

The older adult: Associated fire risks and current challenges for the development of future fire safety intervention strategies

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Summary

Research has highlighted that older people, that is, those aged 60 and over, are over-represented in fatal fire statistics across the globe. The aim of this study was to investigate the circumstances surrounding fatal fires involving older people and examine the role of individuals and agencies that are in contact with the most vulnerable and how they can be involved in reducing fire risk. The study was conducted in two phases. Firstly, a retrospective analysis was conducted of the circumstances surrounding 99 accidental fatal dwelling fires involving 100 older people during a 20-year period. Results suggested that most fires ignited in the living room or the bedroom and these were also the most common locations of the fatalities. The most common causes of the fire were smoking materials, hot coals, cooking and electrical faults and the majority of older fire fatalities had a smoke alarm which operated. Importantly, there was evidence of regular contact between the fatality and at least one other individual from the community prior to the fire. For this reason, the second phase of the research involved focus groups with friends, relatives, neighbours and carers of older people with a view to understanding their attitudes and experiences with regard to fire safety. Overall, the focus groups provided evidence that those in contact with older people regularly observe fire risks in the homes of older people. In addition, gaps were evident in the fire safety knowledge, not only of older people, but also for those assisting older people. In light of the findings, this article also considers the core messages that should be included in any potential future fire safety intervention strategies aimed at the older adult.

KEYWORDS

Carers, Dwelling, Fire risks, fire safety, intervention strategies, older people

1 | INTRODUCTION

Over the last decades, there has been a gradual decrease in the number of fires in dwellings in Great Britain and an associated reduction in related dwelling fire deaths, that is, in the financial year 1981 to 1982 there were 937 fire deaths in dwellings in Great Britain and in 2017 to 2018 this reduced to 394.¹ Although the number of deaths has

been decreasing, a closer look at the statistics indicates that older people, that is, those aged 60 and over, continue to be the most over-represented age group when population is considered.¹ This is a cause for concern given that, globally, we are an ageing society with most countries experiencing growth in the number of older persons, a situation which is predicted to accelerate in the decades to come, particularly in urban areas.² In 2015, for example, it was estimated that one

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in eight people worldwide was aged 60 years or over; by 2050 this is predicted to be one in five.² In England in 2017 to 2018, the average deaths per million population (pmp) in fires was 6, but was higher (8.4 pmp, 8.8 pmp and 19.5 deaths pmp) for those aged 55 to 64, 65 to 79 and over 80 years respectively.¹ In the United States, the statistics are similar, with 30% of all fire fatalities being over 65 years old, even though this age group only comprise 13% of the population.³ In Northern Ireland, older adults are also over-represented in fire statistics; between 1999 and 2009, 46% of all fatalities in accidental dwelling fires were over 60 years old compared to 18.4% of the population in this age category.⁴

Elder et al.⁵ have highlighted that the risk factors for the older population differ from other age groups. Throughout the literature, it is clear that the risks associated with older adults are complex and characterised by many interlinking factors.⁴⁻⁶ A major risk factor for older people is a decline in their physical health.^{3,4,7,8} Age is directly related to a deterioration of physical, mental and neurological functions.^{9,10} Chronic conditions of ageing include cardiovascular disease, stroke, diabetes, cancer, arthritis and osteoporosis.² Not surprisingly, the prevalence of disability increases with age¹¹ and mobility impairments, in particular, are more prevalent in older age groups, for example, in one study, 7.6% of working age adults had a mobility impairment compared to 30% of pension age.¹² Physical disability is also mentioned more frequently in fire fatality investigations as age increases.⁸ In one study, where disability was deemed to have had a direct influence on the outcome, 60% were over 65 years old.³ Harpur⁴ emphasises the role a decline in physical health plays in individuals becoming a victim of fire and suggests that restricted mobility reduces the capacity to escape, even if an early warning is present. While investigating community fire safety (CFS) strategies for older age groups, Diekman et al.⁷ noted that older people frequently expressed concern that their restricted mobility would not only make it difficult for them to escape in the event of a fire but also prevent them from carrying out prevention measures.

Some older people may also have a decreased capacity to identify risk from fire⁵ which may be due to either physical or cognitive frailty.¹³ For older people, clothing catching fire, especially while cooking, has been identified as a significant problem.¹⁴ Harpur⁴ identified that 89% of fatalities over 60 were associated in some way with ignition of the fire. The findings from both studies lend support to the suggestion that older people may not be aware of fire-related risk.

Some studies also suggest that older people may have a more relaxed approach to fire safety.¹⁵⁻¹⁷ Hodsoll and Nayak,¹⁵ for example, found that 87% of older adults did 'not worry at all', or 'only occasionally worried', about the risk of fire in their home. While this study did not compare older people to the general population, it did conclude that older people both under estimated the threat from fire and overestimated their ability to extinguish a fire in their home.¹⁵ In Australia, a study, related to bush fires, discovered that older adults considered the risk from fire to be lower than younger adults.¹⁶ Coty et al.¹⁷ also reported that many of the older adults questioned in their study were unable to formulate a fire escape plan and were ignorant to preventative fire safety measures; when questioned as to the reason for this they often cited health problems.

Living alone is a common risk factor generally, and also, for those aged 60 and over.^{4,14} Harpur⁴ in her study in Northern Ireland, observed that 80% of fatalities, over 60 years old, lived alone; these figures are consistent with other studies in USA and Australia.^{14,18} Living alone reduces the chance of being alerted by the fire by whatever means and thus contributes to a reduction in the effectiveness of smoke alarms.¹⁸

There are several issues around smoke alarms that increase the risk for older people.⁴ Firstly, ownership of smoke alarms has been reported to be lower for older fire fatalities (68.4%) compared to younger (95.6%).⁴ Zhang et al.¹⁹ also reported that ownership of smoke alarms was significantly lower for older people that lived alone (78%), compared to those that lived with others (89%). Secondly, the effectiveness of the alarm for older people has been questioned.²⁰ Barillo and Goode²¹ claim that smoke alarms are not as effective for individuals with a cognitive or physical disability and, as already mentioned, these conditions are more prevalent among the elderly.²² Bruck and Thomas²³ have highlighted that hearing a smoke alarm may also be an issue for older people as 14% to 18% of participants slept through three different types of smoke alarm signals at 75dBA which, at the time, was the minimum requirement for smoke alarms in the United States. Thirdly, there are issues around the maintenance of smoke alarms in homes of older people. It has been reported that older people are more likely to have smoke alarms that are more than 10 years old³; given that other studies²⁴ found only 33% of smoke alarms to be still functioning after 8 to 10 years, this is an area of concern. Harpur⁴ also noted that 35% of older fatalities had a smoke alarm that failed to operate, which was significantly greater than other adults.

