Improving Smoke Alarm Self-Report Via a Prompted Questionnaire

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Abstract

Background: Previous work has demonstrated discrepancies between self-reported and observed smoke alarm functionality. This study aimed to improve self-report of smoke alarm status.

Methods: Participants were asked if they had: 1) any working smoke alarm; and 2) a working smoke alarm on every level of their home (Brief Form). Subsequently, parents answered an Extended Form prompting them to consider each level and how they knew the smoke alarms were functioning.

Results: 554 participants completed both forms. On the Brief Form, 96% of participants reported having any smoke alarm and 92% reported having a working alarm on every level. On the Extended Form, 85% of parents reported having any smoke alarm and 73% reported having a working alarm on every level.

Conclusion: Prompting residents to consider the presence and functionality of smoke alarms on each level of their home increased the opportunity to provided tailoired communication to improve smoke alarm coverage.

Introduction:

In 2016, there were approximately 352,000 residential fires resulting in 2,950 civilian deaths and 12,775 civilian injuries (Haynes 2017). A working smoke alarm is known to reduce the risk of dying in a fire by 50% (Douglas et al. 1999). However, many homes lack the recommended number of smoke alarms (i.e., one on every level of the home) (Chen et al. 2003). Sixty percent of home fire deaths occur in homes with no smoke alarms or smoke alarm that do not work (Haynes 2017).

Previous work also demonstrated discrepancies between self-reported and observed smoke alarm functionality with positive predictive values ranging from 26–90% (Roberston et al. 2005). When answering commonly used questions to assess smoke alarm status. Over reporting may occur because repondents do not consider all levels of the home and because they may be unaware of indicators of alarm functionality (Hatfield et al. 2006)

While observed data may be the recognized gold standard, direct observations may not be feasible from a resource or time perspective. Self reported smoke alarm information is still useful (Stepnitz et al. 2012) but data quality could potentially be improved by asking questions in a manner which causes respondents to think more deliberately about their homes and actions (Chen et al. 2003; Watson et al. 2014) The goal of the research presented here is to compare two self-reported measurement options to determine how to enhance the accurate reporting of the presence and functionality of smoke alarms. As part of a larger study on child home safety, we compared a Brief Form and an Extended Form of questions about smoke alarm status.

Methods:

The methods for this study have been previously described (Ahrens 2011). Briefly, parents of children 4–7 years old were recruited during a visit to the Pediatric Emergency Department (PED) at the Johns Hopkins Hospital or the Arkansas Children's Hospital. Parents were randomized to receive a tailored educational intervention to improve either fire safety or child passenger safety behaviors. Tailored education was delivered via a smartphone app that was downloaded for free by study participants. Upon downloading the app, respondents completed a baseline assessment of their study group's behavior and related beliefs. Based on their responses, a personalized feedback report with tailored education was immediately delivered in the app.

Data for this analysis come from the baseline assessment of the fire safety arm of the study. As part of the assessment, respondents were first asked if they had: 1) any working smoke alarms; and 2) a working smoke alarm on every level of their home. These two questions constitute the Brief Form. Later in the assessment, they answered an Extended Form, which asked them to identify the number of levels in their home (including the basement and attic), and then were prompted for each of those level to report whether a smoke alarm was present, if it was working, and how they knew it was working. (Fig. 1) Answers were summarized to create two variables comparable to the items assessed on the Brief Form: any working smoke alarm and a working smoke alarm on every level. Responses from the Brief and Extended Forms were compared using a Kuder-Richardson test, a measure of internal consistency for binomial data.

Results:

A total of 554 respondents completed both the Brief and Extended Forms. The mean age was 31 years old, 92% of respondents were female, 60% were African American, and 94% had completed high school or received a GED. Approximately one third (33%) were unemployed, 59% were receiving income assistance and 65% were renters. (Table 1)

Comparing responses to the two forms, more respondents reported any smoke alarms on the Brief Form (n = 531, 96%) compared to the Extended Form (n = 478, 85%). Table 2 compares the reports of working smoke alarms between the two forms. Again, more respondents reported more working smoke alarms on all levels on the Brief Form (n = 508, 92%) compared to the Extended Form (n = 411, 73%).

A total of 111 participants reported a working smoke alarm on every level on the Brief Form, but not on the Extended Form. When asked about the reason they did not have a working smoke alarm on every level, respondents most often cited that they thought they did have a working smoke alarm on every level (n = 37), nuisance alarms (i.e., the alarm went off when cooking or showering) (n = 23), or they didn't think they needed one on every level (n = 19). (Table 3) The Kuder-Richardson coefficient was 0.51.

Discussion

Our results show that question phrasing and quantity altered respondents' report of presence and functionality of smoke alarm, presumably for more accurate reporting. Because there are times when self-reported information is the most feasible way to obtain information, researchers need to carefully consider question phrasing, question order, and other prompts to enhance respondents' answers. By first assessing the number of levels in one's home, we were able to alter respondents answers. And, by asking respondents to provide a basis for their report of a "working smoke alarm" we may have encouraged more accurate reporting.

Prompting residents with more detailed questions increased the opportunity for tailored feedback from our smart phone app. For research purposes, devoting more items to measuring a self-reported behavior of interest may increase validity. For educational purposes, tailored messages have been demonstrated to be more effective than generic messages in affecting change (Schmid et al. 2008; Kreuter et al. 2000; Omaki et al. 2017). However, messages that are tailored to a person's reported behaviors are likely to have limited impact when over-reporting occurs. This study provides valuable insight into the effect of more directed survey items to increase accurate reporting.

