

Smoke Alarm Giveaway and Installation Programs

An Economic Evaluation

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Appendix A

Projection of annual fire, fire death, and fire injury rates in target community

Data

Number of homes (Nh): 706^a

Average number of reported home fires (Nf): 4^b

Average number of reported home fire deaths (Nd): 0.038^b

Average number of reported home fire injuries (Ni): 0.066^b

Percentage of home fires without a functional alarm (Pf): 0.41²

Percentage of deaths occurring in home fires without a functional alarm (Pd): 0.62²

Percentage of injuries occurring in home fires without a functional alarm (Pi): 0.43²

Projections

Average number of fires in homes without a functional alarm (Nfna): $Nf \times Pf = 4 \times 0.41 = 1.64$

Average number of home fire deaths without a functional alarm (Ndna): $Nd \times Pd = 0.038 \times 0.62 = 0.0236$

Average number of home fire injuries without a functional alarm (Nina): $Ni \times Pi = 0.066 \times 0.43 = 0.028$

Annual home fire incidence rate: $\frac{Nf}{N_h} = 0.0057$

Deaths per home fire without a functional alarm: $\frac{N_{dna}}{N_{fna}} = 0.0142$

Injuries per home fire without a functional alarm: $\frac{N_{ina}}{N_{fna}} = 0.0167$

^a Authors' estimate based on a population of 1836 and an average household size of 2.6

^b National average values of communities (2004–2008) of population 2500–4999 and communities of population 0–2499¹

Appendix B

Effectiveness of targeted smoke alarm giveaway and installation programs: summary results from a systematic literature review of controlled trials since the early 1990s^{a,b}

Identified studies to inform short-term (≤12 months) program-effectiveness estimates

| Study | Program type | Follow-up period (months) | % homes with FSAs | | Reduction in homes without FSAs (B-A), % | Percentage reduction (B-A)/(1-A), % |
|--|--------------|---------------------------|--------------------|-------------------|--|-------------------------------------|
| | | | Before program (A) | After program (B) | | |
| Douglas (1998) ³ | Giveaway | 3 | 71 | 81 ^b | 10 | 34 |
| Poehlman (2010) ⁴ | Installation | 6 | 59 | 90 ^b | 31 | 76 |
| Thompson (2004) ⁵ | Installation | 12 | 37 | 80 | 43 | 69 |
| Yang (2008) ⁶ | Installation | 12 | 72 | 99 | 27 | 96 |
| Average for installation programs | | | | | | 80 |

FSA, functional smoke alarm

Identified studies to inform the smoke alarm annual functional rate estimates

| Study | Program type | Follow-up period | % installed alarms functional |
|-------------------------------|----------------|------------------|-------------------------------|
| Harvey (2004) ⁷ | Giveaway | 6-12 months | 65 |
| | Installation | | 90 |
| Shults (1998) ⁸ | Giveaway | 3-4 years | 62 |
| | Minnesota | | 73 |
| | North Carolina | | 58 |
| Mueller (2008) ⁹ | Installation | 15 months | 84 |
| Peek-Asa (2010) ¹⁰ | Installation | 3.5 years | 90 |
| Jackson (2010) ¹¹ | Installation | 10 years | 33 |

^a Systematic Review Protocol

Search terms: A AND (B OR C OR D), where A = *smoke alarm OR smoke detector OR fire alarm OR fire detector*; B = *ownership OR prevalence OR use OR coverage OR presence OR functionality OR protection*; C = *injury OR burn OR safety OR risk OR loss OR death OR incidence*; D = *promotion OR installation OR giveaway OR expansion OR intervention OR program OR strategy*

Databases searched: PubMed, PsycINFO, CINAHL, and ERIC. Other sources: CDC and National Fire Protection Association publications

Timeframe: January 1, 1990 to December 31, 2010

Language: English only

Inclusion/exclusion criteria: controlled trials or trials with before- and after-program comparison; targeted smoke alarm giveaway or installation programs using canvassing methods.

Results: 858 titles screened; 122 abstracts screened; 24 full-text articles screened; data from eight studies extracted

^b Authors' estimates based on a conservative assumption of 75% coverage rate for programs

Appendix C

Estimation of program costs^a for targeted installation and giveaway programs,¹² \$ unless otherwise noted

| | Program site | | | |
|---|--------------|---------|---------|---------|
| | A | B | C | D |
| Adjusted total local costs ^b | 178,556 | 190,464 | 255,805 | 227,803 |
| Number of completed visits, <i>n</i> | 779 | 771 | 968 | 1,035 |
| Labor costs | 154,405 | 155,231 | 221,785 | 196,810 |
| Share of labor costs (%) | 84 | 79 | 83 | 81 |
| Cost per completed visit | 229 | 247 | 264 | 220 |
| Average cost per completed visit (Sites A–D): | 240 | | | |

Note: Giveaway program was assumed to have similar cost as the installation program with the exception of only incurring 50% (low: 20%; high: 80%) of the labor cost for the installation program.

^a Updated to 2011 U.S. dollars

^b Local costs minus facility costs

Appendix D

One-way sensitivity analysis results

| Uncertain variable changed | Net benefits for variable changed over plausible range ^a | | ACER for variable changed over plausible range ^b | | ICER for variable changed over plausible range ^b | |
|---|---|------------------|---|-----------------|---|----------------|
| | Giveaway | Installation | Giveaway | Installation | Giveaway | Installation |
| Annual home fires per 100 homes | 8-89 | 27-243 | 23-130 | 19-119 | Ref | 16-113 |
| Death per home fire without functional alarms | 23-58 | 66-161 | 44-88 | 39-80 | Ref | 35-75 |
| Injury per home fire without functional alarms | 49 ^c | 137 ^c | 51 ^c | 46 ^c | Ref | — ^c |
| Proportion of homes without functional alarms | 0-124 | 26-304 | 4-163 | 15-116 | Ref | 32-113 |
| Effectiveness of giveaway program | -3-102 | — | 25-185 | — | Ref | 27-81 |
| Effectiveness of installation program | — | 90-184 | — | 41-60 | Ref | 36-68 |
| Functional alarm against deaths | 17-106 | 53-287 | 20-99 | 16-90 | Ref | 14-84 |
| Functional alarm against injury | 49 ^c | 137 ^c | 51 ^c | 46 ^c | Ref | — ^c |
| Functional alarm against property loss | 46-53 | 128-146 | 51 ^c | 46 ^c | Ref | — ^c |
| Cost of giveaway program | 32-67 | — | 12-90 | — | Ref | 19-66 |
| Cost of installation program | — | 111-163 | 28-75 | 24-68 | Ref | 21-63 |
| Cost of incomplete visit/cost of complete visit (%) | 31-62 | 107-157 | 25-92 | 28-71 | Ref | 31-59 |
| Property loss per fire without functional alarms | 0-124 | 26-304 | 4-163 | 15-116 | Ref | 32-113 |
| Alarm annual nonfunctional rate | 11-146 | 37-385 | 1-119 | 4-109 | Dominated | 0-103 |

Note: The sensitivity analysis results reflect changes in ACERs associated with variable changes over plausible range as specified in the third column of Table 2.

^a 2011 dollars in thousands

^b 2011 dollars in thousands per QALY

^c Change of <\$1000

ACER, average cost-effectiveness ratio; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year

References for Appendixes A–D

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Appendix E

Probability sensitivity analysis: Monte Carlo simulation results of the average cost-effectiveness ratios

