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# An exploration of householder injuries sustained fighting dwelling fires

## Abstract

In this paper we examine the fire injuries sustained by householders fighting accidental dwelling fires in Merseyside in the North West of England over the period 2006 to 2016. In particular, we examine the distribution of injuries sustained by householders fighting accidental dwelling fires by age, gender, and level of deprivation, the types of housing in which injuries related to householders fighting fires occurred, and the types of injuries associated with householders fighting such fires. Injuries sustained by householders fighting accidental dwelling fires made up a significant proportion (19.5%) of the overall set of fire injuries over the period studied. Overall, it appeared that males were twice as likely to be injured fighting an accidental dwelling fire compared to females, however, this ratio varied between different age groups. In addition, single occupancy housing appeared to be the most common housing type in which householders sustained injuries fighting accidental dwelling fires. There also appeared to be a strong link between level of deprivation and incidents of householders being injured fighting such fires.

**Key words** Fire Injury Dwelling Analysis

## 1. Introduction

In the UK, fire and rescue services advise the public to “Get out, stay out, and call 999” (Staffs, 2020; Hamps, 2020; GMFRS, 2020), that is for fire and rescue service officers to fight dwelling fires, rather than householders. However, each year there are numerous accidental dwelling fire incidents where injuries are sustained by householders fighting fires. The English Housing Survey: Fire and Fire Safety, 2016-17 by the UK Ministry of Housing, Communities and Local Government (MHCLG, 2018) found that in the majority of households where an accidental dwelling fire occurred, the fire was put out by someone in the household, or the fire went out by itself. Only a quarter (25%) of such fires were put out by a fire and rescue service, meaning that three quarters (75%) of accidental dwelling fires in the UK are never reported to a fire and rescue service. It is therefore important when examining data concerning injuries sustained by householders fighting accidental dwelling fires to be aware that incidents of householders fighting such fires are likely to be much more widespread than the injury data would imply, since it would appear likely that many (possibly most) of accidental dwelling fires that are not reported to a fire and rescue service are the result of successful fire-fighting on the part of the householder(s). In terms of reducing the risk of injuries sustained by householders fighting accidental dwelling fires Clark et al (2015) had raised concerns that there continue to be sections of society that appear to be non-receptive to fire safety messages. In order to address such concerns, Beaulieu et al (2020) suggested the need to include more messages around safe ways to deal with a dwelling fire in public fire safety and door-to-door campaigns. Thompson and Wales (2015) highlighted the fact that there has been limited research into the reach and effectiveness of fire safety advice and campaigns.

It is important to appreciate how the probability of injury from fighting an accidental dwelling fire is a composite of several factors. Firstly, the probability that a reportable accidental dwelling fire will occur (since the majority of accidental dwelling fires are not reported to a fire and rescue service (MHCLG, 2018)). Secondly that conditional on a reportable accidental dwelling fire occurring, there will be a probability that someone in the household will attempt to fight such. Thirdly, that conditional on someone attempting to fight an accidental dwelling fire, there will be a probability that the person is injured fighting the fire. These probabilities can vary from group to group.

In terms of householders responding to an accidental dwelling fire, Yellman et al (2018) identified that a functioning smoke alarm reduces the risk of fire injuries by more than half. Nilson and Bonander (2020) further analysed the relationship between fire injury risk and fire protection and found that the level of fire protection within a household is affected by gender, age, family composition, and housing type. Gilbert and Butry (2018) identified that whilst the oldest and the youngest are more likely to be

killed in an accidental dwelling fire, those in the middle-age group are more likely to be injured in a dwelling fire. In addition, typically males can be more likely to be injured in dwelling fires than females (Gilbert and Butry, 2018; Beaulieu et al, 2020). Smoke inhalation alone or in combination with cutaneous burns typically accounts for up to 75% of residential fire deaths, with burns alone typically constituting the remaining 25% of such deaths (Eggert and Huss, 2017).

In this paper, we examine the patterns and circumstances of injuries sustained by householders fighting accidental dwelling fires by age, gender, and level of deprivation, the types of housing in which injuries related to householders fighting fires occurred, and the types of injuries associated with householders fighting such fires. Overall numbers concerning injuries sustained by householders fighting accidental dwelling fires over the ten year period studied were used rather than population risk levels due to the changes in the population in the area concerned over the time period studied. Injuries sustained by householders fighting accidental dwelling fires made up a significant proportion (19.5%) of the overall set of fire injuries over the period studied. Thompson and Wales (2015) stated that there has been limited research into incidences of attempting to fight accidental dwelling fires.

The originality of the research presented in this paper is the detailed analysis of the circumstances associated with fire injuries sustained by householders fighting accidental dwelling fires over a ten year period within the area covered by a UK fire and rescue service.

## **2. Literature review**

### **2.1 Householders fighting fires**

Thompson et al (2013) identified that a large proportion of householders may undertake several actions during a dwelling fire including: entering the room in which the fire started, fighting the fire, and re-entering the property before calling the fire and rescue service. Research by Wales and Thompson (2013) indicated there can be a strong desire among householders to tackle the fire themselves, with the decision to call the fire service often being secondary to other aims and concerns, including issues related to shame and guilt. Tannous and Agho (2017) identified that there can be an unwillingness to call fire and rescue services amongst some social groups.

Mytton et al (2017) identified the concern that householders may have the perception that a dwelling fire can be contained and that they have the ability to do so, or that people, pets and possessions can be retrieved safely. Research by Xiong et al (2017) indicated that people with no or only basic fire safety knowledge were more likely to engage in activities such as attempting to extinguish a dwelling fire than those who had some level of fire training. A lack of understanding and awareness of the potentially rapid development and effects of smoke may lead to householders tackling or otherwise attempting to mitigate the fires in their homes with, at best, very limited knowledge, or assessment, of the possible risks inherent in such actions (Thompson and Wales, 2015). Bonny and Leventon (2021) proposed that models of human behaviour in response to fire-related emergencies can explicitly account for potential delays in identifying and acting on the presented risk of a fire. They advocated the use of psychophysical and observational data to contribute to understanding human evacuation behaviour during fire emergencies. Hulse et al (2020) analysed perception of fire hazard properties and identified that whilst increased hazard size reduced willingness, a concerning percentage of individuals nevertheless consider engaging with the largest fire hazards, and that such risky behaviours may explain fire injury outcomes. Prior fire experience and gender affected willingness to attempt to tackle a fire. Thompson et al (2018) noted clear differences between male and female responses to dwelling fires, in that males were more likely to exhibit fire-fighting behaviours whereas females were more likely to alert others and exit the property, and differences between responses to dwelling fires in different types of housing. Deprivation had previously been linked with accidental dwelling fire injury risk (Clark et al, 2015; Bell, 2009), and Purcell et al (2020) had identified the effect of neighbourhood deprivation on residential burn injury severity. Clark and Smith (2015) stated that there is little understanding about how fire risk is perceived by individuals, in particular with regard to tackling domestic fires. Hall (2004) analysed United States

home fire deaths and injuries where people could have avoided harm if they had more time to escape. The analysis indicated that roughly half of the fire deaths and roughly two-thirds of the fire injuries could have been prevented if the times to incapacitating exposures had lengthened sufficiently to result in a more favourable outcome. Many victims were asleep when fatally injured and would have needed help they did not receive in order to awaken, for example, an operational smoke alarm.