There are also some challenges that are specific to older people that can be barriers to the implementation of fire safety in the home.¹⁷ Harpur⁴ suggested that older people have the preconception that raising a fire safety issue may have an effect on their independence. This is supported by Coty et al.¹⁷ who suggest that maintaining independence is extremely important to older people and argue that their ability to maintain home fire safety is therefore strongly influenced by their own physical and cognitive functioning as well as the availability of support from others.

By understanding the risk factors associated with older people, it is possible to highlight and address issues that may lead to a fatal fire.²⁵ Mayhorn²⁵ emphasises the importance of older people having access to hazard information regarding the risk of fire, and suggests instructional vignettes are employed to warn of the risk factors specific to this demographic. The literature around CFS suggests current attempts to increase awareness of risk factors and safety measures among older people is through leaflet drops, door-to-door visits, community visits and attempts to directly intervene through distribution and fitting of smoke alarms. In the United Kingdom, the door-to-door and community visits take the form of home fire safety checks (HFSC) which involve firefighters visiting homes to assess fire risk, give safety advice and install smoke alarms where required. Mayhorn,²⁵ however, highlights issues of cognitive functioning and recommends that, when delivering fire safety information to older people, issues around

memory and processing are considered to prevent over-load. It is not clear whether such considerations are taken into account as materials for older adults are being developed.

A recurring feature in the literature is that the older people who are most at risk from fire are the most difficult to reach.²⁶ Harpur,⁴ however, has suggested that those deemed 'difficult to reach' may not be as elusive as was once thought. Although the majority of older fatalities in her study were living alone, they were not completely socially isolated that is, many were in contact with other people including care-workers, family, friends and neighbours who had tried to address previous risky fire behaviour. Many studies have recognised the limitations of older people and recognised the need for community workers, nurses, public health officials and all those supporting older people to be aware of fire safety issues and to be able to assist individuals with reducing risk in the home.^{7,13,17,22,27} Most studies agree that the involvement of those around older people could reduce the risk from fire^{7,17,24} but, although some initiatives exist, to date they have not been evaluated.^{15,28,29} Coty et al.¹⁷ suggest that individuals, linked to, or assisting, older people, are key to the fire prevention process as they are in a better position to recognise and reduce risks in the home.

To date, no studies have investigated the support network around older people and how this could be exploited to address fire safety issues in the community. The challenge is to assess what fire safety issues are being identified and faced by the support network around older people, and design and evaluate innovative intervention strategies that can address the problems faced in the community. Clearly, given appropriate education, training and support, such persons could be a useful resource in helping to reduce fire risk in the homes of the most vulnerable.

The aim of the study presented in this article, therefore, was to develop a deeper understanding of the fire risks associated with older people, to explore the types of support networks and the issues being faced by those in contact with older people, and how these networks could potentially be employed to reduce fire risk. Suggestions, based on the evidence provided, of what should be included in any prevention strategy, aimed at the support network around older people, to improve fire safety for older people are presented.

2 | METHODOLOGY

This research involved two phases; the first phase was a quantitative analysis of fire fatalities in Northern Ireland over a 20-year period followed by phase two, which consisted of focus groups with individuals found to be in contact with older fire fatalities. Phase one aimed to provide a deeper understanding of fire fatalities and identify the people that may have had contact with the older person prior to the fatal accidental dwelling fire. This involved an updating and analysis of the Dwelling Fire Fatality Database for Northern Ireland developed by Harpur⁴ to comprise information on all fatalities in accidental dwelling fires in Northern Ireland between 1999 and 2019. This is a collection of data over a 20-year period and has highlighted that family members, friends, neighbours and professionals were in regular contact

with older fire fatalities; both of which are distinctive features of this research. As a result, four focus groups, that encompassed a range of support networks that were identified as being in contact with older fire fatalities in phase 1, were conducted to identify risky behaviours of older persons and the thoughts, feelings, practises and concerns regarding fire safety of those visiting older people.

2.1 | Phase one

This study has followed on from research at Ulster University carried out by Harpur⁴ who used information from both the Corner Service for Northern Ireland and the Northern Ireland Fire Rescue Service (NIFRS) to develop and populate a Dwelling Fire Fatality Database for Northern Ireland. Since Harpur's study, the NIFRS has adopted the Incident Recording System (IRS) and now carries out a detailed Fatal Fire Review following all fatal fires. The IRS, and the Fatal Fire Review Report, contain detailed information on the fatality, the property and the incident that include source of ignition, room of ignition, smoke alarm presence and performance, age of the fatality and gender of the fatality.

Fire Service records were used as the main source of data to achieve the objectives for the first phase of this study. Permission to access records was granted by the NIFRS Assistant Chief Fire Officer and ethical approval was obtained from Ulster University. The coding framework used by Harpur⁴ formed the foundation of the database for this study but only the data for variables that could be confirmed using NIFRS records were updated from the previous study.

A master list of all fatal fires between April 2009 and March 2019 was provided by NIFRS. The inclusion criteria for this study were all fires which started unintentionally and in dwellings, that is, intentional fires were omitted. The information was coded directly into the framework adopted by Harpur⁴ and included information such as:

- the fatality, that is, age, sex, location of fatality
- the property, that is, type, occupancy, location, station area
- the incident, that is, time, cause of ignition, location of ignition, who/what raise the alarm

Since an objective of this study was to gain a better understanding of the support network around older people, three additional fields were created to record regular contact with the victim prior to the incident, that is, was regular contact observed? Who was the main point of contact observed? What other individuals were in contact with the victim? The new database comprised a total of 205 fatalities from 196 incidents for the period 1999 to 2019. One hundred fatalities aged 60 and over were then isolated and form the basis of analysis in phase 1 of this study.

