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## **ARSON CONTROL FORUM**

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Research Bulletin no. **9**

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# **Learning Lessons from Real Fires: Findings from Fatal Fire Investigation Reports**

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### **Foreword**

In 2004, the Fire and rescue service recorded a total of 97,300 building fires, of which 59,700 were in dwellings and 37,600 were in other buildings (commercial premises, schools etc.). These fires cost the economy over £7 billion of which £2.44 billion was attributed to arson.

Understanding how fires are caused and how they evolve is essential to developing strategies to prevent similar fires occurring and minimising fire losses. The identification and elimination of hazardous products or careless behaviour can help to prevent accidental fires and also help us devise better building regulations and codes of practice. This means that fire safety advice can be developed to meet particular risks. In the case of deliberate firesetting, effective fire investigation enables those responsible for deliberate fires to be identified and prosecuted.

This bulletin provides an overview of some of the findings from an analysis of a cross-section of fatal Fire Investigation Reports. It identifies several factors that are associated with fire deaths, such as alcohol, the absence of smoke alarms, the careless use of smoker's materials and the age and mobility of the victim. This information will help us to target those most at risk in our communities and provide effective fire safety messages to vulnerable groups.

It is important for public safety that we understand how fires occur and how human behaviour contributes to the overall problem. I therefore welcome this report and commend it to all those who have an interest in promoting fire safety.

ANGELA SMITH MP  
Parliamentary Under Secretary of State  
Department for Communities and Local Government



## Introduction

Research is required to increase our understanding of what actually happens before, during and after a fire.

There is a gap in our knowledge regarding how human behaviour and characteristics<sup>1</sup> contribute to the cause of a fire, and a person's ability to raise the alarm, fight the fire or escape once a fire has started.

Fire and rescue services have the power under the Fire and Rescue Services Act 2004 to undertake fire investigations, but all services have historically undertaken this task, particularly for major fires. However, these reports are not routinely collected or analysed centrally. An analysis of such reports would increase our understanding of what happens during a fire and thus could be used to enhance good practice messages for fire safety and prevention work and potentially building design.

A number of socio-demographic and behavioural factors are known to increase the risk of experiencing a domestic fire, and of being killed once a fire has started. Factors that increase the risk of suffering a domestic fire include:

- The household has previously been a victim of crime
- Lone parents/adults with children compared with single adults
- Whether householders have a disability
- Whether a household contains a smoker
- Social renters compared to homeowners
- Dwelling is in a poor physical condition
- Households with elderly and geriatric people, particularly those living alone<sup>2</sup>

People in households without a functioning smoke alarm are at greater risk of being killed or injured once a fire breaks out. In addition to many of the factors listed above, non-smoke alarm ownership is also influenced by ethnicity (minority ethnic households are less likely to own an alarm) and financial instability.

Earlier research highlighted the role played by other factors including alcohol consumption and disability – a study based on around 400 Fire Investigation Reports in the mid-1990s found that 10% of deaths related to alcohol, and 8% of victims were physically impaired in some way (Causes of Fire Deaths, Home

Office, 1997).

Fire Statistics collected by US municipal fire departments estimate that 12% of fire deaths between 1999 and 2002 were linked to alcohol (10%) or other drugs (2%). However, the National Fire Protection Association – the body that publishes the data – believe that there could be under-recording, perhaps because symptoms may not be immediately obvious, but also because this could be seen by some as '*blaming the victim*'. Research from two US states (Minnesota in the 1990s; Maryland in the 1970s) showed that between 46-51% of adult fatalities had blood alcohol concentrations greater than 0.1 grams per decilitre (the drink drive limit in many US states). A study of fire deaths in Alabama in the 1990s showed a similar proportion (45%)<sup>3</sup>. A 1999 meta-analysis also estimated that alcohol contributed to an estimated 40% of residential fire deaths in the US (Smith et al, 1999).

A closer look at human behaviour in fire will therefore be of use in improving community fire safety messages for both preventing fires and action if a fire breaks out; and also to provide good practice advice for agencies that may have the opportunity to intervene with at risk groups earlier.