Analyses of fire injury data can be used to tailor fire safety messages specifically for groups more vulnerable to risk of injury from fighting accidental dwelling fires (Harpur et al, 2014). Murphy (2013) commented that fire and rescue services can now communicate directly with local citizens via social media, in addition to traditional sources already used, which can magnify the reach of fire safety communications. Social media such as Twitter, Facebook and Instagram can provide an effective means of reaching out to local communities, in terms of fire safety messages (NFC, 2020). Higgins et al (2015) had highlighted the benefits of appropriate data analysis techniques for transforming fire prevention strategies. Taylor et al (2019) commented that appropriately targeted fire prevention activities can have a significant impact in terms of reducing the number of accidental dwelling fires.

## **2.2 Main types of injuries sustained by householders fighting fires**

### *2.2.1 Burns*

Clark et al (2018) commented that most fire burn injuries occur in the home. Accidental dwelling fire burns injuries have both social and economic costs. Burn injuries can be much worse for older adults since their burn injuries are often more severe and can be complicated by co-morbidities, and often require increased medical care and healing time compared with younger adults (Coty et al, 2015). Hussain and Dunn (2015) commented that dwelling fire and burn injury prevention strategies need to be targeted towards high-risk population groups in order to realise maximum impact, which in turn requires accurate, up-to-date and population specific information.

### *2.2.2 Smoke inhalation*

The most common primary injury associated with accidental dwelling fires is exposure to smoke and toxic gases (Jonsson, 2017). Smoke inhalation injury is a serious threat to victims of dwelling fires, this type of injury alone can be lethal (Choi et al, 2010). Smoke inhalation injury is a major cause of mortality in burn patients (Yamamura et al, 2013). Smoke inhalation injury is a complex clinical problem, since injured pulmonary tissue must be protected from secondary injury due to resuscitation, mechanical ventilation, and infection. Morbidity associated with smoke inhalation injury is due to heat exposure and inhaled toxins. Management of toxin exposure in smoke inhalation in dwelling fires can be complex, particularly with regard to carbon monoxide and cyanide exposure (Dries and Endorf, 2013). The physiological effects of exposure to toxic smoke in fires may lead to death or permanent injury (Giebułtowiec et al, 2017).

Overall, there appears to have been limited research that specifically addresses the patterns and circumstances of instances of fire injuries sustained by householders fighting accidental dwelling fires.

## **3. Research method**

The aim of the research presented in this paper was examine the patterns and circumstances of instances of fire injuries sustained by householders fighting accidental dwelling fires in the period 2006 to 2016 in Merseyside, in the North West of England. Data recorded by Merseyside Fire and Rescue Service for accidental dwelling fire injuries, and in particular accidental dwelling fires during which injuries were sustained by householders fighting fires in the period 2006 to 2016 in Merseyside, UK was analysed in order to determine patterns and trends that could then be utilised for informing fire prevention initiatives and guidance for the public. The database used for the research (which included

fire injuries data as well as other fire incident related details) is called the Incident Recording System (IRS) which is managed by the UK Home Office. The code used within the database records for identifying an injury sustained where the householder attempted to tackle an accidental dwelling fire was “Due to fire - Fighting fire (including attempts to)”. In addition, Indices of Multiple Deprivation (IMD, 2021) data for England (produced by the UK Office for National Statistics) was also utilised. The Index of Multiple Deprivation (IMD) decile is a scale from 1 to 10, where 1 = most deprived 10% of Lower Level Super Output Areas (LSOAs) in England (ONS, 2021). The Indices of Deprivation provides a set of relative measures of deprivation for Lower layer Super Output Areas across England, based on seven domains of deprivation, which are combined using different weights to produce the overall Index of Multiple Deprivation. The domains include: Income, Employment, Education, Skills and Training Deprivation, Health Deprivation and Disability, Crime, Barriers to Housing and Services, and Living Environment:

Income Deprivation (22.5%)

Employment Deprivation (22.5%)

Education, Skills and Training Deprivation (13.5%)

Health Deprivation and Disability (13.5%)

Crime (9.3%)

Barriers to Housing and Services (9.3%)

Living Environment Deprivation (9.3%)

The research questions posed by the research reported in this paper were:

- How are the injuries sustained by householders fighting accidental dwelling fires distributed by age, gender, and level of deprivation?
- In what types of housing do injuries related to householders fighting accidental dwelling fires occur?
- What types of injuries are associated with householders fighting accidental dwelling fires?

These are important research questions since accidental fire injuries incur both social and economic costs, and fire and rescue services need to better understand the nature of accidental fire incidents where householders are injured fighting fires, in order to appropriately target fire prevention activities to those most at risk.

The analysis was undertaken by examining the different circumstances recorded for fire injuries, and in particular fire injuries sustained by householders fighting accidental dwelling fires, in the period 2016 to 2016 in Merseyside UK. This included the overall pattern of fire injuries, and fire injuries sustained by householders fighting dwelling fires over the period studied, and analyses of the distribution of fire injuries by householders fighting fires by gender, age group, and different aspects of deprivation. In addition, the types of housing in which injuries occurred by householders fighting accidental dwelling fires, and the distribution of the types of injuries sustained by householders fighting dwelling fires was also examined.

#### **4. Research results**

Over the period 2006 to 2016, the trend of fire injuries sustained by householders fighting accidental dwelling fires in Merseyside in the UK was as shown in Figure 1.

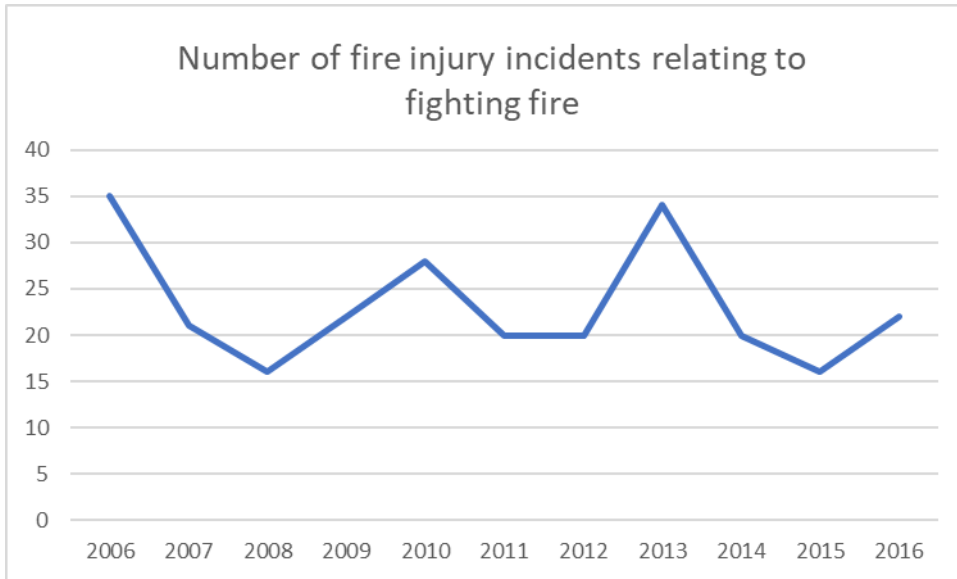


Figure 1. Number of fire injury incidents involving householders fighting fires 2006 to 2016, in Merseyside, UK

There were 254 accidental dwelling fire incidents where householders were injured fighting fires over the period concerned (2006 to 2016) in the Merseyside area, compared to 1309 incidents overall where fire injuries occurred in the Merseyside area over the time period considered (19.4 % of fire incidents involving fire injuries). The number of incidents per year where householders were injured fighting accidental dwelling fires varied between 16 and 35, with an average number of 23. Figure 2 shows the number of accidental dwelling fire incidents per year involving injury for comparison.

