Smoke alarm installation and function in inner London council housing

Carolyn DiGuiseppi, Ian Roberts, Norma Speirs

Abstract
Aim—To determine the prevalence of and predictors for installed, functioning smoke alarms in council (public) housing in a low income, multi-ethnic urban area.
Design—Cross sectional study.
Setting—40 materially deprived electoral wards in two inner London boroughs.
Participants—Occupants of 315 addresses randomly selected from council housing lists, with 75% response rate.
Main outcome measures—Installation and function of smoke alarms based on inspection and testing.
Results—39% (95% confidence interval (CI) 33% to 46%) of council tenants owned a smoke alarm, 31% (95% CI 25% to 38%) had an installed alarm (of which 54% were correctly installed), and 16% (95% CI 12% to 22%) had at least one installed, functioning alarm. Alarms most commonly failed because they lacked batteries (72%). In multivariate modelling, having an installed, functioning alarm was most strongly associated with living in a house versus a flat (apartment) (odds ratio (OR) 3.2, 95% CI 1.1 to 10.0), having two resident adults versus one (OR 2.8, 95% CI 1.2 to 6.5), and recognising stiffs from a Home Office television smoke alarm campaign (OR 2.4, 95% CI 1.1 to 5.5).
Conclusions—Fires are a leading cause of child injury and death, particularly among those younger than 5 years of age and those in social classes IV and V. Smoke alarms are associated with a significantly reduced risk of death in residential fires, and are more protective in households with young children. Few council properties in a multi-ethnic, materially deprived urban area had any installed, functioning smoke alarms, despite a high risk of residential fires and fire related injuries in such areas. Effective methods to increase the prevalence of installed and functioning alarms must be identified.

Keywords: accident prevention; burns prevention and control; protective devices

Unintentional injuries are the leading cause of death among children aged 28 days to 15 years in England and Wales, and fire and flames are the third leading cause of these injury deaths.1 The 1996 mortality rate from fire and flames among children aged 0–14 was 0.4/100 000 population.2 More than half of fire and flame deaths among children occur in house fires, with children aged under 5 years accounting for nearly two thirds of these deaths.3

There is a steep social class gradient in the risk of fire death, with death rates 15 times higher among children in social class V compared to social class I.4 This steep social class gradient in fire deaths is caused in part by differences in risk factors for the occurrence of residential fires, which include living in lone parent or low income households, rental accommodation, or homes in poor condition, and living in “multi-ethnic, low income areas” and “council estate areas with greatest hardship” (ACORN groups 17 and 16, respectively (A classification of residential neighbourhoods; www.caci.com)).5 Differences in smoke alarm ownership might also help explain the social class gradient in fire related deaths among children, since low income, lone parent, and rental households are also among those least likely to own a smoke alarm.6

It has been suggested that the use of smoke alarms to prevent fire related injuries may be the single most effective strategy for injury prevention in children.7 Smoke alarms have been associated with a two thirds reduction in the risk of death when a residential fire occurs, and are more protective against death in fires involving young children.8 Over the past decade, an increasing prevalence of smoke alarm ownership in England and Wales has coincided with a substantial reduction in fire injury death rates among children.9 However, while child death rates from fire have declined by 28% and 5% in children in social classes I and II, respectively, in social classes IV and V they have increased by 18% and 39%, respectively.10

In a 1995 Office of National Statistics survey, the prevalence of smoke alarm ownership in public housing (73%) was the same as that in owner occupied housing (72%).11 Some local authorities have committed to installing alarms in all their housing,12 which may explain these data. However, not all local authorities have made this commitment. In addition, the national survey did not assess the extent to which smoke alarms in council housing were properly installed and functioning.

In inner London, the majority of local authorities do not routinely install smoke alarms in existing council housing (except as required by law or building regulations13), primarily because of concerns about potential liability from the failure to maintain them once
For a given alarm, there may be more than one reason for “failure”.

Testing refused or impossible because of ceiling height in three households; two alarms lacked housing.

For a given alarm, there may be more than one reason for “incorrect installation”.

Table 1 Smoke alarm ownership, installation, and function in inner London council housing

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number/number of participants</th>
<th>% (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ownership and installation (by inspection)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least one smoke alarm present</td>
<td>89/228</td>
<td>39 (33 to 46)</td>
</tr>
<tr>
<td>At least one installed alarm</td>
<td>71/228</td>
<td>31 (25 to 38)</td>
</tr>
<tr>
<td>At least one correctly installed alarm</td>
<td>38/228</td>
<td>17 (12 to 22)</td>
</tr>
<tr>
<td><strong>Reasons for incorrect installation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(all incorrectly installed alarms)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On wall: 25/43 (58%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 30 cm from walls, lights, or corners: 12/43 (28%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In or near kitchen: 8/43 (19%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None on bedroom level: 5/43 (12%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least one installed alarm with positive button test†</td>
<td>36/223</td>
<td>16 (12 to 22)</td>
</tr>
<tr>
<td>At least one installed, functioning alarm†</td>
<td>32/225</td>
<td>16 (12 to 22)</td>
</tr>
<tr>
<td>At least one correctly installed, functioning alarm‡</td>
<td>21/225</td>
<td>9 (6 to 14)</td>
</tr>
<tr>
<td><strong>Reasons for failure (all installed, non-functioning alarms)</strong>‡</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery dead: 2/46 (4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm malfunction: 4/46 (9%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*For a given alarm, there may be more than one reason for “incorrect installation”.
†Testing refused or impossible because of ceiling height in three households; two alarms lacked test buttons.
‡For a given alarm, there may be more than one reason for “failure”.