The aims of the project are therefore to:

1. **Improve knowledge of the influence of human factors before, during and after a fire**, with particular reference to those factors, such as alcohol abuse and disability, that current sources of data do not record and to show how the different human factors that influence fire risk interact.
2. **Make recommendations on how to improve community fire safety practice to reduce dwelling fires, deaths and injuries.** An analysis of the circumstances that lead to fire deaths may show that, with the benefit of hindsight, many deaths were preventable. The study will therefore highlight areas where a local initiative – whether from an individual body or via a multi-agency approach – could have helped, and make appropriate recommendations.
3. **Inform the development of a more structured approach to gaining information from real fires through fire investigation.**

The consultants Greenstreet Berman Ltd were contracted by the (then) ODPM to examine a sample of fatal Fire Investigation Reports. The full report will be published by the Department for Communities

1 The term 'Human Factors' is used to describe human behaviours that can be changed in the short term (e.g. smoking, drug use) and more static characteristics (e.g. disability, age, level of education, income)

2 Source: British Crime Survey 2002/3, ODPM (2004).

3 The full US municipal fire statistics and the relevant references for the Minnesota, Maryland & Alabama studies are quoted in Hall (2005).

and Local Government (DCLG) in 2006. This bulletin discusses a sample of 535 individual fatal fire reports in terms of the characteristics of the victims including age, sex, household structure, mental or physical impairment and substance use, including alcohol. The reports analysed also show where victims had prior contact with local agencies.

### Characteristics of the sample

A total of 535 fatal Fire Investigation Reports were received from 27 individual fire and rescue services. Of these, 342 (64%) were received from six metropolitan fire and rescue services; nonetheless 193 (36%) came from a large range of non-metropolitan fire and rescue services. In comparison, UK fire statistics show that around 45% of all accidental dwelling occurred in metropolitan fire and rescue services, indicating a bias towards metropolitan fire and rescue services within this sample. Nonetheless the research does cover a range of rural areas.

The majority (526) of fires studied occurred between 2002 and 2005. In total, the sample analysed by Greenstreet Berman contains nearly half of all accidental fatal dwelling fires that occurred in England between 2002 and 2004. The findings reported should therefore be seen as representative.

86% (464) of the fires in the sample were started accidentally with the remainder non-accidental (including arson and suicide).

Of the 535 fatal fires, 491 (92%) involved a single victim, 6% – two victims, 1% – 3 victims, 1% – 4 victims with one fire involving 8 fatalities. In total the 535<sup>4</sup> fires led to 598 deaths.

### Gender, age and household structure

The risk of fatal fires differs according to household composition. In particular, single person dwellings are at disproportionately greater risk. Around three-quarters of fatal fires in the sample involved single persons. In comparison, the recent census showed that only 30% of households in the country are single-adults without children.

**Table 1: Household type and fire risk**

| Household type                          | N (%)     |
|---|-----------|
| Single adult male                       | 212 (40%) |
| Single adult female                     | 147 (27%) |
| Single adult with children              | 32 (6%)   |
| All single adult household              | 391 (73%) |
| Couples with one or more children       | 34 (6%)   |
| Couples without children                | 46 (9%)   |
| Adults (not related, e.g. flat sharing) | 25 (5%)   |
| Other/not stated                        | 39 (7%)   |
| All fires                               | 535       |

In terms of housing type, terraced housing is at marginally disproportionate risk of suffering a house fire (33% of the fires in the sample occurred in terraced housing, whereas 27% of the population live in terraced housing).

### Victim information: Age and sex

The majority of fatal fires involved those over the age of 80 years (19%), with 63% of fires involving people over 50. Table 2 shows the profile by age of fire victims for the 403 fatalities where age was identified.