2.2 | Phase two

Phase one highlighted that family members, friends, neighbours and professionals were in regular contact with older fire fatalities between 2009 and 2019. Focus groups were then conducted with

representatives of those groups to identify their thoughts, feelings, practises and concerns regarding fire safety while visiting older people. The focus group discussions centred around what risks, if any, they observe in the homes of older people, what fire safety information they have received to help them identify and manage risks, what fire safety interventions they currently employ and what could be of use to them in the future to increase their awareness of fire safety. The areas of discussion were designed to explore potential gaps in knowledge regarding fire safety, and if needed, what potential fire intervention strategies may be beneficial to the support networks of older people, with a view to increasing their potential to recognise and intervene where appropriate, in the fire safety of older persons with whom they may be in contact. An analysis of the focus groups highlighted several themes regarding attitudes towards fire safety and what any intervention should entail.

Four focus groups were conducted with membership designed to represent the identified social networks of the older fire fatality. Furthermore, to achieve a broad range of society in Northern Ireland, a mix of urban and rural communities were also factored into the design of the focus groups. NIFRS is divided into four areas of command with one being almost entirely urban and the remaining three areas a mixture of urban and rural communities. Both the urban-rural classification and the different areas of command within NIFRS were considered while selecting participants to give a broad representation of the Northern Ireland population and reflect different interventions employed in the different areas of NIFRS. In addition, to be included, participants were required to regularly visit an older relative, friend, neighbour or client.

Professionals were recruited by selecting agencies working with older people in Northern Ireland and inviting them to provide participants. An email, with an information sheet for the study, was sent to managers within the various organisations who suggested the participants that would best fit the criteria; participants then volunteered for the study. To access family, friends and neighbours from an urban and rural environment, an information sheet was emailed to community groups that are proactively working with older people in the community with a request to provide participants. The leaders of these community groups recruited volunteers and the focus groups were conducted during their normal community meetings.

The four focus groups were comprised as follows:

- Focus group 1 – *Professionals*: this included six individuals, at least one representative from each area of command, who are employed to visit older people to provide care or assistance.
- Focus group 2 – *Family friends and neighbours with a fire safety background*: this included five individuals that have knowledge of fire safety and were in regular contact with a relative, friend or neighbour who was over 60 years old.
- Focus group 3 – *Urban family friends and neighbours*: this included eight individuals that visit an older relative, friend or neighbour in an urban environment
- Focus Group 4 – *Rural family friends and neighbours*: this included six individuals that visit an older relative, friend or neighbour in a rural environment.

All but one of the focus groups were recorded using a dictaphone and later transcribed. One focus group was not recorded, at the request of one participant; however contemporaneous and detailed notes were made by the moderator and an assistant. The transcripts of the focus groups were analysed by thematic content analyses using NVivo. The process of data analysis followed Braun and Clarke's³⁰ Phases of Thematic Analysis. The recorded focus groups were transcribed, and notes were collated from the session that was not recorded. The transcripts and notes were read, and re-read, while taking notes of initial ideas. Codes were then generated, and *nodes* were created in NVivo. Themes linking the codes were defined including sub-themes where appropriate. To ensure the reliability of the thematic analyses, transcripts were reviewed and blind coded by two members of the research team. The emergent themes and subthemes were discussed, consolidated and agreed.

3 | RESULTS PHASE 1 (DATABASE)

The database included information on 99 incidents, which resulted in 100 fatalities who were over 60 years of age. This represented 48.8% (n = 100) of all fire fatalities (n = 205) in the 20-year study period, that is, April 1999 to March 2019. Most of the fatalities were male (59%, n = 59) and the older fatalities were fairly evenly distributed among the age groups with 30% (n = 30), 38% (n = 38) and 32% (n = 32) in the 60 to 69, 70 to 79 and over 80 age groups respectively.

3.1 | Circumstances surrounding older fire fatalities

Table 1 shows the most common rooms of origin of the fire, sources of ignition and locations of the fatality. From Table 1, it is evident that the living room and bedroom were the most common rooms of fire origin, with over 70% of fires originating in these locations. These rooms were also the most common location of the fatalities (52%,

TABLE 1 Most common fire incident characteristics for fatalities over 60 years old^a

Factor	Most common for older fatalities	% of incidents/fatalities (number)
Room of fire origin	Living room	46.5 (n = 46)
	Bedroom	24.2 (n = 24)
Source of ignition	Smoking materials	44.4 (n = 44)
	Hot coals	13.1 (n = 13)
	Cooking	8.1 (n = 8)
Location of fatality ^b	Electrical fault	6.1 (n = 6)
	Living room	34 (n = 34/100)
	Bedroom	18 (n = 18/100)

^aThese do not add to 100% as only the most common factors are included.

^bValue refers to the total number of fatalities.

n = 52). Almost half (47%, n = 47) of fatalities were found in the room of ignition. However, this was not always the case for example, in two incidents, the victim was found in the living room, but the fire had started in a utility/laundry room and in three cases it was established that the victim had moved around after ignition possibly to fight the fire, two being found in the kitchen and one in the hall. Another fatality was not in the property at the time of ignition but entered to fight the fire.

