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**Title: Profile of fire fatalities in Ireland using coronial data**

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**Fire Safety Journal**, Available online 10 October 2019, 102892

Publisher: Elsevier

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Note: This is a pre-copy-editing, author-produced PDF of an article accepted for publication in *Fire Safety* following peer review. The definitive publisher-authenticated version [Doyle A, Lyons S & Lynn E (2019) Profile of fire fatalities in Ireland using coronial data. *Fire Safety*, 102892, <https://doi.org/10.1016/j.firesaf.2019.102892>] is available online at <https://www.sciencedirect.com/science/article/abs/pii/S0379711218305708>

## Abstract

For the first time in the Republic of Ireland, analysis using coronial data describes all fire-related fatalities occurring during the years 2014 to 2016. Of the 106 fatalities, the majority of those who died were male (69, 65%) and 55 (52%) were 65 years or older. Most fires took place in private dwellings (97, 92%), in rural locations (58, 55%) and the majority were alone at the time of the fire (73, 69%). Fatal fires occurred more frequently during the night and where known (n=48), the leading cause of fatal fires was due to smoking materials (12, 25%). Mobility was an issue for 16 people (15%) and 32 people (30%) were known to be smokers. Farmers and agricultural workers were over-represented in the data. Alcohol features prominently with alcohol present on toxicology for 54 (51%) fatalities. A Blood Alcohol Concentration (BAC) of at least 160 milligrams of alcohol per 100 millilitres of blood (mg/100ml) was present in 35 fatalities (33% of all fatalities) and of those, the majority were male and in the 35 to 59 years age group. The high BAC levels in a significant number of fire fatalities, draws attention to the negative impact of alcohol on fire-related mortality.

## Key words

Fatal, Fires, Toxicology, Coroners, Ireland

## 1. Introduction

Previous research on fire fatalities indicates that older people (65 years and older) are at an increased risk of death due to fires, males are often over represented and health and/or mobility issues are known to play a role<sup>1 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14</sup>. Geographical and time comparisons in previous studies have found that those living in private residences and in rural locations have an increased risk of death in the event of a fire and that fatal fires are more likely to occur during late night/early morning<sup>2, 5, 12, 13, 14</sup>.

Other factors reported to increase the risk include living alone, smoking and alcohol consumption and fatal fires are regularly reported to be caused by smoking materials and electrical devices<sup>2, 3, 4, 6, 8, 9, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27</sup>. Having correctly installed and working fire safety equipment (smoke alarms/detectors, fire extinguishers) is necessary to provide warning of a fire to occupants of a residence and enable them to potentially fight a fire and thus save lives. However, previous research has shown that where alcohol is involved, the presence of smoke alarms may not be sufficient to alert the occupants<sup>8, 30, 31</sup>. In Ireland, there is a legal requirement that businesses, rented properties, new-builds and multi-unit buildings adhere to fire safety regulations including providing necessary escape means and the provision of fire safety equipment<sup>23, 32</sup>. The law governing private dwellings is not as stringent, particularly for older private homes, where there is no legal requirement to have fire safety equipment.

The aim of this paper is to describe fire-related fatalities in the Republic of Ireland for the period 2014-2016 inclusive using coronial data. Demographic information and the characteristics of the people involved have allowed the authors to gain insight into the circumstances around fire fatalities in Ireland and add to previous research. Providing evidence on fire fatalities lends to supporting the development of policies to reduce the number of such deaths in the Republic of Ireland. This is the first time that data from all Coroners sites in the Republic of Ireland has been analysed for the purposes of fire fatalities. This allows for a more comprehensive, national insight into the circumstances of these fatalities. As this is an on-going system of data collection, trend analysis will be possible in the future allowing the opportunity to make comparisons over time.

## 2. Methods

The National Drug-Related Deaths Index (NDRDI) is an epidemiological census that records all deaths directly due to drug(s) and/or alcohol (known as poisonings or overdose) and deaths among persons who have a known history of drug and/or alcohol dependence or a history of nondependent misuse of drugs in Ireland whether or not the drug was directly implicated in the deaths. A key source of data for the NDRDI is closed inquest files collected from all Coroners in the Republic of Ireland. An inquest file is closed when the Coroner has determined who has died, where they have died, the cause of death and has delivered a verdict.

In July 2015, the Department of the Environment, Community and Local Government (now the Department of Housing, Planning and Local Government, DHPLG) requested the Health Research Board (HRB) to collect data on *all* fire-related fatalities from closed coronial files using the NDRDI methodology and inclusive of extra variables relevant to fires. The HRB began retrospectively collecting data on all fire-related fatalities from 2014 onwards from closed coronial files.

