



# A comparison of fire injuries during and pre-COVID-19 restrictions

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## ABSTRACT

In this article we compare accidental dwelling fire injuries in Merseyside in the North West of England during (April 2020 to April 2021) and before (April 2019 to April 2020) COVID-19 restrictions. Overall, the number of accidental dwelling fire injuries, and the percentage of accidental dwelling fires resulting in injury had shown a slightly larger decrease during COVID-19 restrictions in Merseyside compared to the typical decrease between the preceding years. Comparing accidental fire injuries in the year before and during COVID-19 restrictions in Merseyside, there was a decrease in cooking and candle related fire injuries, and fewer slight burns injuries, and injuries associated with being overcome by smoke/toxic fumes during the COVID-19 restrictions. The COVID-19 restrictions did not appear to have had a significant effect on proportions of fire injuries across areas with different levels of deprivation in Merseyside compared to the previous year.

## 1. Introduction

In England there was a five per cent decrease in accidental dwelling fire incidents during the COVID-19 restrictions (April 2020 to April 2021) [1,2] compared with the previous year, down from 25,529 to 24,293 accidental dwelling fires, and a five percent decrease in non-fatal fire injuries, down from 5154 to 4877 [3]. The UK Home Office commented that the restrictions on life in the UK throughout the year ending March 2021 appeared to be associated with fewer dwelling fires, and suggested that this could be because with people at home more, accidental dwelling fires were prevented before a call to a fire and rescue service was necessary [3].

The statistical analysis of accidental dwelling fire incident and injury data can inform fire prevention activities such as home fire safety checks or safe and well assessments which mitigate the risk of domestic fires among targeted high-risk categories such as older people ([4]; NFRS, 2022; [5–7]). Home fire safety checks can reduce the likelihood of accidental dwelling fire injuries by informing householders regarding escape routes in the event of a fire, as well as checking or installing smoke detectors [8]. Home fire safety checks allow personalization of the fire risks for individuals and can add depth to home fire safety interventions [6]. Higgins et al [9] commented upon the benefits of

appropriate data analysis for informing fire prevention approaches. Taylor et al [10] stated that appropriately targeted fire prevention approaches can have a significant impact with regard to reducing the numbers of accidental dwelling fires and associated injuries.

In order to examine the circumstances relating to accidental fire injuries before and during COVID-19 restrictions, different aspects of accidental dwelling fire injuries in the county of Merseyside in the North West of England were analysed. The analysis covered socio-demographic characteristics (age band and gender), the type of fire and the type of fire injury, the situational context (type of dwelling and level of area deprivation), and behavioural aspects (alcohol and drug use, attempting to fight the fire, and time of day). In particular the analysis involved examination of the distributions of accidental dwelling fire injuries by age bands and gender; the type of fire in which the accidental dwelling injury occurred; the type of accidental dwelling fire injury; the type of dwelling in which the accidental dwelling fire injury occurred; the level of deprivation of the area in which the accidental dwelling fire injury occurred; alcohol and drug related accidental dwelling fire injuries; injuries sustained by householders fighting the accidental dwelling fire; and the time of day during which the accidental dwelling fire injury occurred. In terms of lifestyle and behavioral changes during the COVID-19 restrictions in England, the total volume

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of duty-paid alcohol for the year was 1.2 % less than the year before. This is despite the closure of on-trade premises during the restrictions. However, off-trade volume sales of alcohol in England increased by 25 % during the COVID-19 restrictions compared to the previous year [11]. During the COVID-19 restrictions in England the percentage of those aged 16 and over who smoked decreased to 12.1 % compared to 13.5 % before the restrictions [12]. During the COVID-19 restrictions in England, there was increased home-cooking by individuals compared to the previous year [13]. During the COVID-19 restrictions, Merseyside Fire and Rescue Service conducted fewer home fire safety checks than it would normally undertake. It reviewed which individuals and groups it considered to be at an increased risk from accidental dwelling fire as a result of the COVID-19 pandemic. It decided to continue offering face-to-face home fire safety checks to people where the risk of accidental dwelling fire was high, and gave staff suitable personal protective equipment (PPE) [2]. Other UK fire and rescue services provided some of their home fire safety advice and guidance by telephone, with doorstep delivery of smoke detectors to residents or their carers if required [14]. Home fire safety checks involve not only the fitting and maintenance of smoke detectors in the dwelling, but also fire safety advice concerning how to escape if a fire were to start. After the COVID-19 restrictions had ended, an online home fire safety check tool was made available to residents of the area concerned. Other fire prevention approaches used prior to and following the COVID-19 restrictions included community safety education events. Web-based and social media fire safety advice was also provided prior, during, and after the COVID-19 restrictions.

The originality of the research reported in this paper is the detailed analysis of the distributions of accidental dwelling fire injuries before and during COVID-19 restrictions in the area covered by Merseyside Fire and Rescue Service in the North West of England. This is an important area of study, since analysis of the changes in the nature and distribution of fire injuries during lockdown restrictions can inform fire prevention activities for any future periods of restrictions.