Cross analysis between the room of ignition and cause of ignition determined that the majority of fires started by smoking materials originated in the living room (56.8%, n = 25/44) or bedroom (34.1%, n = 15/44). Other fires originating in the living room were caused by hot coals (n = 12), gas fires (n = 3), candles (n = 2) and heating equipment (n = 1). In addition to these incidents, another fire started in the living room when a TV set caught fire prompting one of the occupiers to attempt to remove it and in doing so spread the fire to their clothing and the hallway. One fire, which started in the bedroom with smoking materials, involved the victim smoking while using oxygen therapy. The victim was set alight and there was no other fire spread in the property. Two fires, caused by electrical faults, originated in the bedroom; in one case an electrical cable was worn internally because it was compressed under the bed post. Other fires starting in the bedroom were caused by electric blankets (n = 2), heating equipment (n = 1) and halogen lamps (n = 2). In the two incidents with halogen lamps, the lamp fell on to bedding setting it alight while the victim was in bed. In one case, the bedroom door was closed, and the fire went unnoticed until a family member came to check on the occupant; the other was the only incident to cause more than one older fatality when the second occupant went to investigate the sounding of a smoke alarm. Bedding was also set alight when a hairdryer was left on, unattended, on top of a bed.

3.2 | Presence and performance of smoke alarms

Table 2 presents an analysis of the presence and performance of smoke alarms as well as the reasons given for a smoke alarm that was installed but did not sound. The presence or otherwise of a smoke alarm could be established in 72.7% (n = 72) of incidents; in other cases, this could not be established because the fire had been so severe. In three incidents, a smoke alarm was present, but it was not possible to determine if it was functioning at the time of the fire.

As shown in Table 2, a smoke alarm was installed in just over half of properties (55.5%, n = 55), and 41.8% of these alarms operated (n = 23/55). Interestingly, it was established that between the periods April 1999 to March 2009 and April 2009 to March 2019, the percentage of incidents, in which a smoke alarm had been present, increased from 40.7% (n = 22/54) to 73.3% (n = 33/45). The majority of alarms that operated (78.3%, n = 18/23) alerted another individual to the presence of fire. However, in 38.9% (n = 7/18) of these incidents there was a delay in calling the fire service. In one case the police were called, by a neighbour, instead of the fire service as the smoke alarm was mistaken for an intruder alarm, and in another case,

TABLE 2 Presence and performance of smoke alarms

Factor	Most common for older fatalities	% of incidents (number of incidents)
Smoke alarm presence	Smoke alarm present	55.5 (n = 55)
	No alarm present	17.2 (n = 17)
	Could not be confirmed	27.3 (n = 27)
	Operated	41.8 (n = 23/55)
	Defective	12.7 (n = 7/55)
Smoke alarm performance	Working but did not operate	29.1 (n = 16/55)
	Covered by dust covers	1.8 (n = 1/55)
	Could not be confirmed	14.5 (n = 8/55)

there was a delay of almost 4 hours between a neighbour hearing the alarm sound in an adjoining property and calling the fire service. In the latter case, the alarm was ignored by the neighbour until they could smell smoke, which then prompted him/her to call the fire service. In 25.6% (n = 10/39) of the incidents that had a working smoke alarm, the fire was not discovered, nor were the fire services alerted, until the fire had self-extinguished and there was already a fatality. Interestingly, in four separate incidents, an alarm sounded in a neighbouring property prompting the occupier to call the fire service; two of these alarms were initiated by carbon monoxide detectors and there was no other sign of fire until investigated further by the fire service.

From Table 2, it can be seen that a smoke alarm was working but did not operate in 29.1% (n = 16/55) of incidents. In three incidents where the working smoke alarm did not operate the victims were set alight and there was very little fire spread; all three victims were discovered by a carer. In two of these incidents, the source of ignition was smoking materials and in the other case, the fatality was sitting too close to a heat source. In the incident where the smoke alarms were covered with dust covers, the victim suffered from dementia and mistakenly put coal on an electric fire that was recently installed in the property.

3.3 | Regular points of contact with the fatality

As mentioned in the section 1, the literature has suggested that agencies or individuals linked to older people could be of use when delivering fire safety information. An analysis of the circumstances surrounding the fatalities demonstrated that most fatalities lived alone (85%, n = 85). However, importantly, there was at least one point of regular contact with the victims in 86.9% (n = 86) of incidents. Notably, in all but one of the incidents that did not have a smoke alarm present, or a smoke alarm was defective (n = 24), someone from the community was in regular contact with the victim. While regular contact with these victims was confirmed, it was impossible to ascertain

the frequency. Table 3 presents an analysis of the different individuals or agencies that were in contact with the fatalities before the incident. In some cases, there may have been more than one point of contact, which is reflected in the totals.

From Table 3, it is evident that family members, neighbours and carers were the most common points of contact. Important to note is that, in over half of the incidents, these individuals were involved in raising the alarm, albeit that this was insufficient to save the victim. Neighbours and carers/assistants/visitors discovered the fire in 51.5% ($n = 51$) and 13.1% ($n = 13$) of incidents respectively.

The analysis of the data gives an indication of the sources of ignition and highlights the points of contact with the older persons. It is important to note, however, that this only provides information on ignition for those who died. It is impossible to gain, from this data, an understanding of the range of risky behaviours that might have been engaged in either by these individuals on previous occasions or the many other near misses or incidents to which the fire service may or may not have been called. This information did, however, inform the next phase of the research which comprised focus groups that involved the groups highlighted in Table 3 above.

4 | RESULTS PHASE 2 (FOCUS GROUPS)

Thematic analysis of the focus groups identified 11 main themes and 17 sub-themes. This article will discuss the five main themes based on the number of references that were made to them. The main themes were: (a) Risk Factors; (b) Fire Risk Identification including the sub-themes, cooking, smoking, smoke alarms and electricity; (c) Fire Interventions; (d) Interactions with the NIFRS; (e) Challenges/Barriers to Implementing Intervention Strategies including the sub-themes awareness, negative attitude, physical barriers and adverse effect on independence. Table 4 provides a description of each main theme and details how many references were made throughout Table 4.