Knowledge were drawn from Home Office fire safety information.14 We also assessed recognition of photographs provided by the Home Office from recent smoke alarm campaigns. The inspection and testing procedures were developed from information provided by the London fire brigade and by the Home Office, and included the use of canned smoke to test alarm function.15 We pilot tested the survey, inspection, and testing procedures in 15 council households.

We calculated exact binomial 95% confidence intervals (CIs) for proportions using Epi-Info 6 software (Centers for Disease Control and Prevention, Atlanta, Georgia, USA, 1997). We used logistic regression to estimate odds ratios (ORs) and 95% CIs for predictors of having an installed and functioning smoke alarm, using EGRET software (Cytel Software Corporation, Cambridge, Massachusetts, USA).

The Great Ormond Street Hospital/Institute of Child Health research ethics committee approved the study.

Methods

From a sampling frame of the addresses of all council housing located in wards with Jarman underprivileged area scores11 of 20 or more (indicating substantial material deprivation) in the inner London boroughs of Camden, Hackney, Hammersmith and Fulham, Haringey, Islington, Lambeth, Lewisham, Newham, Tower Hamlets, and Wandsworth, the Royal Borough of Kensington and Chelsea, and the City of Westminster, 8–12 July 1999).

We inspected council housing in a multi-ethnic, low income urban area in inner London where the councils do not routinely provide smoke alarms, in order to assess the prevalence of installed and functioning smoke alarms.

Results

Twenty addresses were vacant (18), owner occupied (one), or outside the study wards (one). Of 315 eligible addresses, 252 occupants (80%) responded to at least one survey question, 235 (75%) completed the survey (including four surveyed by telephone), and 228 (72%) consented to inspection. Ten (3%) refused any participation and the remainder (17%) were never found at home. Most participants (86%) had lived at their current address for more than two years. Adults aged 65 years or older occupied 32% of households, and children under 5 years old were present in 14% of households. There were, on average, 2.3 occupants per household.

One hundred and eight respondents (43%, 95% CI 37% to 49%) reported owning at least one smoke alarm, while 73 (31%, 95% CI 25% to 37%) reported owning at least one alarm for each habitable floor level (as is recommended by the Home Office). On inspection, 39% (95% CI 33% to 46%) owned at least one alarm, but only 16% (95% CI 12% to 22%) had any installed, functioning alarms. Households with children aged less than 5 years old were more likely to have an installed, functioning alarm than were those without young children (23% ± 13%, respectively), but this difference was not significant (OR 1.7, 95% CI 0.6 to 4.7). Inspection and questionnaire results are shown in tables 1 and 2.

We assessed the effect on having an installed and functioning smoke alarm of fire safety knowledge, awareness of fire safety and smoke alarm campaigns, household composition, type and size of accommodation, and duration of tenancy. In a multivariate model, living in a terraced or semi-detached house versus a flat (apartment) or maisonette (OR 3.2, 95% CI 1.1 to 10.0), having two adults versus one adult in the home (OR 2.8, 95% CI 1.2 to 6.5), and recognising stills from a Home Office television campaign promoting smoke alarms (OR 2.4, 95% CI 1.1 to 5.5) were significantly
Table 2 Smoke alarm maintenance, and fire safety knowledge and awareness among inner London council tenants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number/number of participants % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery ever replaced*</td>
<td>61/86 (71 to 80)</td>
</tr>
<tr>
<td>Battery replaced within past year*</td>
<td>50/86 (58 to 69)</td>
</tr>
<tr>
<td>Battery test button ever pressed*</td>
<td>51/86 (59 to 70)</td>
</tr>
<tr>
<td>Battery test button pressed within last 4 weeks*</td>
<td>28/86 (33 to 44)</td>
</tr>
<tr>
<td>Alarm ever vacuumsed*</td>
<td>16/86 (19 to 28)</td>
</tr>
<tr>
<td>Alarm vacuumsed within past year*</td>
<td>16/86 (19 to 28)</td>
</tr>
<tr>
<td>Any false or nuisance alarms (eg, from smoking)*</td>
<td>58/86 (67 to 77)</td>
</tr>
<tr>
<td>Alarm vacuumed within past year*</td>
<td>16/86 (19 to 28)</td>
</tr>
<tr>
<td>Any fire safety home improvements (other than alarm)*</td>
<td>52/236 (22 to 78)</td>
</tr>
<tr>
<td>Knows correct first response to chup pan (exposed deep fat fryer)</td>
<td>52/236 (22 to 78)</td>
</tr>
<tr>
<td>Recognises Home Office billboard campaign photograph‡</td>
<td>144/230 (63 to 69)</td>
</tr>
<tr>
<td>Any household fires in the past year</td>
<td>9/235 (4 to 7)</td>
</tr>
</tbody>
</table>
|                              *Among subjects reporting at least one installed smoke alarm.  
†Fire extinguisher or blanket, escape ladder, replacement of electrical equipment, other changes for example, rewiring, fire doors.  
‡Four participants surveyed by telephone did not view photographs; one participant refused to view the billboard campaign photograph because of its content.