## 2. Literature review

### 2.1. Fire injuries

Numerous countries have promoted fire prevention and protection strategies underpinned by the statistical analysis of fire incident data, and the effectiveness of those measures have been verified through the collection of such data [15–17]. Previous research had drawn attention to the importance of determining potential influences on trends in fire incidence in relation to fire-related injury rates [18]. Previous research had also examined socio-demographic factors associated with accidental dwelling fire injuries including age, gender, and socioeconomic circumstances [19,20]. Previous studies had identified a link between deprivation and accidental dwelling fire injury risk level [21,22]. Snelling et al [19] commented that in the UK, burns incidence, mortality, and complication rates have been shown to be directly correlated by gender and socioeconomic status. Smoker's materials are a common source of ignition in accidental dwelling fires injuries [23,24]. Previous research had also examined behavioural factors associated with accidental dwelling fire injury. The rate of serious fire injuries in England was four times higher where drugs or alcohol consumption was a contributory factor than where alcohol or drugs was not a factor [25]. Previous research had indicated the high costs of UK dwelling fire injuries such as smoke inhalation and burns injuries to the NHS [26,27].

In terms of the types of accidental dwelling fires resulting in injury, in England between April 2020 and March 2021 cooking appliances were by far the largest ignition category for accidental dwelling fires accounting for 46 % of such fires, 31 % were caused by “misuse of equipment or appliance”, and smoking materials accounted for 8 % of the accidental dwelling fires. The remaining 15 % of accidental dwelling fires involved faulty appliances and leads, and faulty fuel supplies. In terms of the situational context of accidental dwelling fire injuries,

single household occupancy (as opposed to homes in multiple occupancy) accidental dwelling fires accounted for 74% of non-fatal fire injuries during this period in England [28]. There were 4285 non-fatal injuries from accidental dwelling fires in England between April 2020 and March 2021, including those who received first aid (1,362) and those who were advised to seek precautionary checks (1,250). Of the non-fatal accidental dwelling fire injuries requiring hospital treatment (1,673) the largest category of fire injury was “overcome by gas or smoke” (746; 45 %) followed by “burns” (401; 24 %) and “other breathing difficulties” (247; 15 %). All the other categories combined comprised the remaining 17% of accidental dwelling fire injuries [28]. Previous studies had indicated that carelessness when using ignition sources such as cooking, heating, and other domestic appliances, smoker's materials, or candles can be a significant factor in accidental dwelling fire injuries [20,29–31]. Overall, careless use of cooking appliances was the main reason for accidental dwelling fire injuries, resulting from distraction or forgetfulness.

### 2.2. COVID-19 restrictions

The COVID-19 pandemic resulted in stay-at-home orders in numerous countries. The mobility of the general population was significantly reduced, with governments directing people to remain indoors unless absolutely necessary. For emergency services such as fire and rescue services, many of the factors concerning their deployment changed significantly [32–34]. The COVID-19 pandemic was a catalyst for many UK fire and rescue services for transformation, in terms of modernising some of their working practices to become more effective and efficient in the changed circumstances. UK fire and rescue services implemented operational changes, such as re-deploying staff, reducing community activity, and changing working practices [2]. During the COVID-19 pandemic, UK fire and rescue services did more than their ‘business as usual’ activities. Additional COVID-19 pandemic work carried out by UK fire and rescue services included ambulance driving, delivering food to the vulnerable and personal protective equipment (PPE) to healthcare professionals.

In England COVID-19 lockdown restrictions started at the end of March 2020, with the 2 m social distancing rule and some relaxation of restrictions (such as the re-opening of non-essential shops) starting in June 2020 and continuing during July and August 2020. New restrictions were then introduced in England in September and October 2020 including a return to working from home. In early November 2020 a second national lockdown came into force in England which ended in early December 2020. Restrictions were then gradually reduced during March to July 2021, with most legal limits on social contact removed in England in late July 2021 COVIDT [35].

UK fire and rescue services provided specific advice to householders during the COVID-19 restrictions in order to attempt to reduce accidental dwelling fires and injuries [2,36,37]. This included advice regarding individuals potentially smoking more at home, cooking more at home, and using candles more at home. UK Home Office analyses weakly suggested that in England, the COVID-19 restrictions on life were associated with fewer accidental dwelling fires where the cause of the fire was the “misuse of equipment or appliance” or “cooking appliance” or “other electrical appliance” [28]. The presence of more working age adults in dwellings would potentially appear to have resulted in fewer accidental dwelling fire injuries since there would be more working age adults in such dwellings who could notice that an accidental fire might start or had started.

## 3. Research method

The research reported in this paper examined accidental dwelling fires injuries that occurred before (April 2019 to April 2020) and during (April 2020 to April 2021) COVID-19 restrictions in Merseyside in the North West of England. In order to examine changes in the nature and

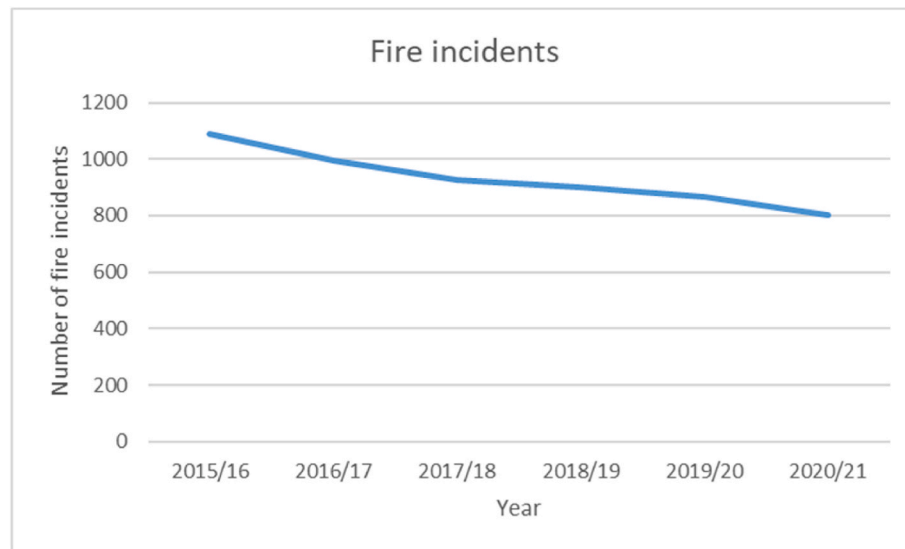


Fig. 1. Accidental dwelling fire incidents between 2015 and 2021 in Merseyside UK.