The population of this study was drawn from a sample of majority renters from one urban setting. Replication of the study with a more diverse sample would improve generalizability. Future studies with observed smoke alarm status would allow for confirmation of our hypothesis that the accuracy of smoke alarm reporting was improved.

Accurate reporting of presence and functionality of smoke alarms is essential for several reasons. First, in the context of research on smoke alarms, which often relies on self-report), valid and reliable measures are needed for rigorous and reproducible studies. Second, interventions such as smoke alarm installation programs often rely on residents' reports of not having working alarms as the indication that they need to enter the home. Third, educational programs need correct information on whether alarms are present and working to provide the correct educational messages. Finally, awareness of smoke alarm functiioality is essential for residenets to understand their level of protection in their homes.

Declarations

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

This manuscript does not contains any individual person's data in any form (including individual details, images or videos).

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Contributions

WS also was the primary author for the writing in the manuscript. EO analyzed the data . All authors were involved in the creation and idea behind the manuscript, as well as some of the writing. All authors read and approved the final manuscript.

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Ethics declarations

Ethics approval and consent to participate

The study was approvied by the Johns Hopkins Institutional Review Board. All particpants consented to participate.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1
Respondent Demographics

		N	%
Participant Age	Mean (SD)	31.46	(7.08)
Participant Gender	Male	43	8%
	Female	5014	92%
Race	Black/African American	330	60%
	White/Caucasian	182	33%
	Other	34	6%
Hispanic or Latino	Yes	19	3%
	No	529	97%
Education	Less than high school (HS)	32	6%
	High school or GED	166	30%
	Greater than HS	196	36%
	Completed college or above	152	28%
Per Capita Income	$5,000 or less	199	41%
	$5,001-$10,000	157	32%
	More than 10,000	130	27%
Parent Receives Aid	Yes	318	59%
	No	224	41%
Employment	Yes, full time	289	53%
	Yes, part time	75	14%
	No	178	33%
Homeowner Status	Own	180	33%
	Rent	353	65%
	I don’t know	9	2%
Child’s Age	Mean (SD)	5.30	(1.16)
Child’s Gender	Male	304	55%
	Female	250	45%

Table 2
Self-report of having a working smoke alarm on every level.

		Extended Form		
		Yes	No	Total
Brief Form	Yes	397	111	508 (92%)
	No/Don't know	8	38	46 (8%)
	Total	405 (73%)	149 (27%)	554

Table 3
Reported Reasons for not having a working smoke alarm on every level among

Reason	N (%)
Thought they had a working SA on every level	37 (33%)
Smoke alarms go off while cooking or showering	23 (21%)
Didn’t think they needed a working SA on every level	21 (19%)
Never thought or decided about having a SA on every level	16 (14%)
Barriers to obtaining/installing smoke alarm (i.e. not enough time/money, don’t know how to install, landlord won’t allow)	14 (13%)
Total	111
* results from n = 111 participants responding having a working smoke alarm on every level on the brief form, but not on the extended form	

Figures

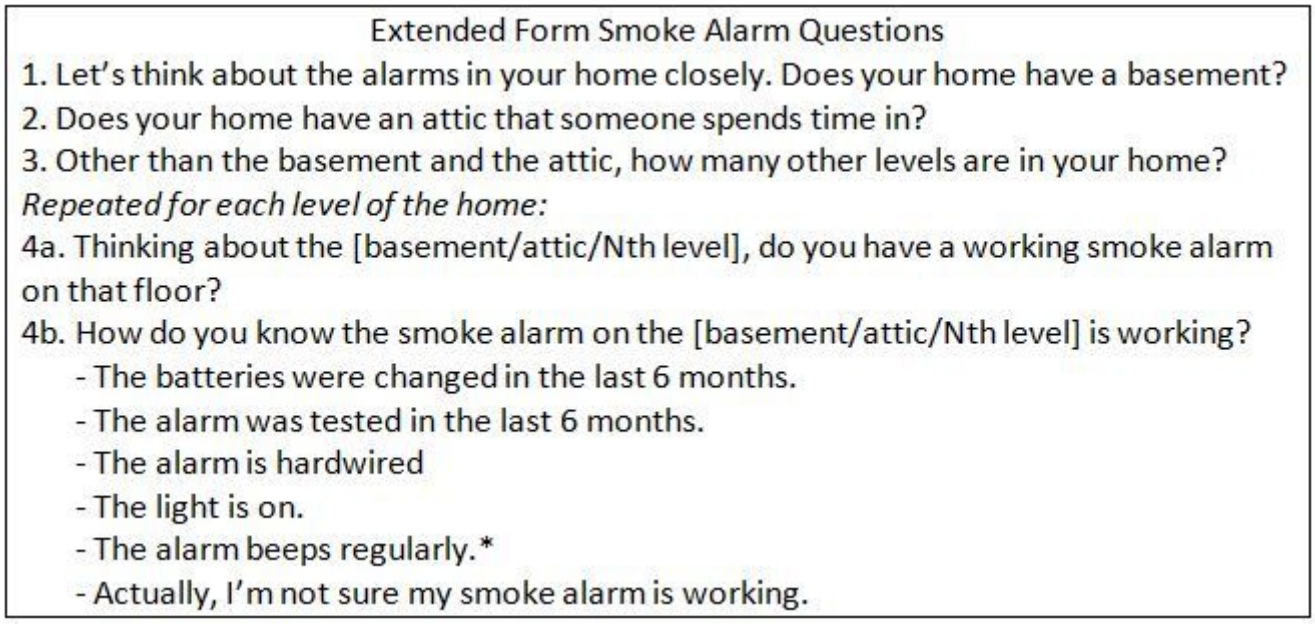

Figure 1

Extended Form Smoke Alarm Questions