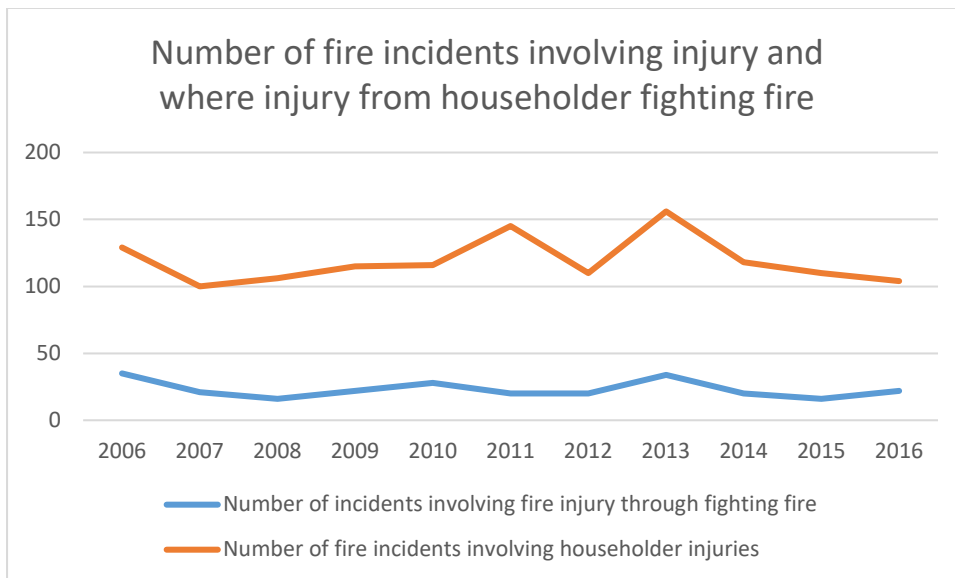


Figure 2. Number of fire injury incidents and number of fire injury incidents involving householders fighting fires 2006 to 2016, in Merseyside, UK

Over the period studied (2006 to 2016) it appeared that there was a roughly equal proportion of fire injuries resulting from householders fighting accidental dwelling fires compared to the overall number of accidental dwelling fire injuries per year.

#### 4.1 Injuries sustained by householders fighting accidental dwelling fires distributed by age, gender, and level of deprivation

In terms of the age profile of householders injured fighting accidental dwelling fires, the number of incidents involving such injuries by age band is shown in Figure 3.

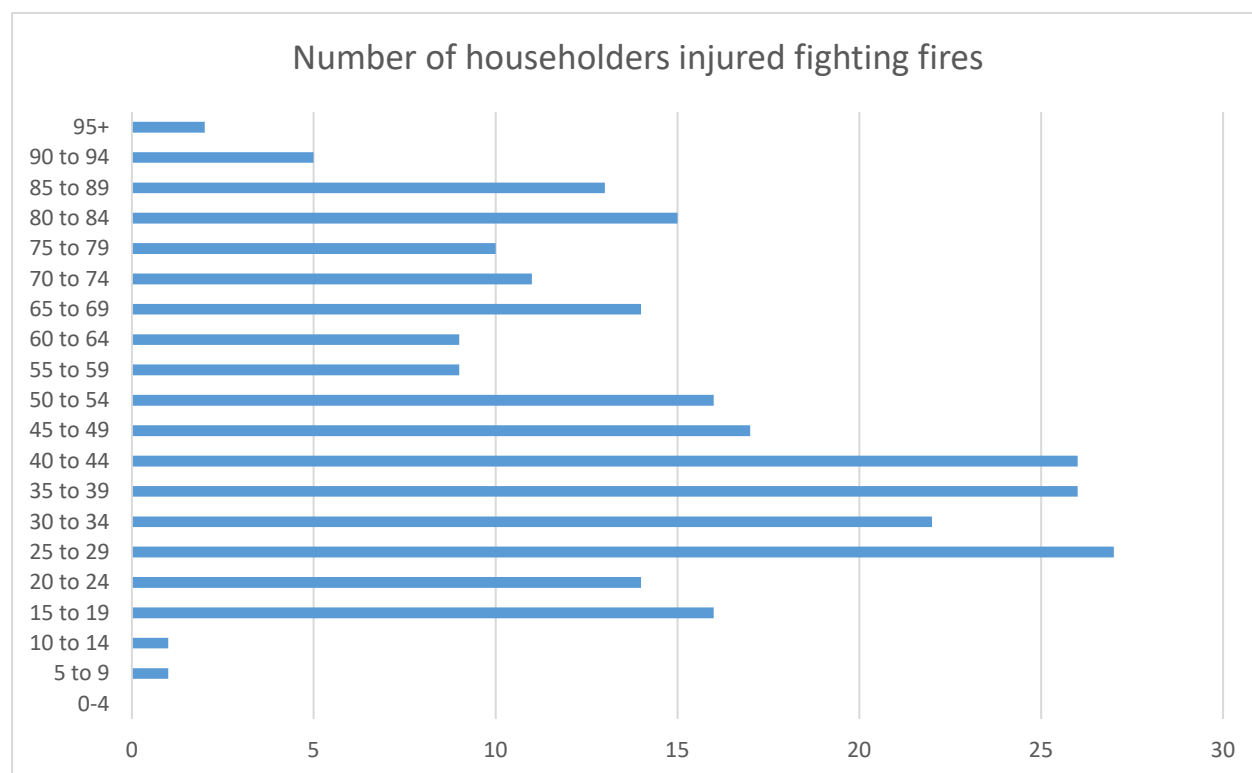


Figure 3. Age profile of householders injured fighting fires, 2006 to 2016, in Merseyside, UK

This appeared to indicate that over the period studied the main age group injured fighting accidental dwelling fires were householders in the range 25 to 50. The relative proportions of the different age bands of those injured as a result of accidental dwelling fires, appeared to be roughly similar as for those injured as a result of injuries sustained fighting accidental dwelling fires, apart from older householders (those aged 80+) and those aged 0 to 9 (which might be expected, as older householders and younger children would typically be less likely to attempt to tackle dwelling fires) as shown in Figure 4.