### *NDRDI methodology*

NDRDI researchers collect data (including the fire fatality data) from closed inquests on-site from all coroner districts countrywide. The data are entered directly into the Microsoft (MS) Access database on laptops secured by encryption. The time between date of death and completion of inquest varies from case to case and because of this, information on some deaths that occurred during the reporting period were not available from the coronial files at the time of data collection. The NDRDI database is updated when the inquests are closed and file is made available<sup>34</sup>.

For each fire fatality, socio-demographic details were collected and where available, other potential risk factors including history of drug and/or alcohol dependency or misuse, history of mental ill-health, ante mortem and post mortem toxicology results and details about the cause of death.

Information on the circumstances surrounding the events of the fatal fire and potential contributory risk factors, where available in the file, are recorded, including the location and seat (of fire), the time of the fire, pre-fire behaviour (e.g. consuming alcohol, sleeping), cause of fire, whether others were present at the time of the fire, whether the person who died was a smoker, their mobility status and if fire safety equipment (smoke alarms/detectors, fire extinguishers etc.) was in place and if they were in working order. The absence of information in coronial files is not indicative of missing data, rather that the information was not recorded in the files for the Coroner's investigation.

The fire fatality data entered into the MS Access database was then exported, anonymised, to SPSS version 22. A descriptive analysis was conducted to describe the data on fatal fires and chi-squared tests were used to compare differences between groups.

### 3. Results

Information on a total of 106 fire-related fatalities collected for years of death 2014 to 2016 inclusive (2014=44, 2015=40 and 2016=22) were included in the analysis based on 101 fatal fires occurring during this period (five fires resulted in more than one fatality). This number varies from official figures reported from emergency services who attended the scene of fires (2014=37, 2015=41 and 2016=20). The data reported in this paper refers to closed coroner files and as the emergency services may not attend all fatal fire sites, the numbers reported differ. Of note, data on the number of fatalities from coronial data pertaining to years of death 2015 and 2016 is expected to rise once data becomes available from closed inquest files including a fire that claimed the lives of 10 individuals in 2015. These fatalities are not included in this analysis as the inquests had not been held at the time of data collection.

The information contained in the coronial files is not collected for research purposes and as a result, not all information is available. The analysis contained in this study is based on the data collected for the coronial investigation. Information, particularly for the cause and source of the fire, is limited and all totals and percentage totals are therefore based on the available information.

### 3.1. Socio-demographics

Those in older age groups were over-represented among fire fatalities in Ireland. Over half of those who died in house fires were aged 65 or over (55, 52%) despite this group comprising 19% of the population of the Republic of Ireland <sup>35</sup>.

More males (69, 65%) died as a result of fire than females (37, 35%) representing an over-estimate of the mortality rate for males in fires compared to all other causes of death. Census data for the years of this study (2014, 2015 and 2016) showed a male:female mortality ratio of 1.03:1 whereas the fire death ratio was 1.9:1 <sup>36</sup>.

The overall median age was 65 years (Table 1) and the median age for males was 63 years and for females, 69 years.

The marital status of the majority of fatalities was single (including separated, divorced and widowed) (80, 76%).

Where occupation was known (n=67), farmers and agricultural workers featured more than other occupations (14, 21%) signifying an over-representation of that occupation (the occupation data from the 2016 Census data from Ireland showed a rate of 3.5% of the population were farmers or agricultural workers) <sup>37</sup>.

As would be expected, all but one of the farmers/agricultural workers lived in a rural setting (13, 93% of this group), 9 (64%) were 65 years or over, 12 (86%) were single or divorced and 11 (79%) were alone at the time of the fire. Of most concern is that the majority of this already vulnerable group had a positive BAC at the time of their death (12, 86%).

### 3.2. Fire circumstances

#### 3.2.1 Location and seat of fire

Of the 101 fatal fires, there was an even geographical spread with over half (57, 56%) occurring in a rural setting and the remainder (44, 44%) in an urban location. Almost all fires occurred in a private dwelling (92, 91%). Where the information was known, the majority of those who died were alone at the time of the fire (73, 72% of 101 fire fatalities). Of those that were alone at the time of the fire (n=73), the majority were aged 65 years and over (43, 59%) and of those alone at the time of the fire, more were in a rural setting (46, 63%) than in an urban setting.

The seat of the fire was recorded for 55 of the fatal fires (54%) and the leading area of fire origin reported was the sitting/living room (19, 35%) followed by bedroom (12, 22%) and kitchen (8, 15%).

### 3.2.2 Time of fire

The time the fire occurred was known for half of the fatal fires (52, 49%). Where the time of fire was known, late night through to early morning accounted for 40% of fatal fires (21). The most common time period for fires occurring being during the time period midnight through to 01:59hrs (12, 23%) followed by 02:00hrs through to 05:59hrs (9, 17%) (Figure 1).