4.1 | Theme 1: Risk factors

Focus group participants identified that the older people they visited displayed a variety of known risk factors in relation to fire safety. Quite often, the older people had health issues such as Parkinson's disease, chronic obstructive pulmonary disease, dementia and mobility

problems. Alcohol consumption and mental health issues were also reported, both of which are often directly linked to risky fire related behaviour. For example, one participant discussed how they visited several older people who had mental health issues and used smoking and alcohol as a coping mechanism to deal with their problems; this often led to unsafe practises with smoking materials. Four participants discussed visiting an older person who lives alone and in one case, the sole purpose of the visit was to reduce the loneliness of the older person. Three family members and four professionals mentioned fire

TABLE 4 Themes emerging from focus groups analysis

Theme Name	Description of Theme	Number of Times Referred To
1. Risk factors	Risk factors associated with individuals.	16
2. Fire risk identification	General fire risks associated with activities and/or safety systems and has the sub-categories detailed below.	7
• Cooking	Risks associated with cooking.	18
• Smoking	Risks associated with smoking.	17
• Smoke alarms	This includes any mention of smoke alarms, either problems associated with smoke alarms or using them as a fire safety solution.	24
• Electricity	This is any mention of risks associated with electricity.	14
3. Interventions	Fire safety intervention either observed or implemented by participants.	18
4. Interaction with NIFRS	Interaction with Northern Ireland Fire and Rescue Service including partnership agreements between external agencies.	13
5. Challenges to fire safety	Challenges that could be perceived as barriers to implementing Fire Safety Strategies.	31
• Awareness	This includes any discussion about older people having a lack of awareness of fire risk in the home or fire safety interventions.	24
• Attitude	This includes any discussion about older	20

(Continues)

TABLE 3 Type of regular contact with fatalities

Type of contact	% of older fatalities (no. of fatalities)
Family members	46 ($n = 46$)
Neighbours	30 ($n = 30$)
Carers	19 ($n = 19$)
Friends	10 ($n = 10$)
Social services	3 ($n = 3$)
Delivery driver	1 ($n = 1$)

TABLE 4 (Continued)

Theme Name	Description of Theme	Number of Times Referred To
	people having a negative attitude towards fire safety.	
• Physical barriers	This includes any discussion about the physical barriers that prevent older people from implementing fire safety strategies.	10
• Independence	This includes any discussion about how fire safety intervention strategies have an adverse effect on an older person's independence.	9

safety related concerns for older people with dementia. One participant said: 'I think dementia is a big issue obviously because you don't know what they are going to do next'.

4.2 | Theme 2: Fire risk identification

All focus groups discussed times when they identified a fire risk in the home of older people they visit. However, there was a noticeable difference between the groups, and within the groups, on their ability to identify risks. While friends, family and neighbours intended to identify risks that arguably were more obvious such as a missing smoke alarm, some of them indicated that they would overlook fire risks while visiting their older friends, family and neighbours. Professionals seemed to have a greater ability to identify fire risk and were often required to complete a formal risk assessment of a property when visiting. It should be noted, however, that the ability to identify risk varied among the professionals with three displaying a much more detailed knowledge of fire safety than the other four professionals.

The focus groups highlighted four main categories of risks for older adults in their homes that consisted of: (a) cooking; (b) smoking materials; (c) issues related to smoke alarms and (d) electrical appliances. Details of the risk associated with these are discussed below.

Cooking, in terms of an activity that could cause ignition, was the most common risk observed. Cookers, microwaves, toasters and camping stoves were observed being used in a risky manner in the homes of older people. Four participants, each in different focus groups, described cookers being left on by accident or turned on inadvertently. Three out of four participants related this to dementia sufferers with two out of three reporting items such as tea towels being left on cooker hobs, which added to the fire risk. Confusion with operating microwaves also led to items being overcooked and causing ignition. One professional described witnessing the incorrect container in a microwave which led to a malfunction of the appliance. Another

explained an incident where a toaster malfunctioned when the power cable was placed over the heating element causing the power cable to burn. One participant observed a camping stove being used in the living room of a property and another witnessed a cooker being used to heat a home.

Many risks around *smoking materials* were also observed by participants. Disposal of cigarettes was often an issue and overloaded ashtrays were reported by four participants. One participant observed a plastic container being used as an ashtray and another discussed how they commonly noticed ashtrays placed on upholstered furniture which were often unstable. Some risky methods of lighting cigarettes were discussed; one professional described a client lighting a cigarette directly from a gas hob and another talked about a client using a toaster to light paper which was used as an ignition source for a cigarette. Smoking while intoxicated was witnessed by three participants and two others recalled examples of older people falling asleep while smoking. Scorch marks on furniture and flooring was a common indication that there was a fire risk involving smoking materials. One participant recalled an older person, with dementia, regularly putting cigarettes in their pocket while still lit and another having a fascination with cigarette lighters which was a major concern at the time as the individual was hoarding lighters under her pillow.

All groups observed issues relating to *smoke alarms*. In each focus group, there was at least one participant who had witnessed the removal of smoke alarms in the home of an older person they visit. Issues prompting the removal of smoke alarms included the annoyance of a low battery warning, sounding of alarm due to dust, repeated sounding while smoking or cooking and removal to replace the battery but never completing the task. Those friends, family and neighbours who had no fire safety background agreed they would not consider whether the person they were visiting had a working smoke alarm and some even admitted not knowing the condition of their own smoke alarm. Some family, friends and neighbours commented that they were not aware of how many smoke alarms should be installed in the home and where they should be installed. One family member, with a fire safety background, spoke of many occasions when he was approached for advice around smoke alarms, suggesting that there is a lack of awareness in the community.

There was much discussion around the fire risk associated with *electrical appliances*. One of the main risks reported was the use of several electrical adaptors combined in one socket. One participant reported observing scorched plugs and sockets, and another raised concerns about how long their family members charge mobile phones and e-cigarettes for. While some were discussing the fire risk in relation to electrical appliances, others expressed confusion as to what was being discussed and, reflecting on their own practises, confirmed that they had previously been unaware of the risks associated with electrical safety. There was, however, a noticeable difference in the level of knowledge around electrical safety among participants. Participants from a fire safety background, and three professionals, had an increased awareness of fire risk from electricity while all but two family, friends, neighbours and three professionals displayed a lack of awareness.