distribution of accidental dwelling fire injuries before and during COVID-19 restrictions in a broader context, data for the years April 2015 to April 2019 was also examined in order for the changes in the nature and distribution of fire injuries in the year before and year during COVID-19 restrictions to be examined in the context of longer term patterns and trends.

The research examined socio-demographic characteristics (age band and gender), the type of fire and the type of fire injury, the situational context (type of dwelling and level of area deprivation), and behavioural aspects (alcohol and drug use, attempting to fight the fire, and time of day) related to accidental dwelling fire injuries. The research examined the distributions of accidental dwelling fire injuries by age bands and gender, the type of accidental dwelling fire in which the injury occurred, the type of accidental dwelling fire injury, the level of deprivation of the area in which the accidental dwelling fire injury occurred, the type of dwelling in which the accidental dwelling fire injury occurred, alcohol and drug related accidental dwelling fire injuries, injuries sustained by householders fighting the accidental dwelling fire, and the time of day during which the accidental dwelling fire injury occurred.

Data that was recorded for accidental dwelling fire injuries by

Merseyside Fire and Rescue Service during the period April 2019 to April 2021 for the Merseyside region was analysed in order to identify trends and patterns in order to attempt to understand the circumstances relating to such fire injuries. The data examined concerning accidental dwelling fire injuries was obtained from the UK Fire Incident Recording System, which is administered by the UK Home Office. In addition, data regarding English Indices of Multiple Deprivation deciles [38] was also utilised. The Index of Multiple Deprivation (IMD) decile scale ranges from 1 to 10, where 1 represents the most deprived 10 % of Lower Layer Super Output Areas (LSOAs) in England (LSOA, 2022). A Lower Layer Super Output Area represents a geographical area containing between 1000 and 3000 individuals representing between 400 and 1200 households.

The research questions posed by the research concerned how COVID-19 restrictions affected:

- The distributions of accidental dwelling fire injuries by age bands and gender
- The type of fire in which the accidental dwelling fire injury occurred
- The type of accidental dwelling fire injury

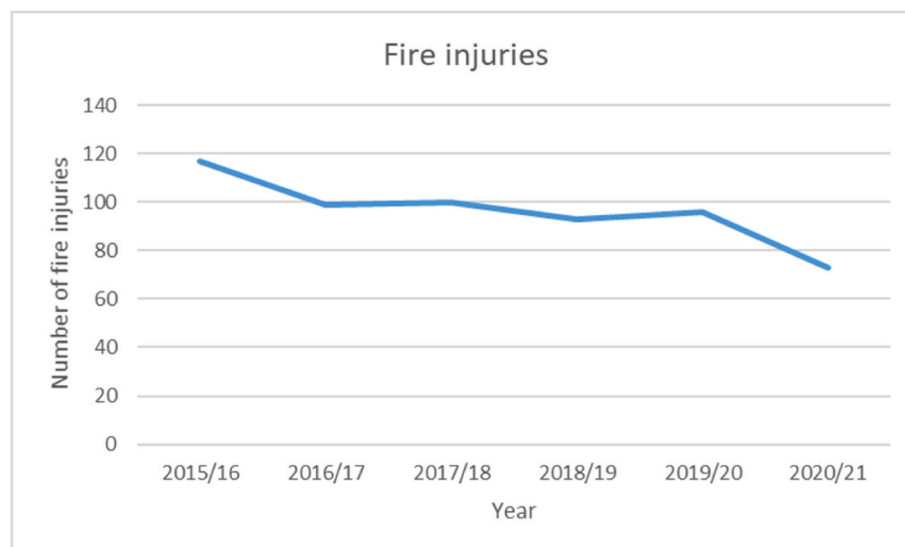


Fig. 2. Accidental dwelling fire injuries per year between 2015 and 2021 in Merseyside UK.

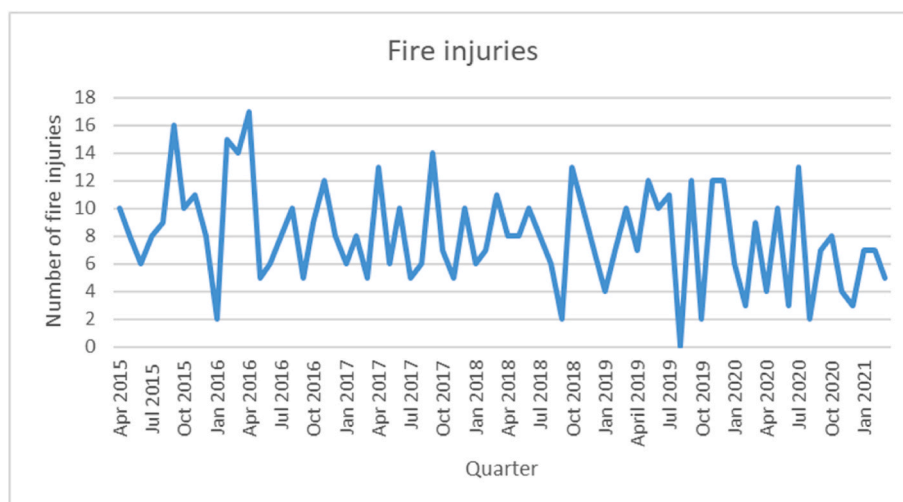


Fig. 3. Accidental dwelling fire injuries per quarter between 2015 and 2021 in Merseyside UK.