More fatal fires occurred during winter months with the highest number occurring during the month of November (13, 13%). The weekend period were the most common days of the week with Fridays and Sundays (16, 16% each) and Thursdays and Saturdays (14, 14% each) the most common days of the week for fatal fires to occur (Figure 2).

### 3.2.3 Fire safety equipment

Fire safety equipment refers to smoke alarms (also known as smoke detectors or fire alarms), fire extinguishers, fire blankets, water sprinklers, fire doors, emergency lights, fire blankets and fire escapes. Potentially due to extensive damage as a result of many of the fires, the information relating to fire safety equipment was limited and smoke alarms, fire extinguishers and fire blankets were the only fire safety equipment mentioned in the records in this analysis. Where available in the Coroner's files, it is known that 17 fatal fires (17%) were known to have occurred in dwellings with smoke alarms present; two of these dwellings also had a fire extinguisher and/or a fire blanket (2%) and one dwelling had a fire extinguisher only.

Of the dwellings with smoke alarms (n=17), 13 (76%) were known to have been in working order as reported in the Coroner's files. Note that it is unknown whether the remaining 6 alarms were in working order as the information was not available in the coronial data files.

Those in urban locations were more likely to possess smoke alarms and/or extinguishers (13, 72%) than those in rural locations (5, 28%). Those aged over 65 years were more likely to possess smoke alarms (11, 61%).

### **3.3. Potential risk factors**

#### **3.3.1 Pre-fire behaviour**

A number of potential risk factors were observed in the coronial data before or around the time the fire occurred that may have resulted in the individual being at increased risk of harm due to slower response times. The most frequently reported was that the individual was asleep (10, 10%) at the time of the fire. As the majority of fatal fires occurred during the period midnight to 6am, it is likely that a greater proportion were asleep at the time of the fire however, this information was limited in the coronial files. A small number were reported to have been socialising outside the home preceding the fire.

Alcohol consumption is well documented to influence reaction times and the presence of alcohol on the toxicology report is documented in section 3.4.

#### **3.3.2 Potential contributory factors**

It is outside the remit of the Coroner to attribute blame and/or investigate the cause of a fire but from the data available in the coronial data files, possible contributory factors were present for 48 fires (48%). Often combinations of different factors were potentially deemed responsible. Where available in the coronial files (n=48), the potential cause of the fatal fire was reported as being caused by smoking materials (including cigarettes) (12, 25%) and electrical devices (either left plugged in or malfunctioning) (11, 23%). Also mentioned in the coronial files as potential causes to the fatal fire were self-harm (8, 8%), open fires (6, 6%) and frying pans/chip pans (5, 5%). Less than five fires were reported to be caused by the presence of candles.

#### **3.3.3 Mobility issues and disabilities**

Sixteen fatalities (15%) were reported to have mobility issues (used a walking stick/frame, wheelchair or were otherwise immobile). A small number of fatalities were reported to have had other disabilities including having poor eyesight or a hearing impairment. Having mobility issues and/or a disability has the potential to have a negative impact on the ability to respond and/or escape from a fire.

Of the group with mobility issues (n=16), 12 (75%) were 65 years or older, 5 (31% of those with mobility issues) also had a positive BAC reading. The seat of the fire for this cohort was the sitting room/living room (6, 28%).

### 3.3.4 Arson

A small number (n=<5) of fatalities were potentially as a result of arson. However, detailed examination of these fires is not possible due to the small numbers involved and due to the absence of detailed confirmation, including forensic reports.

### 3.3.5 Smoking

The coronial data noted that 32 people (30%) were smokers or it was 'highly probable' that they were smoking around the time of the fire (for the purposes of this analysis, this group are referred to as 'smokers'). The rate of smokers in Ireland is currently estimated to be 20-23% and hence smokers are over-represented in the fire fatalities<sup>21</sup>. The time of the fire for the smokers was most likely to be during the period midnight through to 01:59hrs (6, 19%) and of the 32 smokers, twelve (38%) had smoking materials listed as a possible cause of the fire. The seat of the fire for this group was more likely to be the sitting room/living room (9, 28%).

The majority of smokers had alcohol present at the time of their death, as reported on their toxicology (21, 66%) and 14 (67%) of these had a BAC of 160 mg/100ml or higher. Mobility issues were reported for 5 smokers (16%). It was recorded that 8 smokers (25%) had fire safety equipment (alarms, extinguishers etc.) in place however due to limited data available it is unknown whether this equipment was in working order.

### *3.3.6 Mental health*

Twenty five people (24%) were recorded as having a history of mental ill-health including most commonly; depressive disorders, mood disorders and anxiety disorders. The leading cause of the fire for this group as reported in the Coroner's files was death by self-harm related to fire (8, 32%) followed by smoking materials (4, 16%). Almost half had consumed alcohol prior to the fire (12, 48%).