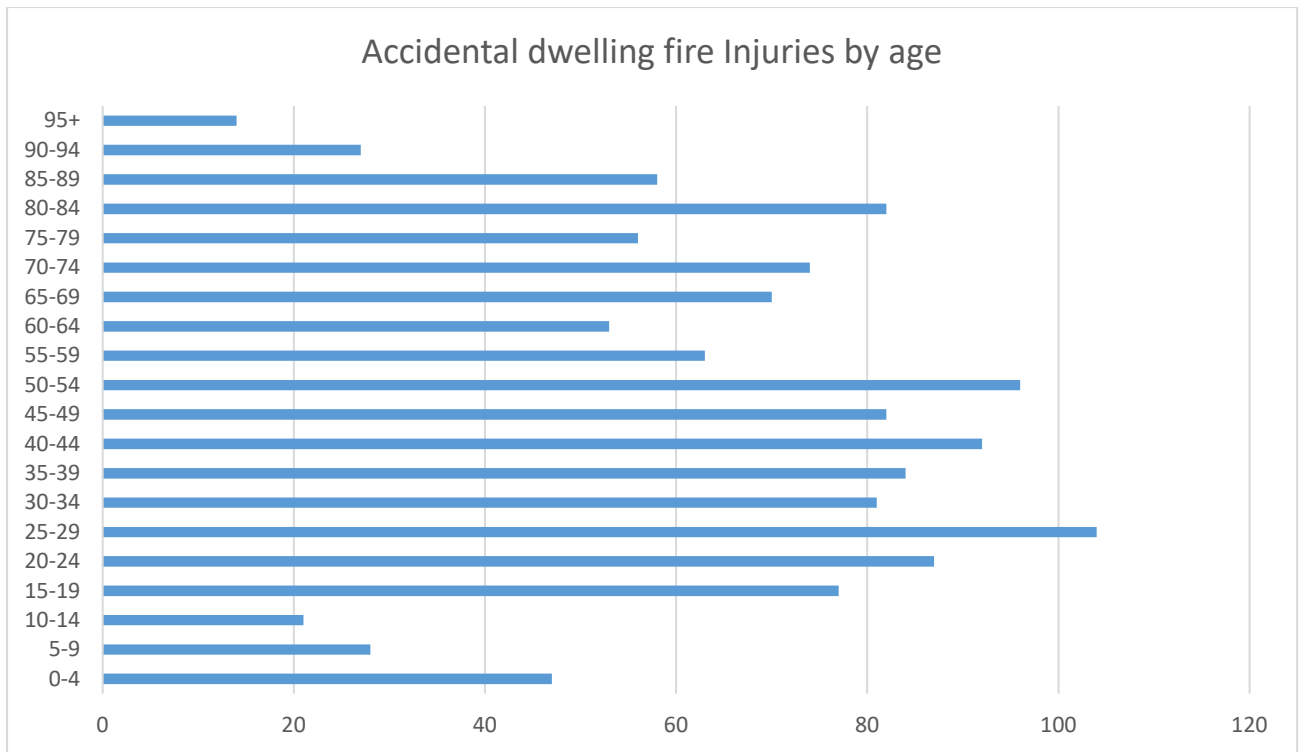


Figure 4. Age profile of householders injured in dwelling fires, 2006 to 2016, in Merseyside, UK

The gender of householders injured in fighting accidental dwelling fires in Merseyside, UK between 2006 and 2016 is shown in Figure 5.

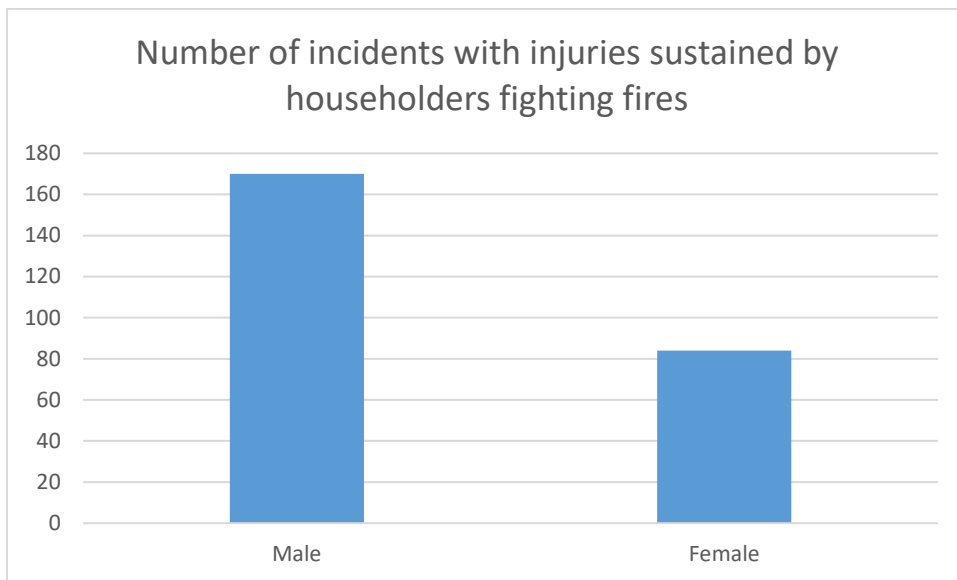


Figure 5. Gender of householders injured fighting accidental dwelling fires between 2006 and 2016 in Merseyside, UK.

Overall, it appeared over the period studied that male occupants were twice as likely to be injured fighting a domestic fire than female occupants over the period studied (a ratio of 2.02 to 1). In comparison, for the period studied, in terms of overall number of householders injured in domestic fires, the ratio of male to female injuries was 1.11 to 1.



An examination of gender and age group injuries sustained by householder fighting accidental dwelling fires is shown in Table 1, which shows the distribution by age group and gender in terms of numbers and approximate percentages.

Table 1. Distribution of fire incidents involving injuries related to householders fighting fires by age group and gender.

		Male	Female	Total	Male %	Female %
Age Group	0-4	0	0	0	0.0%	0.0%
	5-9	1	0	1	0.6%	0.0%
	10-14	1	0	1	0.6%	0.0%
	15-19	12	4	16	7.0%	4.8%
	20-24	10	4	14	5.9%	4.8%
	25-29	17	10	27	10.0%	11.9%
	30-34	12	10	22	7.0%	11.9%
	35-39	22	4	26	12.9%	4.8%
	40-44	16	10	26	9.4%	11.9%
	45-49	12	5	17	7.0%	6.0%
	50-54	11	5	16	6.5%	6.0%
	55-59	8	1	9	4.7%	1.0%
	60-64	6	3	9	3.5%	3.6%
	65-69	12	2	14	7.0%	2.0%
	70-74	7	4	11	4.1%	4.8%
	75-79	5	5	10	2.9%	6.0%
	80-84	8	7	15	4.7%	8.3%
85-89	7	6	13	4.1%	7.1%	
90-94	2	3	5	1.2%	3.6%	
95+	1	1	2	0.6%	1.0%	
Total		170	84	254		

This indicated that although overall the ratio of males to females injured fighting accidental dwelling fires was 2 to 1, there were differences to this ratio between the different age bands. For those aged 75+ there were roughly similar numbers of males and females injured fighting such fires, however, for the other age bands there were higher ratios, with the highest ratios in terms of numbers being 8 to 1 for those aged 55 to 59, 6 to 1 for those aged 65 to 69, and 5.5 to 1 for those aged 35 to 39. However, in percentages terms the ratios were 4.7 to 1 for those aged 55 to 59, 3.5 to 1 for those aged 65 to 69, and 2.7 to 1 for those aged 35 to 39.