**Table 2: Age and risk**

| Age group | Number/proportion all fire deaths in sample | Prevalence within general population (2004) <sup>1</sup> |
|-----------|---|--|
| 0-9       | 16 (4%)                                     | 12%  |
| 10-19     | 8 (2%)                                      | 13%  |
| 20-29     | 39 (10%)                                    | 12%  |
| 30-39     | 42 (10%)                                    | 15%  |
| 40-49     | 44 (11%)                                    | 14%  |
| 50-59     | 66 (16%)                                    | 13%  |
| 60-69     | 48 (12%)                                    | 9%   |
| 70-79     | 64 (16%)                                    | 7%   |
| 80 & over | 76 (19%)                                    | 4%   |
| Total     | 403   | 100%   |

Source: <sup>1</sup>2004 mid-year population estimates, Office National Statistics

4 Unless otherwise stated, all percentages used in this report use 535 – the number of fire reports – as the base

By comparing the age structure of the fire fatalities within the sample of Fire Investigation Reports<sup>5</sup> with the age structure, we can see that relative risk increases with age. Those between 70 and 80 are twice as likely to be killed in a house fire than we would expect given their prevalence within the general population (16% compared with 7%), with those over 80 nearly **five times more likely** to be killed in a house fire than would be expected (19% compared with 4%) given the current age-profile of the population.

Marginally more males were victims of fires within this sample than females (56% of victims were males and 43% female, 1% not stated).

### Immediate cause of fire

The single most common cause of fire is 'careless use of smokers materials', responsible for at least 220 accidental fatal fires (49%) with chip pans/cooking responsible for 80 fires (18% of all accidental fatal fires).

These proportions are broadly in line with the published UK fire statistics. In 2004 smokers' materials (including cigarette lighters and matches) were the source of ignition for 44% of accidental fire deaths, with cooking appliances responsible for 16% (ODPM, 2006).

| Accidental                                     | N (%)      |
|--|------------|
| Careless use of smokers' materials             | 220 (49%)  |
| Chip pan                                       | 47 (11%)   |
| Careless use of heat emitting electrical items | 42 (9%)    |
| Cooking  | 33 (7%)    |
| Naked flame                                    | 28 (6%)    |
| Candles/incense                                | 29 (6%)    |
| Electrical appliances malfunctioning           | 23 (5%)    |
| Children playing with matches                  | 13 (3%)    |
| Covering electrical equipment                  | 8 (2%)     |
| Gas leak                                       | 3 (1%)     |
| All accidental                                 | 446 (100%) |

A detailed analysis of Fire Investigation Reports will shed light on the human factors that contribute to these immediate causes.

### Mental and physical impairment

An analysis of Fire Investigation Reports shows a high level of mental and/or physical impairment among fatal fire victims, summarised in the table below. Reports often refer to 'impairment' whether due to mental or physical factors (including age), or due to alcohol or drug use. The precise nature of the impairment is not discussed in detail. Typically, the report would state within the main narrative that the victim(s) had disability problems, or suffered from depression, or that there was evidence of alcohol consumption – e.g. empty bottles – prior to the fire. Nonetheless the information gleaned is sufficient to draw some robust conclusions on the contribution of impairment to fatal fires.

#### Mental impairment

Eighty fires (15%) involved victim(s) who suffered some form of mental impairment. The nature of the Fire Investigation Reports means that descriptions of conditions are usually quite generic (e.g. 'depression') rather than detailed clinical diagnosis. The main categories are shown in table 4:

| Mental impairment          | N (%)    |
|----------------------------|----------|
| Depression                 | 36 (7%)  |
| Other mental illness       | 32 (69%) |
| Age related mental illness | 11 (2%)  |
| Learning difficulties      | 1 (-)    |
| All mental impairment      | 80 (15%) |

Depression was the biggest single category – 7% of all house-fires involved one victim with diagnosed depression. In terms of age, 50-59 year olds represent the biggest single category, accounting for 22% of all cases of mental impairment.

The prevalence of depression within the general population is hard to establish. The National Institute of Clinical Excellence (NICE, 2004) estimate that 21/1000 (2%) of the population has a major depression at any one point in time (this is the 'point prevalence'). Prevalence rates do vary according to a wide range of socio-economic factors. For example, among single persons living alone – the majority of fire victims in this sample – depression tends to be more common<sup>7</sup>.

5 The age profile of the sample is broadly comparable with the profile of all fire victims reported with UK fire statistics. The only notable difference is for infants: 4% of fatalities within this sample are under 9 years of age, compared with 9% cent of all building fire victims in England between 2002 & 2004. All other age-groups within the sample were within 1 or 2 percentage points of the national figure.

6 Cause of accidental fire "not known" for 18 fires.

7 For example, depression is more prevalent among people who are separated, widowed males & divorced females – three common reasons why a person may live alone – and less common among married couples (NICE, 2004).