### *3.3.7 Multiple-fatality fires*

Five fires in Ireland (5%) during the period 2014 to 2016 inclusive involved more than one fatality. The majority were aged between 18 years and 39 years (6, 60%) and were male (6, 60%). All 10 victims of multiple-fatality fires had a high BAC reading of 160 mg/100ml, indicating intoxication.

## *3.4. Drugs and alcohol*

Of the 106 people who died, 18 (17%) were recorded as being alcohol dependent representing a considerable over-representation of the general population considered to be alcohol dependent (7%)<sup>22</sup>.

The majority who were alcohol dependent were male (12, 67%) and their ages were evenly spread from 35 years to 69 years (13, 72%). Six people (6%) who were recorded as alcohol dependent were also recorded as having a history of misusing drugs, both illicit and licit.

Toxicology reports were available for the majority of those who died due to fires (91, 86%) (four were ante mortem and 87 were post mortem). Unsurprisingly carbon monoxide was the main substance reported in the toxicology findings. Seventy-four toxicology reports (81%) had alcohol and/or drugs listed, of which: 28 (38%) had alcohol only, 20 had drugs only (27%), and 26 (35%) had both drugs and alcohol (Table 2).

Forty-six people (43%) had positive toxicology findings for drugs and 67% of this group (31) had more than one drug listed. Where there were drugs reported on toxicology (n=46), antidepressants (21, 46%), benzodiazepines (16, 35%), non-opioid analgesics (15, 33%), hypnotics (11, 24%) and opioids (6, 13%) were the most frequently found substances after alcohol.

Alcohol was recorded in the ante or post mortem toxicology report for 54 people (51%). The BAC levels ranged from *present* to levels from 23 mg/100ml up to 385 mg/100ml (Table 3). Males were more likely to have a positive BAC (33, 67%) however gender was not significantly associated with alcohol being present on toxicology ( $\chi^2 (1) = 0.66$ , exact  $p=0.798$ ).

Almost half of those with alcohol recorded on their toxicology report (n=54) were 65 years of age or older (25, 46%). In addition, many of the over 65's were in the highest BAC group of 240 mg/100ml (6, 30%) indicating substantial intoxication (Figure 3) however there was no statistically significant relationship between age group and alcohol being present on toxicology ( $\chi^2 (3) = 3.485$ , exact  $p=0.323$ ).

Of the 35 people with a high BAC reading of 160mg/100ml or higher, 14 (40%) were female and 21 (60%) were male and of the 21 males with high BAC readings, most (12, 57%) were aged between 35 to 59 years.

Among the group who had consumed alcohol before their death, there were smoke alarms present for 10 of the premises the fire occurred (19%), half of which were known to be in working order. Nine of those were substantially intoxicated with BAC readings of 160mg/100ml or higher. In addition, 39% were smokers (21) and the most common cause of the fire reported for those who had consumed alcohol was due to smoking materials (9, 17%).

Alcohol was more likely to be present on toxicology when the fire occurred during the night/early morning. Seven people (13%) who had consumed alcohol prior to the fire died in the time period midnight through to 01:59hrs and 6 people (11%) who had consumed alcohol prior to the fire died in the time period 02:00hrs through to 05:59hrs.

Where there was alcohol present on toxicology (n=54), 25 (46%) had one or more other drug(s) also present on their toxicology (Table 2). The main other drugs present on toxicology with alcohol were antidepressants (11, 20%), benzodiazepines, (12, 22%), and/or hypnotics (7, 13%).

#### 4. Discussion

Analysis of the coronial data of the 106 fire fatalities with closed inquests that occurred in the Republic of Ireland during the three year period 2014 to 2016 inclusive provides a unique insight to the circumstances of the events and the characteristics of the people who died which has never previously been highlighted at a national level. The analysis found that the majority of those who died due to fires were male, single and were over 60 years of age (median age of 65 years). Where occupation information was available, farmers and agricultural workers were over-represented. The majority occurred in rural settings as per previous research<sup>13</sup>. Fatal fires were found to be more likely to occur at weekends and the night, increasing the likelihood of the occupants being asleep and therefore less alert and slower to react to alarms (if present)<sup>2,12</sup>. More fatal fires occurred in the months of November and March, findings consistent with previous research in the area of fatal fires<sup>1, 2, 3, 4, 5, 6, 7, 12, 13, 14, 16</sup>.