Discussion

Less than 40% of council tenants in this materially deprived, inner London community owned a smoke alarm. Home inspections showed, moreover, that 20% of these alarms were not installed, and nearly half of installed alarms did not function. Thus, only 16% of council tenancy households had at least one installed and functioning smoke alarm. Non-function was most often caused by an absent or disconnected battery, rather than by alarm or battery failure. Batteries are commonly removed or disconnected in response to nuisance alarms and to the low battery warning sound. Among owners, having changed the battery within the past year strongly predicted alarm function, after adjustment for other factors associated with alarm function, including fire safety knowledge and awareness. Smoke alarm function was more likely in households where the occupants recognised photographs from Home Office smoke alarm promotion campaigns, suggesting that such campaigns may persuade some tenants who own an alarm to maintain it.

The local authorities in the two study boroughs do not routinely install smoke alarms in existing council housing, except as required by law (for example, for houses in multiple occupancy) or by building regulations (that is, in new construction or substantial renovation), and in special circumstances such as sheltered accommodation or major rewiring. This policy is consistent with that of nine of the 10 other inner London local authorities that we informally surveyed. Hence, our results are likely to be generalisable to other inner London authorities, and to other urban, materially deprived boroughs with similar policies.

It is unlikely that many families living in poverty will identify either buying a smoke alarm or maintaining its battery as a high priority. Hence, in the absence of a commitment from the council, relatively few council tenants in materially deprived areas will have installed, functioning alarms. These results may help explain the steep social class gradient in fire related deaths among children. Because fire and flames are a leading cause of death among children, particularly among children in poverty, an increase in functioning smoke alarms in council housing could have important benefits for child health.

As part of its “National Contract on Accidents”, the government has recommended smoke alarm installation to reduce accidental deaths. Promoting the need to have a properly maintained smoke alarm is a centre piece of the government’s new strategy to reduce dwelling fire deaths by 20% by 2003. Most inner London authorities do not routinely install alarms because of cost and concerns about potential liability in the event that tenants fail to maintain their alarms. The installation of hard-wired smoke alarms, which do not require annual battery change, is one potential solution. However, such alarms are relatively expensive to purchase and install (requiring an electrician), which may be problematic for councils stretching their funds to meet other obligations. Smoke alarms with 10 year batteries, which are less costly to purchase and install...
and also do not require annual battery changes, may be a more cost effective option. Addressing
council concerns about liability—for example,
through legislative protection—may also be effective. Since some councils provide alarms to all tenants despite these concerns (depending, for example, on release forms or tenant instructions), sharing information on methods to address liability concerns is another potential solution. There is an urgent need to identify effective and cost effective methods to increase the prevalence of installed, functioning smoke alarms in materially de-
prived council households.

We thank the participating council tenants, the London
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Chronic pain from the appendix

"Appendixes never grumble, they either shout or remain silent." That was
the teaching I was brought up with and have taught to others, and it is
probably regarded as almost axiomatic by many readers of this journal.
Nevertheless attempts have been made from time to time to implicate the
appendix as the source of chronic or recurrent abdominal pain. Now a sur-
geon in Cincinnati, Ohio has reported his extensive experience (Journal of
Pediatric Surgery 1999;334:950–4). Over 12 years (1985–97) he operated on 52 patients with chronic right
lower quadrant abdominal pain. Fifty of them were followed up for at least
a year. All were judged before operation to have had "appendiceal colic" for
at least a year, the interval between attacks being very variable.
Appendiceal colic was diagnosed when, during an attack, the patient suf-
fered abdominal colic and had tenderness at McBurney's point. There was
usually severe pain making the patient curl up and writhe, and often retch-
ing or vomiting with facial pallor or flushing and a clammy skin or sweating.
Food or drink characteristically exacerbated the pain and this was
often used as a provocative test in the surgeon’s consulting room.

The 50 patients (37 female) followed up were aged 5–20 years. Almost half
of them (23) had attended the emergency department or been admitted to
hospital because of previous episodes. Preoperative investigations such as
abdominal ultrasound or gastrointestinal contrast studies proved unhelpful
and were eventually abandoned as a routine. None of the removed
appendixes showed acute or chronic appendicitis histologically. Seven were
entirely normal and the most common findings in the rest were fibrosis (15),
faecolith (13), and kinking (15). Forty nine patients were cured of their pain
on follow up and the one remaining developed ureteric colic.

This experienced surgeon insists that appendiceal colic is a specific condi-
tion which can be diagnosed clinically and cured by appendicectomy.
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