- The type of dwelling in which the accidental dwelling fire injury occurred
- The level of deprivation of the area in which the accidental dwelling fire injury occurred
- Alcohol and drug related accidental dwelling fire injuries
- Injuries sustained by householders fighting the accidental dwelling fire
- The time of day during which the accidental dwelling fire injury occurred

These research questions are important as it necessary to understand how the restrictions associated with COVID-19 affected the patterns of accidental dwelling fire injuries in order to inform current and future fire prevention activities. Since such restrictions may occur again in the future, it is important to understand how such restrictions may affect the nature and distributions of fire injuries, and the circumstances of those likely to be most at risk of fire injury. The originality of the research reported in this paper is the detailed analysis of the circumstances of accidental dwelling fire injuries before and during COVID-19 restrictions in the area covered by a UK Fire and Rescue Service.

#### 4. Research results and discussion

In order to examine changes in the nature and distribution of fire injuries before and during COVID-19 restrictions, it was first necessary to examine such in the context of the recent time period leading up to the restrictions. In this manner changes in the nature and distribution of fire injuries in the year before and year during COVID-19 restrictions can be examined in the context of longer term patterns and trends. Between 2015 and 2021 accidental dwelling fire incidents in Merseyside had shown a steady reduction in numbers as shown in Fig. 1.

Accidental dwelling fire incidents in Merseyside had shown a similar level of decrease during COVID-19 restrictions compared to the typical decrease between the preceding years as shown in Fig. 1.

Accidental dwelling fire injuries in Merseyside had in comparison to the steady decrease in the number of accidental dwelling fire incidents between 2015 and 2021, shown a larger decrease during COVID-19 restrictions compared to the typical decrease in the numbers of accidental fire injuries between the preceding years as shown in Fig. 2.

However, when years were broken down into months, it was clear that the number of fire injuries did not remain steadily in a negative trend while England went through its lockdown periods (see Fig. 3, in particular the line showing the second quarter of 2020, which

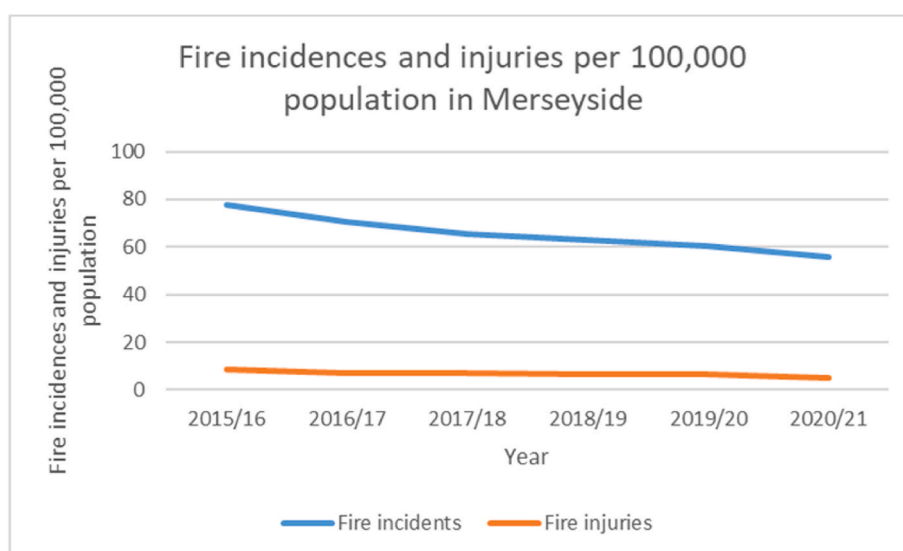


Fig. 4. Number of accidental dwelling fires and injuries per 100,000 population 2015 to 2021 in Merseyside UK.

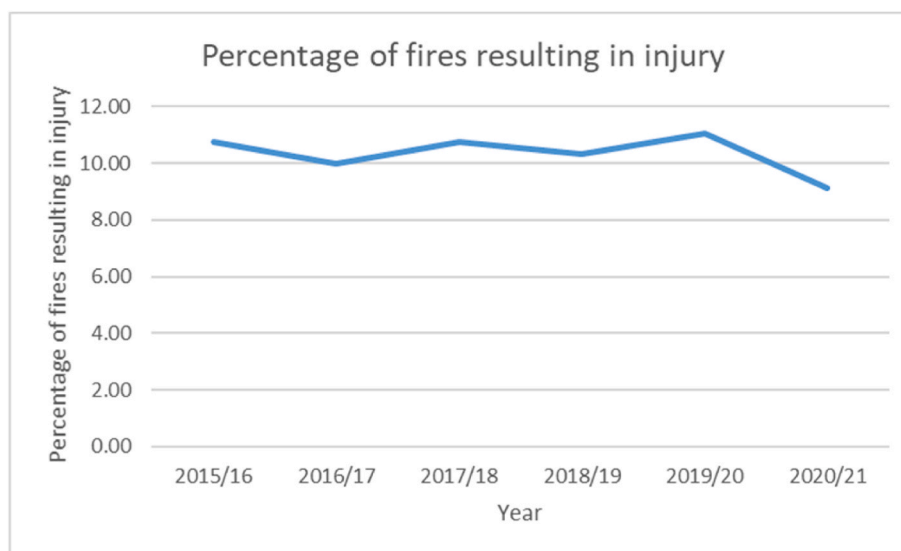


Fig. 5. Percentage of accidental dwelling fires resulting in injury in Merseyside UK between 2015 and 2021.