The coronial data available regarding the presence of fire safety equipment (smoke alarms, fire extinguishers etc.) is limited but the results show few residences with such equipment present (n=17). Irish law (Fire Services Act 1981 and 2003) stipulates that all rental properties and 'new build' houses must '*...take all reasonable measures to guard against the outbreak of fire*', this includes the installation of a minimum of one smoke alarm per floor and at least one fire blanket<sup>29,32</sup>. However coronial data does not specify which, if any, of the premises involved in the fatal fires reported here were rented properties or the age of the property. Furthermore, older private dwellings are not legally obliged to have such equipment in place and older people are more likely to live in older premises, thus placing them at increased risk of fire.

Where smoke alarms were present, fatalities still occurred, potentially indicating that the alarm was insufficient in alerting the individual. This appears to particularly be the case for those under the influence of alcohol. Previous research has suggested that standard smoke alarms are often insufficient for those who are at a higher risk including the elderly, those who consume large quantities of alcohol, smokers and those with mobility issues and the findings presented here concur with that that<sup>6, 8, 30, 31, 33</sup>.

As per previous research, this analysis also found that those in rural locations are less likely to possess smoke alarms<sup>1, 11</sup>. Fire prevention strategies, including the provision and maintenance of monitored smoke alarms for individuals and communities at greater risk of fire, including older people and those in isolated rural communities should be targeted as per previous research findings<sup>1</sup>. The finding that farmers and agricultural workers are over-represented is noteworthy and supports the proposal for targeting rural locations as the majority of this group resided in rural locations. Farmers and agricultural workers were more likely to be alone at the time of the fire, were 65 years or older and a high number had consumed alcohol prior to their death. These factors individually are of concern but in combination make this group of people particularly vulnerable.

The data clearly shows that older people are overrepresented in the data and therefore at increased risk. This supports previous international research but is new information for Ireland<sup>9, 10, 11, 14</sup>. Potentially related to ageing, mobility issues were also evident as a possible contributory factor in the cause of death and/or the cause of the fire. The observation of higher fire fatalities in older people and those with mobility issues may be indicative of a reduced ability to respond to, and escape from, fires. The risk factors for older people are evident; they are more likely to live in older homes, they may have hearing and/or vision impairments that could hinder successful escape and they may use older appliances and may use electric blankets or portable heaters inappropriately<sup>10, 13</sup>. With the increased risk factors for older people, the presence of smoke alarms and other fire safety equipment is essential. This analysis found that the older cohort, aged 65 years and over, were more likely to have fire safety equipment (smoke alarms/detectors, fire extinguishers etc.) but perhaps suggests that such equipment was ineffective in alerting the household or that the individual was unable to effectively work equipment on detection of a fire.

This analysis found that almost a third of those who died due to fires were known to be smokers or it was highly probably they were smoking at the time of the fire. Where the cause of the fire was known, it is reported that smoking materials caused the majority of fires. This is consistent with previous studies finding that over 30% of fatal residential fires are caused due to smoking<sup>1, 6, 8, 12, 17, 28</sup>. The current rate of smokers in Ireland is between 20% and 23% but were

over-represented in this research at 30%. Further research with a larger number of deaths is required to ascertain if this is statistically significant. Nevertheless, it indicates the importance of effective and targeted fire safety messages to this group, with emphasis placed on reducing the prevalence of smoking and promoting responsible disposal and storage of cigarettes and smoking materials, including lighters and matches<sup>20,21</sup>.

The analysis found that one in five (25, 23%) of those who died had experienced mental ill-health at some point in their lives. Although this is in line with the general population as per the Healthy Ireland report Ireland<sup>20</sup>, it nonetheless highlights the vulnerability of this population. Those who work in front-line health services could use their expertise to inform fire services of best practice procedures for such at-risk groups.

A key finding from this analysis is the compelling association of alcohol use and/or alcohol dependence with fatal fires in Ireland. Seventeen percent (n = 18) of those who died were known to be alcohol dependent. This is higher than expected, as the 2013 National Alcohol Diary Survey found that 7% of the general population were alcohol dependent<sup>22</sup>. To examine the statistical significance of this association, ongoing research using the coronial data is necessary.

The majority of fire fatalities were drinking around the time of the fire, consistent with previous literature<sup>8, 25, 26, 27</sup>. Previous research<sup>10</sup> indicates that males were found to be more likely than females to be drinking prior to their death, however, this analysis did not find a statistical significant association between gender and alcohol consumption.

Analysis of the toxicology reports and the BAC levels showed that 34 fatalities (32%) had a BAC greater than 160 mg/100ml and 20 of those had a BAC higher than 240 mg/100ml indicating substantial intoxication. Of note, in Ireland the current legal limit to drive for a fully licenced driver is less than 50mg/100ml and for professional and learner drivers, 20 mg/100ml<sup>38</sup>. Alcohol has been well reported to lead to accidents including fires<sup>6, 8, 18, 19</sup>. Evidence of the link between alcohol and fire fatalities is highlighted in this paper and people who are intoxicated may not be able to, or be slower to respond to a fire which is likely to increase the risk of mortality<sup>13, 16</sup>. This clearly demonstrates the risk of harmful alcohol consumption and the need to target this at-risk population.