4.3 | Theme 3: Interventions

A number of fire safety intervention strategies were employed by the focus group participants to reduce fire risk; most commonly these attempted to address issues related to cooking, smoking materials and smoke alarms. However, it should be noted that, fire safety knowledge, including the ability to identify and manage fire risk, varied greatly among participants. Often, while one participant was describing a risk and an intervention strategy, other participants were learning from the discussion. In fact, for the friends, family and neighbours who did not have any fire safety background, they confirmed that much of the discussion was new information to them.

A number of intervention strategies were used by family, friends, neighbours and professionals to reduce the fire risk caused by *cooking* among the older people they visit. To prevent the cooker hob being turned on accidentally, one relative described how they removed the controls from a cooker. A professional and a family member both recalled a risk from cooking so great that the cooker had to be disconnected and meals were provided by family members. For one older person with dementia, a lock was installed on the main cooker switch, which controlled the power supply, meaning cooking could only be carried out while supervised. An advantage of this was that the person with dementia maintained some independence. However, this was not always possible with all family members with dementia; one family member described how they had prevented their relative from accessing the kitchen due to the risky behaviours they had observed in relation to cooking. While this was difficult for the individual, and their relatives, it was a necessary intervention and one that was made in consultation with social workers.

Risky behaviours involving *smoking materials* were controlled in various ways. In two cases, smoking was restricted to outside the property. One professional recalled a client, with limited mobility, who was instructed to place a fire blanket on their lap while smoking as a precaution if the cigarette was to drop. Four professionals described how they must continually need to remind clients to dispose of cigarettes properly and often they are required to intervene to dispose of smoking materials. While discussing smoking materials, the professionals expressed frustration at the fact that often the advice about smoking materials would be ignored, and they needed to repeatedly reinforce the message. The same complaints and frustrations were also made and felt by a friend and a neighbour. The risk posed by smoking materials was often enhanced by the smoker removing smoke alarms in their property to avoid activating the alarms while smoking.

Missing and defective *smoke alarms* were addressed in different ways. One participant discussed how they have replaced smoke alarm batteries in the homes of their older relatives, and friends and neighbours expressed their willingness to do so if required. Issues with smoke alarms were only addressed by family, friends and neighbours, without a fire safety background, on request and they agreed that they were not proactive in discovering defective or missing smoke alarms. For professionals, ensuring their older clients had a working smoke alarm was a priority. Four professionals even had to consider sensory and mobility issues while assessing a client's ability to respond

to a normal smoke alarm and three professionals discussed the regular use of specialist equipment that used a vibrating pad that worked in conjunction with smoke alarms.

Professionals noted that they often referred clients to NIFRS if they noticed missing or defective smoke alarms and relied on HFSC conducted by NIFRS to address other fire safety concerns. Three professionals tested their client's ability to hear a smoke alarm and if there was any concern, they worked in partnership with NIFRS to install specialist equipment. All but two of the friends, family and neighbours, without a fire safety background, were unaware of what a HFSC entailed or how to request one; only two had a HFSC carried out in their own property. In both the urban and the rural focus groups, participants discussed their own home fire safety and it was suggested that they could benefit from a HFSC themselves. All professionals agreed that their clients would be unaware of a HFSC without them recommending one.

4.4 | Theme 4: Interaction with Northern Ireland fire and rescue service

The interaction participants had with NIFRS varied between groups. On one hand, professionals had a strong relationship with the service and provided very positive feedback about their partnership. On the other hand, family, friends and neighbours, without a fire safety background, were under the impression that the fire service was only a resource to be used in emergencies.

Participants discussed how a partnership agreement with NIFRS, and their organisation, has improved their working relationship and has encouraged an increased awareness of fire safety. Some discussed how they would carry out joint visits with NIFRS representatives, to assess fire safety in the homes of their clients. This was a very beneficial as often firefighters would provide valuable safety information, and fire safety solutions, that they were previously unaware of. In one case, firefighters highlighted an electrical safety issues to a healthcare worker and they worked together to provide a solution. Half of the professionals discussed their attendance at a HFSC carried out with at least one of their clients. There was a noticeable difference in the fire safety knowledge of those whom had not experienced a HFSC and they all spoke of their desire to attend one in the future.

4.5 | Theme 5: Challenges/barriers to implementing intervention strategies

Participants discussed challenges they had to overcome while considering fire safety in the community. Four subthemes emerged from theme 5 related to lack of awareness of fire risk and safety, attitudes of the older person towards fire safety, negative effect of an intervention strategy and physical barriers that prevent fire safety intervention strategies from being implemented.

Within all focus groups, lack of *awareness* of fire risks and fire safety interventions was highlighted as a challenge to overcome.

All professionals agreed that their clients would be unaware of what intervention strategies might be employed or what opportunities existed for assistance for example, a HFSC until suggested by them. This was something addressed by family members with a fire safety background as they shared examples of times when they had to provide fire safety advice. Family, friends and neighbours, without a fire safety background, were all unaware of many fire risks or potential intervention strategies.

The *attitude* of the older person towards fire safety was identified as a barrier to overcome in order to implement safety strategies. Two professionals discussed how clients would sometimes decline fire safety advice because they did not think it was applicable to them and another participant commented that their friend would put up resistance to any sort of intrusion into their home. In one case, a HFSC was initially declined because it was causing the individual anxiety and stress and they had to be convinced of the benefits.

The *physical barriers* experienced by older people while attempting to implement intervention strategies were discussed. One participant spoke of the location of his own smoke alarms, and the smoke alarms in his neighbour's property, stating that they were too high and out of reach for them to be tested. Another participant described how his neighbour would be physically incapable of carrying out an escape plan if a fire were to start in their property. Two professionals discussed how they regularly visit clients that would be incapable of hearing regular smoke alarms and, although they need specialist equipment installed, they are often unaware of the risk until it is described to them.

Three family members discussed how their relatives' *independence* was seen to be adversely affected by intervention strategies. Family members discussed how removing candles from an older relative with dementia and the restriction of access to rooms, due to rooms containing significant hazards, had a belittling effect on the older person that they found difficult to accept. Another relative discussed how the negative effect of an intervention strategy was considered before implementation, that is, an analysis of the risk in relation to the effect on quality of life often determined whether a strategy was implemented. The example given was a case where an open fire may be considered a risk, but as it was a source of comfort for the older person the risk could not be eliminated. These interventions were seen as difficult for the entire family but were considered necessary. One participant discussed how their relative with dementia reacted to interventions being put in place saying:

'If she was in her sound mind, she would have agreed but because she wasn't in her sound capacity it was robbing her of her kind of independence'.