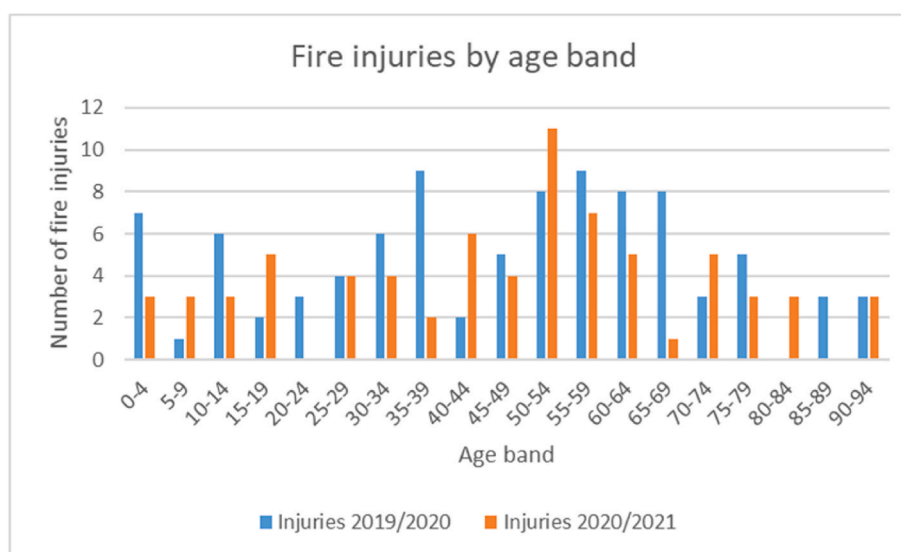


Fig. 6. Accidental dwelling fire injuries by age band before and during COVID-19 restrictions in Merseyside UK.

approximately covers the start and end of the first lockdown). Indeed, the variability across each year prior to the COVID-19 restrictions did not disappear after the commencement of COVID-19 restrictions. Furthermore, there was not a statistically significant difference in the average monthly numbers of accidental dwelling fire injuries per year using paired T-tests between April 2019 to April 2020 and April 2020 to April 2021 ( $p = 0.2$ ), or for the preceding years from 2015 to 2019.

There was also likely some variability in the population of Merseyside when the national lockdowns were introduced and then lifted. Fig. 4 shows the rate of accidental dwelling fire incidences and injuries per 100,000 population in Merseyside UK. The incidence and injury rate appeared to plateau somewhat prior to the COVID-19 restrictions but a decline was becoming more evident in 2020/21. In 2021 the population of Merseyside was 1,423,300 [39].

The percentage of accidental dwelling fires resulting in injury in Merseyside showed a slightly larger decrease during COVID-19 restrictions compared to the preceding years as shown in Fig. 5.

The observed trends of the slightly larger decreases in fire injuries, and in the percentage of accidental dwelling fires resulting in injury

during COVID-19 restrictions compared to previous years might be linked to lockdown restrictions since by having working age adults spending more time at home, there would be more time available for cooking, meaning that the cooking activities might be less rushed [40], implying less risk of a cooking fire. In addition, in multi-adult households, more working age adults who could notice that an accidental fire might start or had started would be present.

Distributions of fire injuries by age bands and gender.

In terms of the distributions of accidental dwelling fire injuries by age band, slightly fewer children were injured in accidental dwelling fires in Merseyside during the COVID-19 restrictions (April 2020 to April 2021) (14) compared to the previous year (16), there were also fewer injuries in the 35 to 39 and 65 to 69 age bands as shown in Fig. 6.

The smaller number of children injured in accidental dwelling fires during the COVID-19 restrictions could be due to more working age adults being present in the home to supervise children, in multi-adult households. The decrease in fire injuries in the 35 to 39 age band could be due to more adults in this working age group being present in multi-adult households, who could notice that an accidental fire might

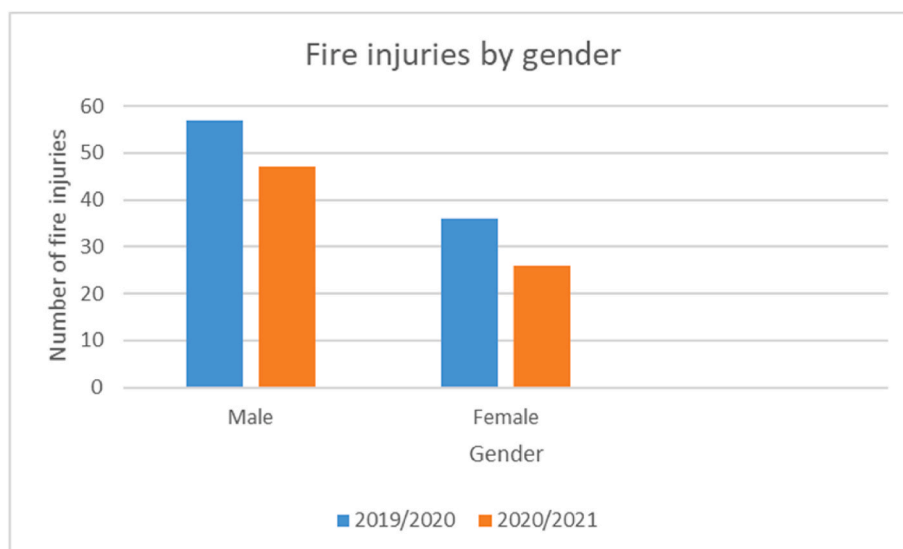


Fig. 7. Accidental dwelling fire injuries by gender before and during COVID-19 restrictions in Merseyside UK.