A Two-way Chi-square test of the relationship between age group and gender resulted in a significance level of 0.51, indicating that there was not a significant relationship overall between age group and gender in terms of injuries sustained by householders fighting fires.

In terms of the relationship between injuries sustained fighting dwelling fires and the level of deprivation of the Lower Layer Super Output Area (LSOA) (ONS, 2021) in which the fire incident occurred, Figure 6 shows the distribution of incidents where injuries were sustained by householders fighting dwelling fires by Indices of Multiple Deprivation (IMD) decile (produced by the UK Office for National Statistics). The Index of Multiple Deprivation (IMD) decile is a scale from 1 to 10, where 1 = most deprived 10% of LSOAs in England.

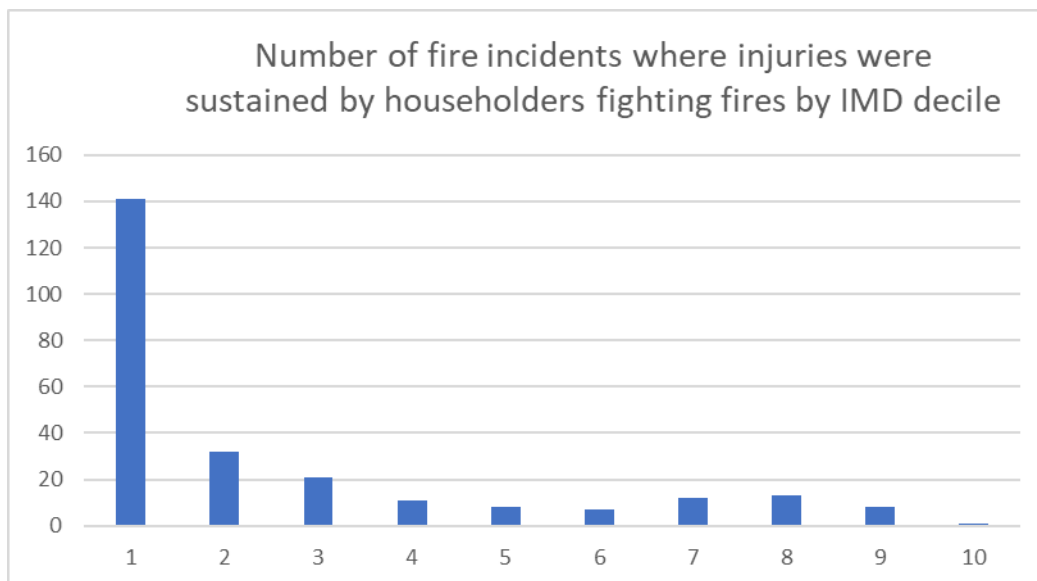


Figure 6. Number of fire incidents where injuries were sustained by householders fighting fires by IMD decile.

The level of deprivation of an area appeared to be linked to the number of incidents where injuries were sustained by householders fighting fires, with the vast majority occurring in areas which were in the most deprived 10% of Lower Layer Super Output Areas in England. However, Thompson and Wales (2015) stated that it is important to make clear that deprivation itself does not cause fires, rather that deprived areas tend to have greater concentrations of those who are at greater risk of dwelling fires.

To put this in context, the distribution of Indices of Multiple Deprivation (IMD) deciles across the Lower Layer Super Output Areas within Merseyside is shown in Table 2.

Table 2. Distribution of Indices of Multiple Deprivation (IMD) deciles across the Lower Layer Super Output Areas within Merseyside.

Merseyside LSOA IMD decile counts

1	289
2	114
3	79
4	67
5	77
6	69
7	75
8	60
9	48
10	32
Total	910

Table 2. shows counts of the number of Lower Level Super Output Areas (distinct geographical areas defined by the UK Office for National Statistics) within the Merseyside area identified as being in a given IMD decile.

With regard to the distribution of fire incidents across the Lower Level Super Output Areas in Merseyside where injuries were sustained by householders fighting dwelling fires by the different domains, Income Deprivation, Employment Deprivation, and Health and Disability Deprivation all showed similar patterns of injuries sustained by householders fighting accidental dwelling fires to that of the overall Indices of Multiple Deprivation.

With regard to the distribution of fire incidents across the Lower Level Super Output Areas in Merseyside where injuries were sustained by householders fighting dwelling fires by Living Environment Deprivation decile, and Barriers to Housing and Services decile, different patterns emerged as shown in Figures 7 and 8.

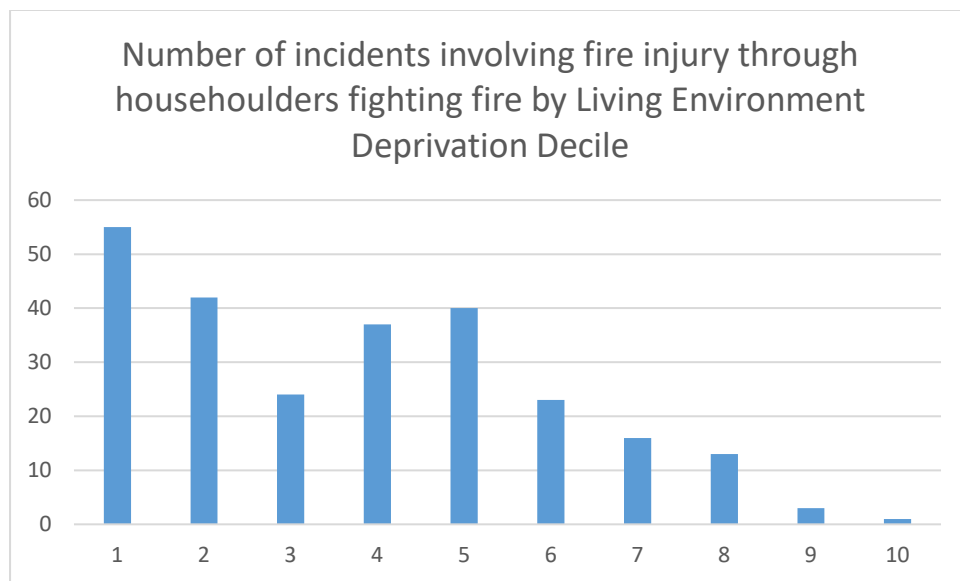


Figure 7. Distribution of injuries sustained by householders fighting accidental dwelling fires by Living Environment Deprivation deciles across the Lower Layer Super Output Areas within Merseyside.