5 | DISCUSSION

This article has presented the findings of a two-phase investigation into fire risks in the homes of older people. Firstly, data was collected, from all fatal fires in Northern Ireland over the last 20 years and analysed to identify why older people are dying in fires and what

support network, if any, was around older fire fatalities. Secondly, focus groups were conducted with individuals in contact with older people, in order to explore fire risks and risky behaviours (whether or not they lead to a fire) being observed in the homes of older people. This was to identify what, if any, risks they observe, what they currently do to reduce fire risk in the homes of older people and understand what might help them reduce that risk in the future.

From the data analysed, the main causes of fire among older fatalities were established as smoking materials, hot coals, cooking and electrical faults, which is consistent with that found in other studies.³ Most fires ignited in the living room (46.5%) or the bedroom (24.2%) and almost half (47%) of fatalities were found in the room of ignition, having not responded or responded too late to the presence of fire. Often the smoke alarm alerted others in the vicinity of the deceased rather than the deceased themselves but there was often a delay in alerting the fire service; this suggests that the general public often could intervene but may need educated about the importance of alerting the fire service when they suspect a fire, even in a neighbouring property.

The data around smoke alarms in this study reveal some interesting trends. Firstly, although smoke alarm ownership has increased in the last two decades, there is still some improvement to be made as only 55.5% of dwellings in this study had a smoke alarm present. Secondly, the maintenance of the alarms that are present may need addressed as seven of the 55 alarms present (12.7%) in this study were defective and one was covered by dust covers (1.8%). This suggests that education around the testing and maintenance of smoke alarms could be more effective. Lastly, 29.1% of working smoke alarms failed to operate, which is something that could be investigated further.

Despite previous research indicating that the older adult is 'difficult to reach',²⁶ this research suggests that older fatalities were not necessarily isolated as 86.9% of older fatalities were found to have at least one point of regular contact prior to the incident. Family members (46%), neighbours (30%) and carers (19%) were the most prominent contact points and, importantly, these individuals were noted as observing risky behaviours prior to the fatal fire in 43.4% of incidents.

The focus groups in this study have provided an insight into the risky behaviours being observed, the interaction between the older adult and their relatives, friends, neighbours and carers in regard to fire risk and the challenges that the support network around the older person face in relation to fire safety. The common fire risks that are regularly being observed in the homes of older people are consistent with those identified through the data analysis and other studies;⁵ however, the focus groups provided much more insight into the circumstances and behaviours of the older person relating to cooking, smoking and using electrical appliances. Particular issues exist in respect to the above for persons with dementia, which supports and adds to the findings of Heward and Kelly³² in this respect. The fire risks associated with dementia, that were evident in both phases of this study, are challenging to overcome and require a coordinated approach by all stakeholders.

It is clear from the focus group responses that some novel interventions are being used in the community to reduce fire risk in the

homes of older people. It is also clear, however, that for some, there is a lack of understanding of fire risks and a lack of awareness of interventions which might be used to address such risks. Lack of awareness of fire risk was hugely evident in the focus groups with family, friends and neighbours, who had no fire safety background, with many being unaware of what might be considered fire safety basics, such as the maintenance of smoke alarms.

Even when a fire risk is observed in the home of an older person, there are often barriers to addressing the risky behaviour or implementing fire safety solutions. In some cases, the attitudes of the older person were difficult to change; in other cases, individuals were aware of fire safety strategies but had challenges implementing them whilst maintaining the independence of their relatives, friends, neighbours or clients; in other cases there were physical barriers to addressing issues such as smoke detectors being out of reach.

Many family, friends and neighbours are also not fully aware of the services provided by NIFRS to reduce fire risk in the home. In fact, only two members of the family, friends and neighbours (without a fire safety background) were aware that NIFRS would provide support by conducting a HFSC or how they could request one. Professionals seemed to be more equipped to deal with fire risks but there were also varying levels of fire safety knowledge even among this group. Some agencies have good collaborative relationships with NIFRS, referring their clients for HFSCs on a regular basis, to provide fire safety solutions in the homes of older people. NIFRS are working proactively to encourage collaborative working; over the course of this research, NIFRS have increased the number of partnership agreements with agencies in contact with older people from 24 to 86.³¹ However, it was interesting to note that two professionals were unaware of the agreement their organisation had with NIFRS and two were not entirely sure how to refer clients for a HFSC.

6 | CONCLUSIONS

From this analysis, two core messages that should inform any future fire safety intervention strategies, emerge. Firstly, those deemed to be more at risk from fire often do have contact within the community; these points of contact should be used as fire safety advocates and should be equipped through education and training to understand how they can reduce fire risk among older people. Huseyin and Satyen³³ have concluded that even a little exposure to fire safety information has a positive influence on its recipients. Of particular importance is support in understanding how to deal with risky behaviours around smoking, open fires, cooking and electrical safety whilst still maintaining the dignity and independence of the older person. With increased awareness and support mechanisms, carers, friends, family and neighbours could help reduce risk in the homes of the most vulnerable.

Secondly, consideration needs to be given to optimising the effectiveness of alarms in the homes of older people, through better location and/or new technologies. This research would suggest that smoke alarms should be located in the bedroom and living room, as this analysis has identified that fatalities are often located in the room

of ignition, having not responded to the alarms or that the alarm did not sound because it was not in the room of ignition. Currently most UK Fire and Rescue Services recommend installing one smoke alarm on each level of the home with only a few recommending installing an alarm in bedrooms.

