery smoke alarms installed in 750 homes during a fire department home visit found that 1344 (97%) of the installed alarms were still up and working six months later. Of the 37 non-working alarms, most residents reported that they did not know why the alarm was not working. A minority of residents reported taking the alarm down because of cooking and chirping. (unpublished data)

⁵ Parker, E M et al. "Fire and Scald Burn Risks in Urban Communities: Who Is at Risk and What Do They Believe about Home Safety?" *Health Education Research* 28.4 (2013): 599–611.

⁶ Peek-Asa C, Yang J, Hamann C, Jones MP, Young T, Zwerling C. Smoke alarm and battery function 42 months after installation: a randomized trial. *Am J Prev Med* 39.4(2010): 368-371.

⁷ Jackson M, Wilson J, Akoto J, Dixon S, Jacobs DE, Ballesteros MF. Evaluation of fire-safety programs that use 10-year smoke alarms. *J Community Health* 35.5(2010): 543-548.

⁸ McCoy MA, Roper C, Campa E, Stephens-Stidham S, Carlin DK, Istre GR. How long do smoke alarms function? A cross-sectional follow-up survey of a smoke alarm installation programme. *Inj Prev* 20.2(2014): 103-107.