Previous research<sup>6, 8, 14, 25, 27</sup> has shown that older adults (aged 65 years and older) were less likely than younger adults to have positive BAC toxicology when involved in fatal fires; however, this research found that older adults in Ireland were just as likely to have consumed alcohol before their death. Alcohol consumption coupled with physical and/or sensory disabilities associated with the ageing process is particularly dangerous especially for those that live alone and who may not have working fire safety equipment in place. The finding that men had higher BAC readings is consistent with previous studies reporting males to be at a greater risk of consuming large amounts of alcohol before their death placing them at increased risk<sup>8</sup>.

Toxicology tests are routinely carried out for the majority of fire fatalities and the results provides a valuable insight into the events preceding the fire. The coronial data showed that, as would be expected, carbon monoxide was listed in the majority of toxicology reports. Alcohol followed as the next most commonly reported substance in toxicology followed by drugs, including antidepressants, benzodiazepines, non-opioid analgesics, hypnotics and antipsychotic drugs. The prevalence of these drugs within the fire fatality cohort represents that of the general population's drug use however, drug use, especially in combinations, is likely to impede a person's ability to respond adequately<sup>23</sup>. This particularly relates to central nervous system (CNS) depressants drugs (e.g. benzodiazepines, opioids and hypnotics). Taking a combination of CNS depressant drugs can increase drowsiness, thus hindering alertness to respond to a fire. This analysis supports previous research that the use of multiple drugs places people at increased risk of death due to fires<sup>1</sup>.

Having access to national coronial files, allowed for the first time, to show definitively that alcohol, the presence of drugs, smoking and mobility limitations potentially play a contributory factor in fire-related fatalities in Ireland. As more data is collected, further statistical analysis can be undertaken to continue to see how this data can best inform prevention measures.

In order to educate on the prevention of fires, emphasis should be placed on smoking cessation and the importance of thoroughly extinguishing cigarettes. Furthermore, education needs to emphasise the importance of having a plan in place for older people who live alone and to identify particular risk factors including alcohol misuse, combining alcohol with prescribed medication, cooking under the influence of alcohol and the lack of fire safety equipment.

## 5. Conclusion

This study can be used by the Department of Housing, Planning and Local Government and the Irish Fire services to work with specific organisations to improve target preventions. In particular, this study has highlighted the elderly as an at-risk group of fire-related deaths. Keeping the elderly population safe from the dangers of fire is a complex situation. Having working smoke alarms is only one potential safety measure but there are several barriers to enabling this population to stay safe including their ability to effectively use fire safety equipment if a fire is detected. There also may be particular behaviours that could prove challenging to change; use of older electrical appliances, drying clothes on heaters, using alternative heating methods (open fires, electric heaters, stoves) and overloaded outlets (particularly relevant in older homes with limited power sockets). This complex situation requires careful consideration and it is essential that organisations liaising with the elderly work closely with fire safety specialists to ensure the most effective and best possible outcome.

Investment in smoke alarms, fire extinguishers and other equipment to alert households to fires, and equipment to potentially extinguish a fire is required, particularly in rural areas. Ensuring that this equipment is in correct working order and that the individuals are capable of using them effectively is essential. Monitored smoke alarms may save lives, particularly for those in rural settings and especially for vulnerable groups (older people, people with disabilities and/or mobility issues, those who misuse alcohol). Family members and neighbours of the higher risk populations should educate these residents of the potential risks of fires and to assist in developing and practicing an escape plan for successful exit from their home in the event of a fire. The high percentage of those who consumed alcohol before

their death, especially those who were severely intoxicated at the time of the fire, is a common finding in previous studies involving fatal fires and also a prominent finding in this study.

Alcohol is a key factor contributing to these unnecessary deaths. The negative impact of alcohol, and especially if it is mixed with drugs, needs to be reiterated. General Practitioners and other health professionals who are prescribing drugs to older clients with a history of alcohol misuse or dependency and/or those with mental ill-health need to consider possible implications and attempts should be made to inform of the dangers. The availability and accessibility of appropriate addiction treatment for this at risk group also needs to be considered.

Finally, the continued use of coronial data to identify patterns of fatal fires and their causes should be used to inform future fire prevention efforts.

## Limitations

Coronial data is collected for the purpose of the Coroner's investigation and not specifically for research. Therefore data that may be of interest for research purposes is not always available in the coronial files. Forensic fire reports are not carried out for all fatal fires and therefore not available in coronial files for a number of those who died during the period of this study.