While this article has highlighted core messages that might inform future intervention strategies, the challenge now is to examine the issues raised and how a coordinated approach, as suggested by Jennings,⁶ can assist those closest to older people in the community. Further investigation is required to clarify more precisely where the gaps in knowledge appear for those closest to the most vulnerable and how their knowledge could be increased. Further work is also required to understand current inter-agency relationships with the fire and rescue services and their key stakeholders and how these can be developed and optimised to decrease the risks in the homes of older people and ultimately reduce fire fatalities among this vulnerable group.

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REFERENCES

1. Great Britain. Home Office. Fire and statistics Tables (2019) Fire0501: Fatalities and non-fatal casualties. <https://www.gov.uk/government/statistical-data-sets/fire-statistics-data-tables#fatalities-and-casualties> Accessed April 30, 2019.
2. World Population Ageing. New York: United Nations, Department of Economic & Social affairs (ST/ESA/SER_A/390); 2015. http://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2015_Report.pdf Accessed November 15, 2015.
3. Ahrens M. *Characteristics of Home Fire Victims, NFPA Fire Analysis and Research*. MA: Quincy; 2014.
4. Harpur A. A Detailed Investigation into Occupant Behaviours and Influencing Factors Surrounding Fatal Dwelling Fire Incidents in Northern Ireland, PhD thesis, University of Ulster; 2014.
5. Elder AT, Squires T, Busuttill A. Fire fatalities in elderly people. *Age Ageing*. 1996;25(3):214-216.
6. Jennings CR. Social and economic characteristics as determinants of residential fire risk in urban neighbourhoods: a review of the literature. *Fire Saf J*. 2013;62:13-19.
7. Diekman ST, Stewart TA, Teh SL, Ballesteros MF. A qualitative evaluation of fire safety education programs for older adults. *Health Promot Pract*. 2010;11(2):216-225. <https://doi.org/10.1177/1524839908318169>.
8. Flynn JD. *Characteristics of Home Victims, NFPA Fire Analysis and Research*. MA: Quincy; 2010.

9. Reeves ND, Spanjaard M, Mohagheghi AA, Baltzopoulos V, Maganaris CN. The demands of stair descent relative to maximum capacities in elderly and young adults. *J Electromyogr Kinesiol*. 2008;18:218-227.
10. Kang HG, Dingwell JB. Effects of walking speed, strength and range of motion on gait stability in healthy old adults. *J Biomech*. 2008;94(9):1567-1573.
11. Chappell NL, Cooke HA. Age related disabilities – aging and quality of life. In: Stone JH, Blouin M, eds. *International Encyclopedia of Rehabilitation*. 2010. <http://cirrie.buffalo.edu/encyclopedia/en/article/189/> Accessed December 5, 2016: 1-3.
12. Family Resources Survey. 2014-15, Department for Work and Pensions, UK; 2016.
13. Ball M, Graesser H, Bruck D, Thomas I. Increased fire death risk for the elderly. *Aus Nurs J*. 2009;16(7):35.
14. Graesser H, Ball M, Bruck D. Risk factors for residential fire fatality across the lifespan: comparing coronial data for children, adults, and elders. Proceedings of the fourth International Symposium on Human Behaviour in Fire Interscience Communications, London, 2009: 639-644.
15. Hodsoll K, Nayak USL. The perception of fire risk by older people and its impact on relevant fire safety education. *Int J Consum Prod Saf*. 1999;6(3):159-168.
16. Beringer J. Community fire safety at the urban/rural interface: the bushfire risk. *Fire Saf J*. 2000;35(1):1-23.
17. Coty MB, McCammon C, Lehna C, Twyman S, Fahey E. Home fire safety beliefs and practices in homes of urban older adults. *Geriatr Nurs*. 2015;36(3):177-181.
18. Fahy RF, Molis JL. Fatalities in home fires where smoke alarms activated. Third International Symposium on Human Behaviour in Fire Interscience Communications. London; 2004:57-56.
19. Zhang G, Lee AH, Lee HC, Clinton M. Fire safety among the elderly in Western Australia. *Fire Saf J*. 2006;41(1):57-61.
20. Almand KH. NFPA Journal. *ProQuest* 2006; 100, 5.
21. Barillo DJ, Goode R. Fire fatality study: demographics of fire victims. *Burns*. 1996;22(2):85-88.
22. Tanner EK. Assessing home safety in homebound older adults. *Geriatr Nurs*. 2003;24(4):250-256.
23. Bruck D, Thomas I. Comparison of the effectiveness of different fire notification signals in sleeping older adults. *Fire Technol*. 2008;44(1): 15-38.
24. 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*. 2010;35(5):543-548.
25. Mayhorn CB. Warning the Elderly: Understanding and Overcoming Barriers to Risk Communication [Homepage of Prepared for SUPDET; 2012.
26. Holborn PG, Nolan PF, Golt J. An analysis of fatal unintentional dwelling fires investigated by London Fire Brigade between 1996 and 2000. *Fire Saf J*. 2003;38(1):1-42.
27. Ta VM, Frattaroli S, Bergen G, Gielen AC. Evaluated community fire safety interventions in the United States: a review of the literature. *J Community Health*. 2006;31(3):176-198.
28. Chien SW, Wu GY. The strategies of fire prevention on residential fire in Taipei. *Fire Saf J*. 2008;43(1):71-76.
29. Communities and Local Government. Safer Houses: Celebrating 20 Years of Fire Prevention in the Home. Department for Communities and Local Government; 2008.
30. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77-101.
31. Heward M, Kelly F. Fire Safety Innovations for People Affected by Dementia; 2015. https://www.nationalfirechiefs.org.uk/write/MediaUploads/RD%20newsletters/Research%20and%20development/Guidance/Fire_Safety_Innovations_-_Focus_Group_and_Survey_Findings.pdf Accessed December 10, 2016.
32. Northern Ireland Fire & Rescue Service. Annual Report 2018-2019; 2019. <https://www.nifrs.org/wp-content/uploads/2019/07/Annual-Report-Statement-of-Accounts-NIFRS-2018-19-no-signatures.pdf> Accessed November 10, 2019.
33. Huseyin I, Satyen L. Fire safety training: its importance in enhancing fire safety knowledge and response to fire. *Aus J Emerg Manage*. 2006;21(4):48-53.

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