The Living Environment Deprivation domain measures the quality of the local environment, based upon the 'indoors' living environment which measures the quality of housing, and the 'outdoors' living environment which contains measures such as air quality and road traffic accidents. This appeared to indicate that instances of householders injured fighting accidental dwelling fires were concentrated in areas with lower living environment levels.

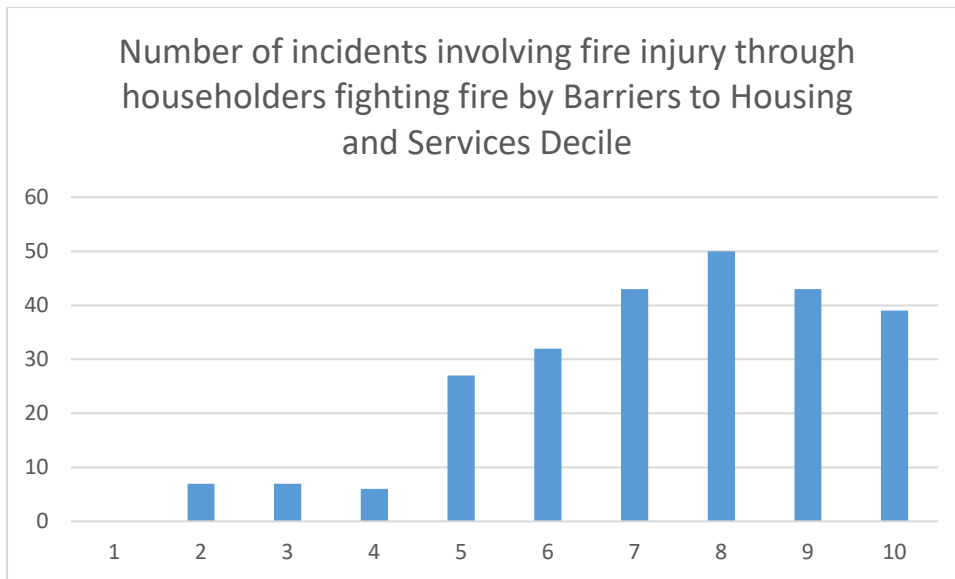


Figure 8. Distribution of injuries sustained by householders fighting accidental dwelling fires by Barriers to Housing and Services deciles across the Lower Layer Super Output Areas within Merseyside.

The Barriers to Housing and Services domain measures the physical and financial accessibility of housing and local services, including 'geographical barriers' relating to the physical proximity of local services, and 'wider barriers' which includes issues relating to access to housing such as affordability and homelessness. This appeared to indicate that incidents involving householders injured fighting accidental dwelling fires occurred in areas that had relatively good access to local services, and had reasonable affordability of housing and lower levels of homelessness.

#### 4.2 Types of housing where injuries related to householders fighting accidental dwelling fires occurred

In terms of the type of housing in which such fire injuries occurred, the number of incidents where injuries were sustained by householders fighting accidental dwelling fires by type of housing is shown in Figure 9.

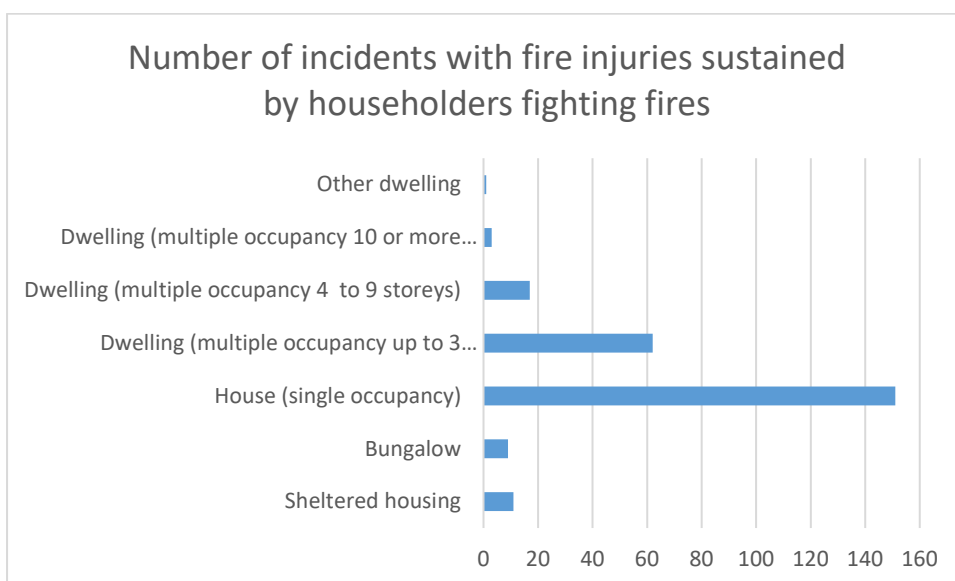


Figure 9. Number of incidents per housing type in which householders sustained injuries fighting fires, 2006 to 2016, in Merseyside, UK.

This indicated that the vast majority of incidents in which householders were injured fighting accidental dwelling fires occurred in single occupancy housing, followed by multiple occupancy dwellings up to three storeys high.

#### 4.3 Types of injuries associated with householders fighting accidental dwelling fires

The type of injuries sustained with regard to householders fighting accidental dwelling fire in Merseyside, UK between 2006 and 2016 is shown in Figure 10.

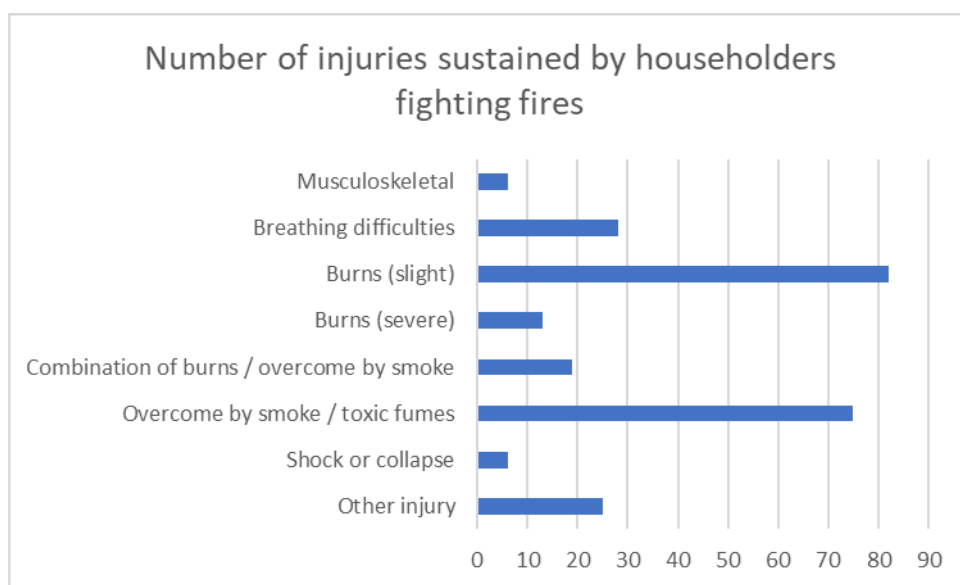


Figure 10. Number of types of injuries sustained by householder fighting accidental dwelling fires between 2006 and 2016, in Merseyside, UK.