It should be noted that the figures reported on in this paper apply to those whose inquest files were closed at the time of reporting. In addition, not all of those who died in fires will have had a toxicology report carried out and therefore, the numbers with a positive toxicology finding could in fact be higher.

## Acknowledgements

We would like to sincerely thank all the services that provide data for the NDRDI in particular the staff of the Coroner Service and Forensic and Legal Medicine University College Dublin (UCD). We would like extend our gratitude to the staff at the National Directorate for Fire and Emergency Management of the Department of Housing Planning and Local Government for their advice and support. We would also like to thank the NDRDI researchers; Emma Spelman, Helen Power, and Roseanne Stephenson.

### **Funding**

The NDRDI is funded by the Department of Health and the Department of Justice and Equality in Ireland and the collection of the fire data is funded by the Department of Housing, Planning and Local Government. The funding source neither had any role in the design of the study, the analysis and interpretation of the data or the writing of, nor the decision to publish, the article.

### **Conflict of interest**

None declared.

### **Key Points**

- Older people are at an increased risk to dying in residential fires.
- Alcohol is a key factor in fatal fires in the Republic of Ireland.
- Smoking materials are a contributory cause of fatal fires
- Campaigns on fire safety need to be specifically targeted at those most at risk, especially the elderly and/or those living alone, particularly in rural locations.
- Those who prescribe and/or dispense medications should be educated on advising patients on dangers of mixing alcohol with prescription medications.
- Further longitudinal analysis of the coronial data when available will add to the knowledge on fire fatalities.

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Table 1. Age group and gender of fire fatalities in Ireland, 2014-2016						
	Male		Female		Total	
0-39 years	11	16	5	14	16	15
40-64 years	26	38	9	24	35	33
65-79 years	22	32	15	41	37	35
80 years and over	10	14	8	22	18	17
<b>Total</b>	<b>69</b>	<b>100</b>	<b>37</b>	<b>100</b>	<b>106</b>	<b>100</b>

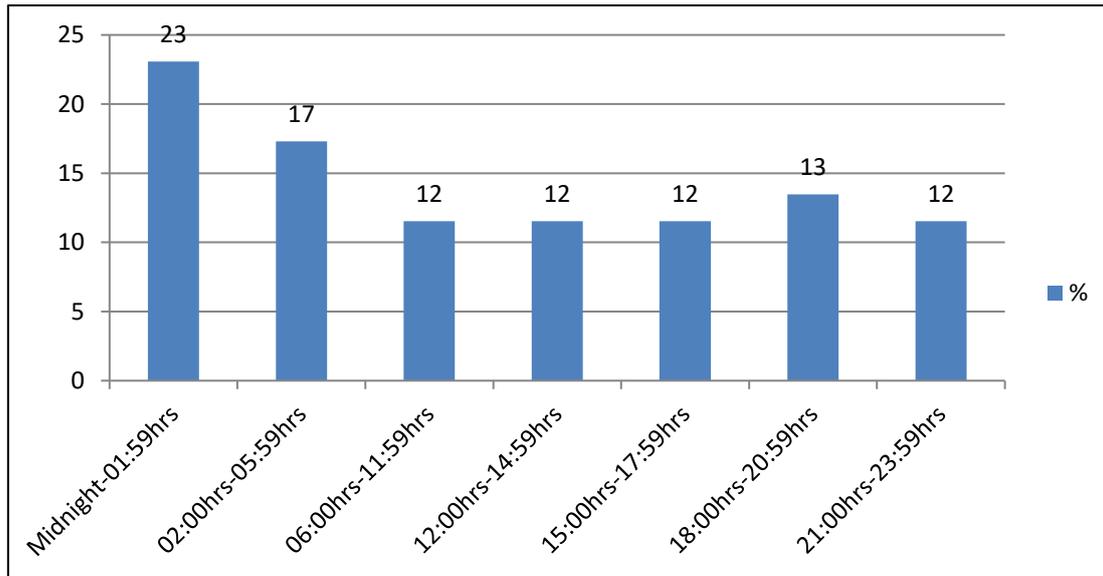
Note that some % totals add to more/less than 100 due to rounding up/down

Table 2. Toxicology findings by age group where drugs or alcohol were listed							
Age group	Alcohol only		Drugs only		Drugs & alcohol		Total
	n	% (row)	n	% (row)	n	% (row)	
0-39 years	~	15	~	23	8	62	13
40-59 years	11	58	~	16	5	26	19
60-79 years	14	44	8	25	10	31	32
80 years and over	~	10	6	60	~	30	10
<b>Total</b>	<b>28</b>	<b>38</b>	<b>20</b>	<b>28</b>	<b>26</b>	<b>35</b>	<b>74</b>