### Physical impairment

The analysis showed that a significant proportion of fatal fires involved at least one victim with a physical impairment – at least 30% of all fatal fires (159). 19% involved victims with some form of limited mobility (including wheelchair users or those bedridden). A small number of fatal fires involved those with visual or hearing difficulties.

| Physical impairment                      | N (%)     |
|--|-----------|
| Limited mobility                         | 101 (19%) |
| Other condition                          | 21 (4%)   |
| Condition causing lapse in consciousness | 10 (2%)   |
| Wheelchair user                          | 9 (2%)    |
| Bedridden                                | 8 (1%)    |
| Visual/hearing                           | 8 (1%)    |
| Unknown                                  | 2 (–)     |
| Total                                    | 159 (30%) |

The Department of Health estimate that 18% of the general population have either a moderate or serious disability, a rate that increases significantly with age: three-quarters of those over 85 have a disability.

### Age related impairments

Age related impairment is a significant factor in the risk of a fatal fire occurring, with 39% of fatal fires within the sample involving age-related impairments (35% elderly; 4% young infant).

### Substance use and fatal fires

Substance use, whether illegal or legal, was common at the time of the fire. In total, for 251 fires (47%) the Fire Investigation Report indicated that the victim was impaired by a substance at the time of the fire – in other words, evidence that the person was, to some degree, under the influence of the substance at the time of the fire.

| Substance use                 | N (%)     |
|-------------------------------|-----------|
| Alcohol                       | 178 (33%) |
| Prescribed drugs              | 65 (12%)  |
| Non-illegal substance (glue)  | 1 (–)     |
| Class A                       | 1 (–)     |
| Illicit drugs – not specified | 5 (1%)    |
| Class C                       | 1 (–)     |
| All substance abuse           | 251 (46%) |

Alcohol use was often associated with fires at weekends and during the night. Substance use was strongly associated with 50-59 year-olds, but was less common among the elderly.

| Impairment   | As a cause of the fire | As a factor effecting response to the fire |
|--|------------------------|--|
| Alcohol  | 135 (25%)              | 137 (26%)                                  |
| Mobility including bedridden/wheelchair user       | 44 (8%)                | 80 (15%)                                   |
| Depression/Other mental illness                    | 31 (6%)                | 30 (6%)                                    |
| Prescribed drugs                                   | 24 (4%)                | 33 (6%)                                    |
| Age related physical impairment                    | 30 (6%)                | 22 (4%)                                    |
| Neurological impairment leading to unconsciousness | 12 (2%)                | 13 (2%)                                    |
| Age related mental illness                         | 12 (2%)                | 6 (1%)                                     |
| Visual   | 6 (1%)                 | 5 (1%)                                     |
| Oxygen dependency                                  | 3 (1%)                 | 2 (–)                                      |
| Illicit drugs – all                                | 3 (–)                  | 5 (1%)                                     |
| Hearing  | 2 (–)                  | 3 (1%)                                     |
| Learning difficulties                              | – (–)                  | 5 (1%)                                     |
| All fires  | 302 (56%)              | 341 (64%)                                  |

### Summary: Risk factors directly contributing to the fatal fires

Overall, nearly 80% of all fires involved victims who were impaired in some way, either through substance use, mental or physical impairment, whether or not related to age, or a combination of these factors.

A closer examination of reports sheds light on where the 'impairment' was directly related to either the fire starting (e.g. cigarettes not extinguished due to alcohol-induced sleep, chip pan unattended for the same reason) and/or impeded effective response. Table 7 shows the main factors.

Alongside the immediate causes of a fire (e.g. carelessly discarded cigarettes), **alcohol, mobility and mental illness** are the biggest single influences on whether a fire starts and/or whether it has fatal consequences.

### Smoke alarms and immediate response to the fire

In 30% of fatal fires in this sample there was no smoke alarm. In 23% of fatal fires a smoke alarm functioned correctly. Only 7% of reports stated why there was no alarm. The main reasons stated for a lack of a smoke alarm were:

- Lack of awareness of fire risk
- Status as tenants
- Alarm regarded as a nuisance

The proportion of fatal fires without a smoke alarm (30%) is lower than the proportion in the UK fire statistics, where over half of all fatalities in accidental dwelling fires occurred in fires without alarms. For 57% of fires in this research there was no smoke detector present or information on smoke alarm presence was not included in the Fire Investigation Report. (However, fire and rescue services have to include smoke alarm information in the fire data report forms completed for each primary fire. These form the basis of national fire statistics, so this data source is comprehensive).