Overall slight burns and being overcome by smoke and toxic fumes were the main types of injuries sustained by householders fighting fires over the period studied. In comparison, examination of the different proportions of types of fire injuries sustained by householders over the period studied, showed a smaller proportion of slight burns, indicating that fighting domestic fires increases the risk of sustaining slight burns as shown in Figure 11.

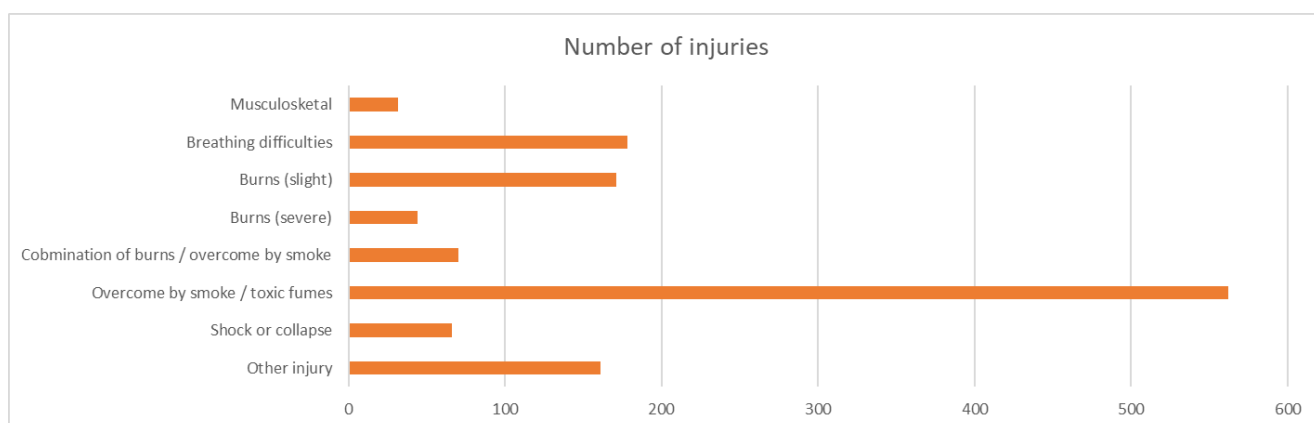


Figure 11. Number of types of injuries sustained by householders in dwelling fires between 2006 and 2016, in Merseyside, UK.

## 5. Discussion

The implications of the findings of the research for fire safety campaigns include the need to strengthen the message to individuals to exit the building in the event of an accidental dwelling fire, to not return to the fire, and to call the fire and rescue service. Appropriate use of social media may help to disseminate the get out, stay out, call 999 message. However, although social media may help to disseminate the message, in terms of increasing the reach, it may not be any more effective in convincing the public to follow the message. Thompson and Wales (2015) had commented that there has been limited research into the reach and effectiveness of fire safety advice and campaigns. Whilst the research results indicated a tendency for relatively younger adults to be injured when tackling a fire, older adults (65+) still made up more than a quarter of all those injured in tackling a fire. Therefore, although use of social media might be an appropriate approach for reaching out to younger adults with fire safety messages, since this age group typically make regular use of social media, this might be less relevant to older adults, who might typically use social media less. Potentially, the higher incidence of males being injured when attempting to tackle a domestic fire could be addressed by targeting fire safety messages specifically to males. Deprivation appeared to have a significant relationship with accidental dwelling fire injuries, therefore targeting home fire safety checks to such areas could also have the potential to reduce such injuries. Typically, UK fire and rescue service fire safety campaigns are mainly targeted towards preventing accidental dwelling fires from happening in the first place (MFRS, 2021), which potentially reduces costs for the fire and rescue service. Fire safety campaigns relating specifically to reducing or preventing injury from occurring during a fire by advising individuals to leave firefighting to the professionals (Staffs, 2020; Hamps, 2020; GMFRS, 2020) could possibly increase costs for fire and rescue services as fire crews might have to attend more fire incidents.

A limitation of the research undertaken was that dwelling fires resulting in no injury when the householder had attempted to tackle the fire were not recorded by the fire and rescue service concerned. A further limitation to the research undertaken concerned potential limitations regarding the generalizability of the research findings to other UK fire and rescue services and beyond since the area covered by Merseyside Fire and Rescue Service included some of the most deprived areas in England.

The research results appear to be broadly similar to previous research in this area in terms of the higher likelihood of males being injured in an accidental dwelling fire (Gilbert and Butry, 2018; Beaulieu et al, 2020), and the strong link between deprivation and fire injury (Purcell et al, 2020; Clark et al, 2015; Bell, 2009), however this research has examined the nature of accidental dwelling fire injuries in more detail than previous research studies. Overall, targeting of fire safety campaigns and home fire safety checks can potentially reduce the level of accidental dwelling fire injuries, and also potentially reduce costs not only for fire and rescue services, but also health services involved in treating such injuries.

## Conclusion

Overall, over the period studied (2006 to 2016) it appeared that there was a roughly equal proportion of fire injuries resulting from householders fighting accidental dwelling fires compared to the overall number of accidental dwelling fire injuries per year. In terms of the injuries sustained by householders fighting accidental dwelling fires, it would appear that for the Merseyside area over the period 2006 to 2016, overall, males were twice as likely to be injured fighting an accidental dwelling fire than females. However, there were different gender ratios of injuries sustained by householders fighting dwelling fires across the different age bands.

The overall level of deprivation of an area (measured by the Indices of Multiple Deprivation decile) appeared to be linked to the number of incidents where injuries were sustained by householders fighting fires, with the vast majority occurring in areas which were in the most deprived 10% of Lower Layer Super Output Areas in England. However, although deprivation factors such as income deprivation,

employment deprivation, and health and disability deprivation all showed similar patterns of injuries sustained by householders fighting accidental dwelling fires to that of the overall Indices of Multiple Deprivation measure, different patterns emerged with regard to other deprivation factors such as living environment deprivation, and barriers to housing and services deprivation.

It is hoped that the research presented may be of use to other UK Fire and Rescue Services, and to other Fire and Rescue Services worldwide, in terms of understanding the circumstances associated with injuries sustained by householders fighting accidental dwelling fires. This can hopefully be used to inform fire prevention and public awareness strategies used by Fire and Rescue Services, in order to attempt to reduce the frequency of such injuries.