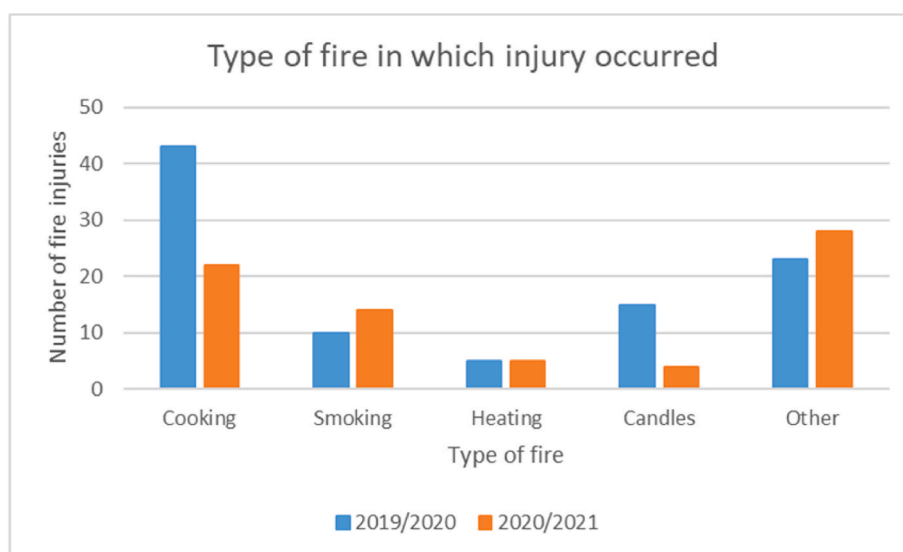


Fig. 8. Type of fire in which injury occurred before and during COVID-19 restrictions in Merseyside UK.

start, or had started. The reduction in fire injuries in the 65 to 69 age band could be due to more adults of working age being present in multi-generational households, where elderly people were better accompanied and taken care of by their relatives [41].

The numbers of both male and female accidental dwelling fire injuries in Merseyside decreased during COVID-19 restrictions (April 2020 to April 2021) compared to the previous year. However, the ratio of male to female accidental dwelling fire injuries increased during the COVID-19 restrictions from 1.58 during 2019/2020 to 1.81 during 2020/2021 as shown in Fig. 7. A paired T-test for the monthly ratios of male to female accidental dwelling fire injuries per year showed no statistically significant increase from 2019/2020 to 2020/2021 ( $p = 0.32$ ).

#### 4.1. The type of fire in which the injury occurred

There was a decrease in cooking and candle related accidental dwelling fire injuries in Merseyside during the COVID-19 restrictions (April 2020 to April 2021) compared to the previous year, and an

increase in smoking related accidental dwelling fire injuries compared to the previous year as shown in Fig. 8.

The decrease in cooking and candle related accidental dwelling fire injuries during the COVID-19 restrictions could be due to working age adults spending more time at home having more time available for cooking, meaning that cooking activities might be less rushed [40], implying less risk of a cooking fire. Cooking fires can result from even short distractions [42]. In addition, in multi-adult households, more working age adults who could notice that an accidental fire might start or had started from cooking or candle use would be present.

#### 4.2. The type of fire injury

There were less accidental dwelling fire injuries overall in Merseyside during COVID-19 restrictions (April 2020 to April 2021) (73) compared to the previous year (96). In particular, there were fewer slight burns injuries, and fewer injuries associated with being overcome by smoke/toxic fumes as shown in Fig. 9.

The fewer slight burns injuries, and fewer injuries associated with



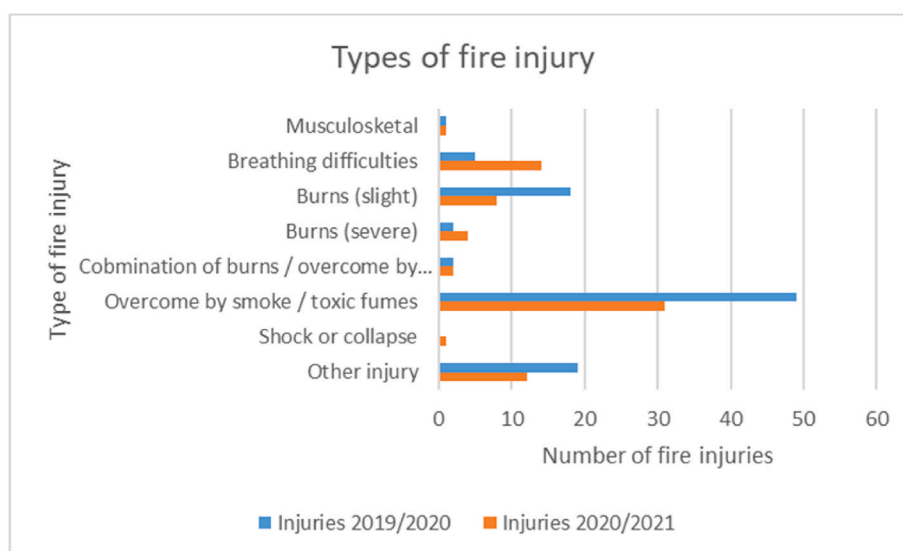


Fig. 9. Type of fire injuries before and during COVID-19 restrictions in Merseyside UK.