In most fatal fires (70%) there was no immediate response from the victim, usually due to being asleep/unconscious or otherwise immobile due to some form of impairment. In 17% of fires (73) the victims' first response was to investigate or attempt to tackle the fire, which is contrary to fire and rescue service advice.

### Contacts with agencies

A minority of fatal fires victims had had some prior contact with fire and rescue service or other agencies, although in over half of Fire Investigation Report's studied prior contact was not reported.

- 31% of fatal fire victims had been in contact with an agency other than the fire and rescue service (e.g. social services)
- 5% of fatal fires happened to people already in a care environment
- 6% of fatal fires involved victims that had previous contact with community fire safety

### Quality of reporting

The tentative nature of some findings was in part due to the variable quality of reporting. Table 8 describes the quality of reporting of various factors. In general, those factors that are reported tend to be those included in the fire data report form that fire and rescue services must complete for every fire.

More consistent data collection would allow for more consistent identification of risk factors. For example, some Fire Investigation Reports always explore **whether or not** certain factors, such as disability, are relevant, whereas many reports only mention such factors when they appear to be relevant. If all Fire Investigation Reports also considered an agreed number of potential causal factors for each fatal/serious fire, then a more comprehensive picture of risk could be developed.

### Discussion

The majority of cases can be summarised as:

- Single persons impaired by substance, age or depression
- Carelessly ignited textiles in their immediate environment – often by a cigarette or other naked flame
- Failure to react effectively due to impairment, sleeping or lack of smoke alarm
- Fires discovered by neighbour, visitor or passer-by (because person is alone)

A number of 'case studies' emerge from the findings. In terms of local or national community fire safety campaigns, the following generic case-study groups can be identified:

- Elderly man with limited mobility, smoking, impaired by alcohol
- Depressed middle-aged person all alone at home
- Struggling single-parent family

| Poorly reported factors   | Adequately reported factors                      | Well reported factors  |
|---|--|--|
| Tenure  | Postcode   | Late call  |
| Deprivation   | Indicators of household behaviour towards fire   | FRS  |
| Overcrowding  | Substance use                                    | Type of premise  |
| Ethnicity   | Mental impairment                                | No. occupants and visitors in building/relationships between occupants |
| Building design impact on consequences of fire                      | Physical impairment                              | Cause of death   |
| Reason for lack of smoke alarm                                      | Age related impairment                           | Date/time  |
| Previous contact with Community Fire Safety/Fire and Rescue Service | Victims activity at time of fire                 | Household type   |
|   | Misguided behaviour                              | Location of fire   |
|   | Impairment contribution to the cause of the fire | Probable cause of fire   |
|   | Initial response to fire                         | Inappropriate attitudes & behaviours                                   |
|   | Rescue effected by impairment/escape behaviour   | Whether fire was due to human behaviour or not                         |
|   | Condition of smoke detector                      |  |
|   | Prior history of contact with other agencies     |  |

- Single elderly women with limited mobility alone and impaired; fire due to careless use of cigarettes or cooking.
- All age groups – fall asleep with no functioning smoke alarm
- Young or middle aged adult, careless use of cigarette (with or without alcohol)
- Young adults coming in after a night out drinking, making themselves some food, leaving stove unattended

Fire and rescue services are currently engaged in extensive community safety related activity, in particular home fire safety checks. The findings of this study should help improve targeting of such activity, particularly whether partnerships with other agencies (e.g. social services, charities) would improve effective practice. Alongside national fire campaigns focussing on smoke alarm ownership maintenance, DCLG do run a number of targeted campaigns for specific communities (e.g. around the festival of Diwali). The findings of this work, not to mention more consistent data collection in the future, will help identify other risk groups who could be targeted via national media campaigns.

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The full report by Michael Wright and Greenstreet Berman Ltd will be published online by DCLG in 2006.

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