## References

- Beaulieu, E., Smith, J., Zheng, A., Pike, I. (2020) The geographic and demographic distribution of residential fires, related injuries, and deaths in four Canadian provinces, *Canadian journal of public health*, 111, 1, 107-116.
- Bell, N., Schuurman, N., Hameed, S. (2009) A small-area population analysis of socioeconomic status and incidence of severe burn/fire-related injury in British Columbia, Canada, *Burns*, 35, 8, 1133-1141.
- Bonny, J., Leventon, I. (2021) Measuring human perceptions of developing room fires: The influence of situational and dispositional factors, *Fire and Materials*, 45, 4, 451-461.
- Choi, W., Syrkina, O., Kwon, K., Quinn, D., Hales, C. (2010) JNK activation is responsible for mucus overproduction in smoke inhalation injury. *Respiratory research*, 11, 1, 1-8.
- Clark, A., Campbell, S., Arnoldo, B. (2018), *Prevention of burn injuries*, in *Total burn care*, Elsevier, New York, USA, pp. 28-35.
- Clark, A., Smith, J. (2015) Experiencing a domestic fire: an overview of key findings from a post incident research programme, *Safer Communities*, 14, 2, 95-103.
- Clark, A., Smith, J., Conroy, C. (2015) Domestic fire risk: a narrative review of social science literature and implications for further research, *Journal of Risk Research*, 18, 9, 1113-1129
- Coty, M., McCammon, C., Lehna, C., Twyman, S., Fahey, E. (2015) Home fire safety beliefs and practices in homes of urban older adults, *Geriatric nursing*, 36, 3, 177-181.
- Dries, D., Endorf, F. (2013) Inhalation injury: epidemiology, pathology, treatment strategies, *Scandinavian journal of trauma, resuscitation and emergency medicine*, 21, 1, 1-15.
- Eggert, E., Huss, F. (2017) Medical and biological factors affecting mortality in elderly residential fire victims: a narrative review of the literature, *Scars, burns & healing*, 3, doi: 10.1177/2059513117707686.
- Giebułtowicz, J., Rużycka, M., Wroczyński, P., Purser, D., Stec, A. (2017) Analysis of fire deaths in Poland and influence of smoke toxicity, *Forensic science international*, 277, 77-87.
- Gilbert, S., Butry, D. (2018) Identifying vulnerable populations to death and injuries from residential fires, *Injury prevention*, 24, 5, 358-364.
- GMFRS (2020) *Fire safety at home*, Greater Manchester Fire and Rescue Service, Manchester, UK <https://www.manchesterfire.gov.uk/staying-safe/what-we-do/fire-safety-at-home/>
- Hall, H. (2004) How Many People Can Be Saved from Home Fires if Given More Time to Escape?, *Fire Technology*, 40, 117-126

Hamps (2020) In the event of a fire, Hampshire Fire and Rescue Service, Eastleigh, Hampshire, UK <https://www.hantsfire.gov.uk/keeping-safe/loveyourhome/afterfire/in-the-event-of-a-fire/>

Harpur, A., Boyce, K., McConnel, N. (2014) An investigation into the circumstances surrounding elderly dwelling fire fatalities and the barriers to implementing fire safety strategies among this group, *Fire Safety Science*, 11, 1144-1159.

Higgins, E., Taylor, M., Francis, H., Jones, M., Appleton, D. (2015) Transforming fire prevention: a case study, *Transforming government: policy, process and people*, 9, 2, 223 – 236

Hulse, L., Galea, E., Thompson, O., Wales, D. (2020) Perception and recollection of fire hazards in dwelling fires, *Safety science*, 122, p.104518.

Hussain, A., Dunn, K. (2015) Burn related mortality in greater Manchester: 11-year review of regional coronial department data, *Burns*, 41, 2, 225-234.

IMD (2021) Indices of Multiple Deprivation, UK Office for National Statistics, <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019>

Jonsson, A., Bonander, C., Nilson, F., Huss, F. (2017) The state of the residential fire fatality problem in Sweden: epidemiology, risk factors, and event typologies, *Journal of safety research*, 62, 89-100.

MFRS (2021) Home fire safety, Merseyside Fire and Rescue Service, <https://www.merseyfire.gov.uk/safety-advice/home-fire-safety/>

MHCLG (2018) English Housing Survey, Fire and fire safety, 2016-17, UK Ministry of Housing, Communities and Local Government, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/724327/Fire\\_and\\_Fire\\_Safety.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/724327/Fire_and_Fire_Safety.pdf)

Murphy, M. (2013) Social media and the fire service, *Fire technology*, 49, 1, 175-183.

Mytton, J., Goodenough, T., Novak, C. (2017) Children and young people's behaviour in accidental dwelling fires: A systematic review of the qualitative literature, *Safety science*, 96, 143-149.

NFC (2020) Fire kills campaign briefing, National Fire Chiefs Council, UK, <https://www.nationalfirechiefs.org.uk/>

Nilson, F., and Bonander, C. (2020) Household fire protection practices in relation to socio-demographic characteristics: evidence from a Swedish national survey, *Fire technology*, 56, 3, 1077-1098.

ONS (2021) Lower Layer Super Output Areas, UK Office for National Statistics, <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/lowersuperoutputareamidyearpopulationestimates>

Purcell, L., Bartley, C., Purcell, M., Cairns, B., King, B., Charles, A. (2020) The effect of neighborhood Area Deprivation Index on residential burn injury severity, *Burns*, <https://doi.org/10.1016/j.burns.2020.07.014>

Staffs (2020) Get Out, Stay Out, Staffordshire Fire and Rescue Service, Stone Staffordshire, UK <https://www.staffordshirefire.gov.uk/your-safety/campaigns/get-out-stay-out/>

Tannous, W., Agho, K. (2017) Socio-demographic predictors of residential fire and unwillingness to call the fire service in New South Wales, *Preventive medicine reports*, 7, 50-57.



Taylor, M., Appleton, D., Keen, G., Fielding, J. (2019) Assessing the effectiveness of fire prevention strategies, *Public Money & Management*, 39, 6, 418-427

Thompson, O., Hulse, L., Wales, D., Galea, E. (2013) "Get out, stay out" versus occupier independence: the results of an 18 month study of human behaviour in accidental dwelling fires in Kent, in *Proceedings of Interflam 2013 Conference, 13th International Fire Science and Engineering Conference, 24 - 26 June 2013, Royal Holloway College, Windsor, UK Interscience Communications, Greenwich, London, UK*, pp. 943-954

Thompson, O., Galea, E., Hulse, L. (2018) A review of the literature on human behaviour in dwelling fires, *Safety science*, 109, 303-312.

Thompson, O., Wales, D. (2015) A qualitative study of experiences, actions and motivations during accidental dwelling fires. *Fire and Materials*, 39, 4, 453-465.

Wales, D., Thompson, O. (2013) Human behaviour in fire: should the fire service stop telling and start listening?, *International Journal of Emergency Services*, 2, 2, 94-103.

Yamamura, H., Kaga, S., Kaneda, K., Mizobata, Y. (2013) Chest computed tomography performed on admission helps predict the severity of smoke-inhalation injury, *Critical Care*, 17, 3, 1-7.

Yellman, M., Peterson, C., McCoy, M., Stephens-Stidham, S., Caton, E., Barnard, J., Padgett, T., Florence, C., Istre, G. (2018) Preventing deaths and injuries from house fires: a cost-benefit analysis of a community-based smoke alarm installation programme, *Injury prevention*, 24, 1, 12-18.

Xiong, L., Bruck, D., Ball, M. (2017) Human response to non-injury accidental house fires, *Fire and Materials*, 41, 5, 431-440.