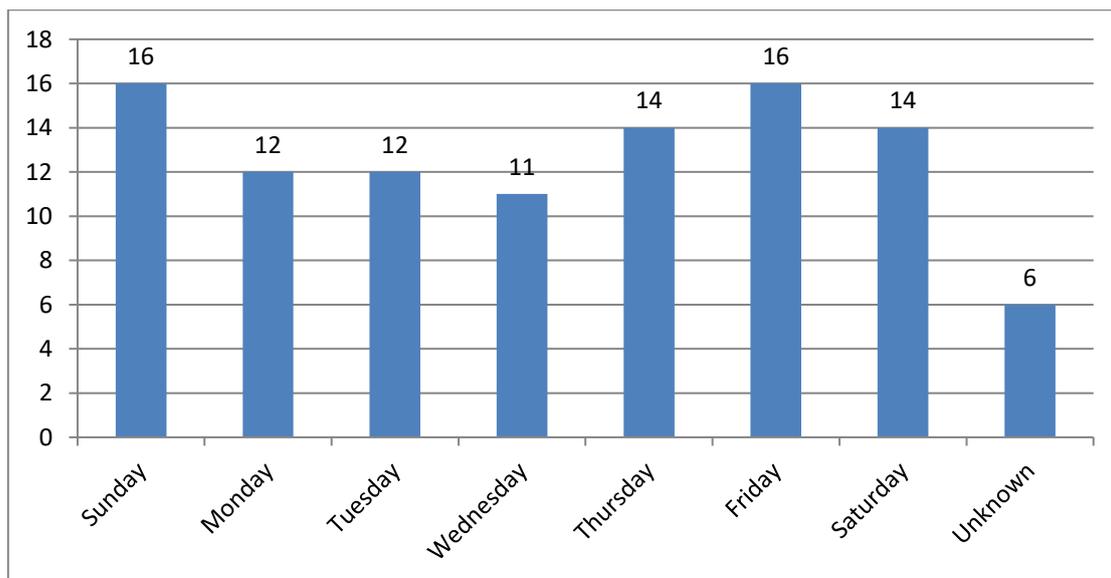
~=*less than five*

Table 3. Blood alcohol concentrations (BAC) for fire fatalities 2014-2016		
	n	%
Present/trace	~	8
0-79 mg/100ml	5	9
80-159 mg/100ml	10	19
160-239 mg/100ml	15	28
240+mg/100ml	20	37
<b>Total</b>	<b>54</b>	<b>100</b>

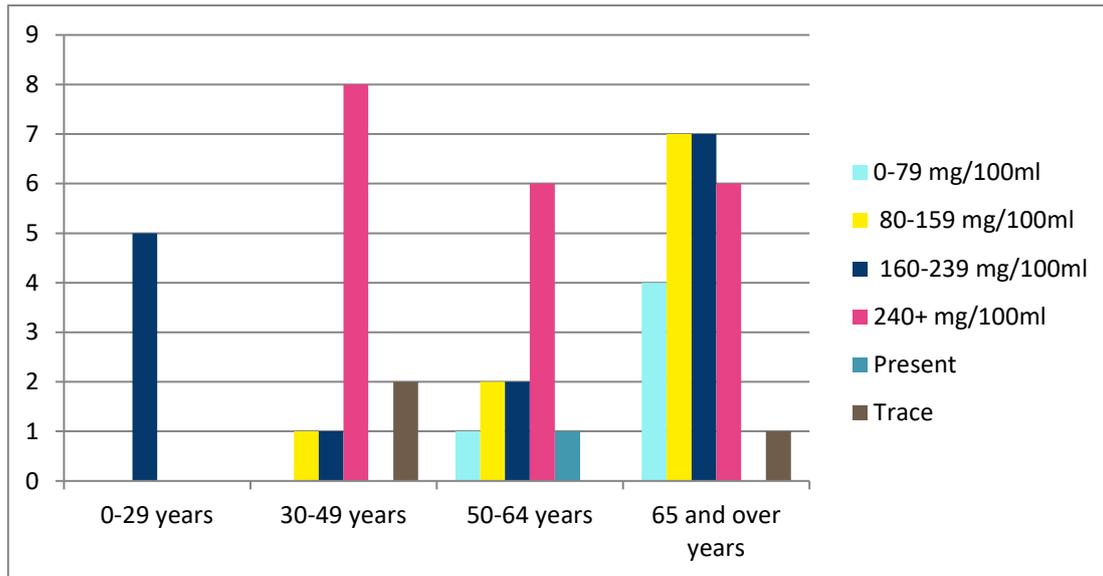
~=*less than five*



**Figure 1. Time of day recorded for fatal fires in the NDRDI, 2014-2016**



**Figure 2. Day of the week fatal fire occurred 2014-2016**



**Figure 3. Age group and BAC reported in toxicology of fire fatalities, 2014-2016**