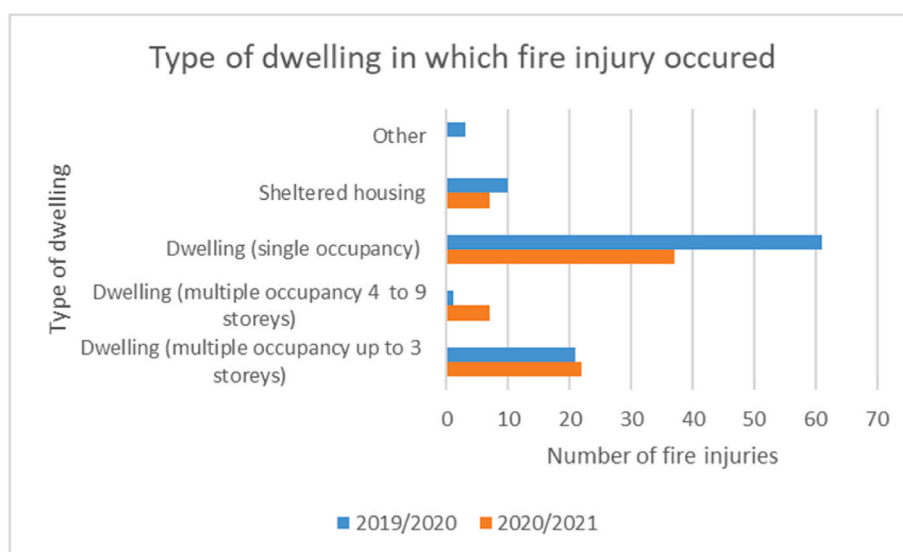


Fig. 10. Type of dwelling in which fire injuries occurred before and during COVID-19 restrictions in Merseyside UK.

being overcome by smoke/toxic fumes during the COVID-19 restrictions could be due to more working age adults being present in the home who could detect that a fire had started, or assist in evacuating the building in multi-adult households.

#### 4.3. The type of dwelling in which the fire injury occurred

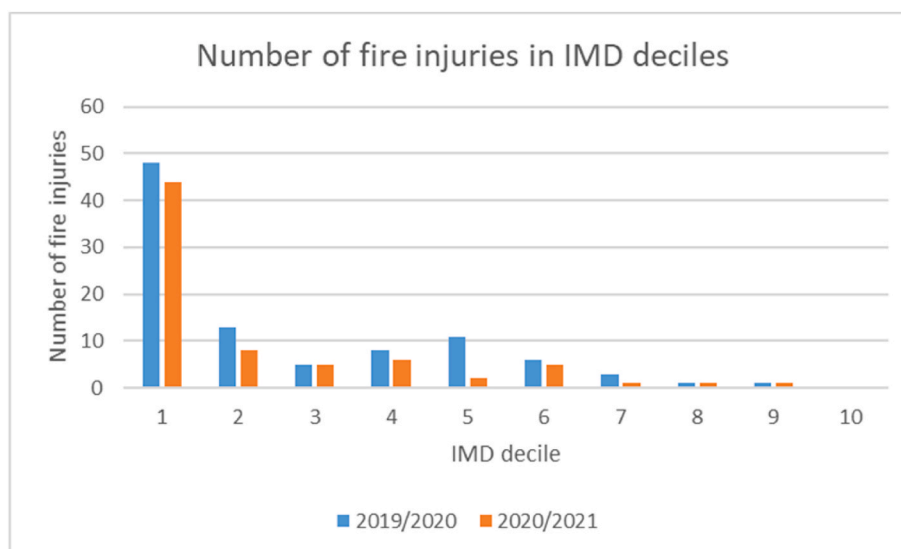
During the COVID-19 restrictions (April 2020 to April 2021) less accidental dwelling fire injuries occurred in single occupancy dwellings in Merseyside compared to the previous year as shown in Fig. 10. A single occupancy dwelling is a dwelling occupied by just one household. In dwellings in multiple occupation (shared housing) there may typically be more individuals living in smaller sized households comprising less adults who could notice that an accidental fire might start or had started.

#### 4.4. The level of deprivation of the area in which the fire injury occurred

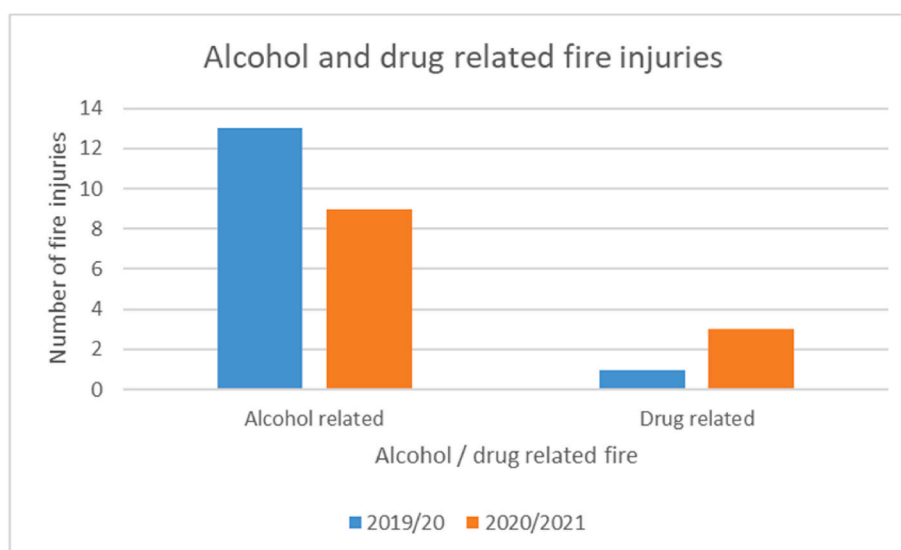
The COVID-19 restrictions did not appear to have had a significant

effect on accidental dwelling fire injuries across areas with different levels of deprivation in Merseyside as shown in Fig. 11. A Two-way Chi-square analysis of the data yielded a p-value of 0.65, with a Pearson Chi-Square value of 5.95, and degrees of freedom  $df = 8$ . The significance level is 0.05, i.e., the threshold that the p-value must not exceed if the result is to be statistically significant, meaning that the differences in the numbers of accidental dwelling fire injuries across the IMD deciles could have occurred by chance.

A limitation of the research regarding the Indices of Multiple Deprivation (IMD) decile analysis was that the IMD deciles data from the UK Office for National Statistics was only available at the Lower Layer Super Output Area (LSOA) level of geography, which meant that analysis could only be undertaken at that level of geographic granularity, where the IMD decile would represent the average level of deprivation for that area. There could, however, be variability in terms of deprivation in each LSOA.



**Fig. 11.** Number of fire injuries occurring in areas with different IMD deciles before and during COVID-19 restrictions in Merseyside UK.



**Fig. 12.** Alcohol and drug related fire injuries before and during COVID-19 restrictions in Merseyside UK.

#### 4.5. Alcohol and drug related fire injuries

There were fewer alcohol related accidental dwelling fire injuries in Merseyside during COVID-19 restrictions (April 2020 to April 2021) compared to the year before, however there was a small increase in drug related fire injuries during COVID-19 restrictions compared to the year before as shown in Fig. 12.

The fewer alcohol related accidental dwelling fire injuries during COVID-19 restrictions might be due to more working age adults being present in the home who could detect that a fire had started, or assist in evacuating the building in multi-adult households. The reduction in alcohol related injuries could also be more indicative of responsible drinking. That is, moderately drinking a single type of beverage over a meal at home with family members, rather than drinking on an empty stomach with colleagues straight after work or going on a pub crawl with friends and mixing drinks and then coming home and starting an activity that involves a heat source.

#### 4.6. Injuries sustained by householders fighting the fire

The ratio of male to females injured whilst fighting accidental dwelling fires in Merseyside increased during the COVID-19 restrictions from 1 to 1 in 2019/2020 to 4.5 to 1 in 2020/21 as shown in Fig. 13. However, there were only very low numbers of such injuries, and overall, the number of such injuries increased from just 10 to 11 from 2019/2020 to 2020/2021.

#### 4.7. The time of day during which the fire injury occurred

Overall, there were fewer accidental dwelling fire injuries in most time bands during the COVID-19 restrictions (April 2020 to April 2021) compared to the previous year in Merseyside, other than mainly late afternoon (15:00 to 17:00), early evening (20:00 to 21:00) and early in the morning (01:00 to 02:00, and 03:00 to 04:00) as shown in Fig. 14.

The fewer accidental dwelling fire injuries in most time bands during the COVID-19 restrictions compared to the previous year could be due to more working age adults being present in the home who could detect



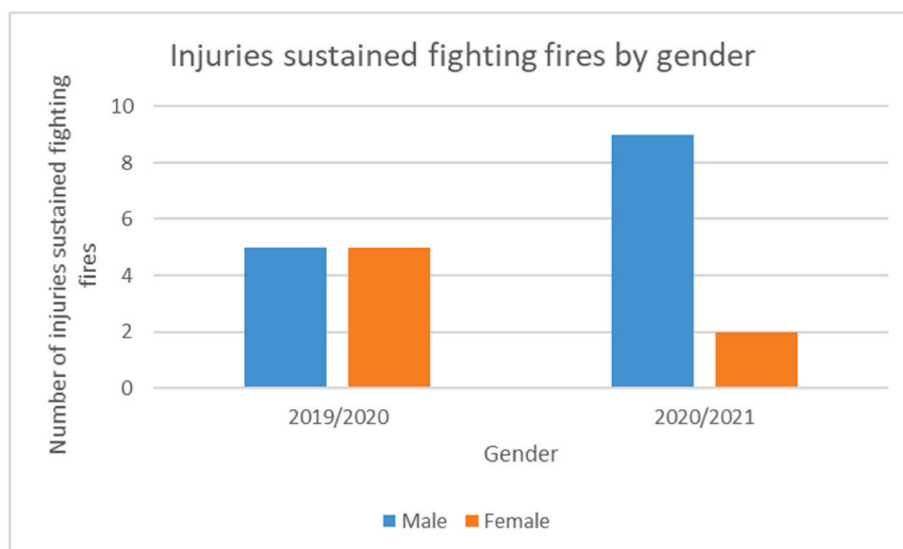


Fig. 13. Injuries sustained by householders fighting accidental dwelling fires before and during COVID-19 restrictions in Merseyside UK.

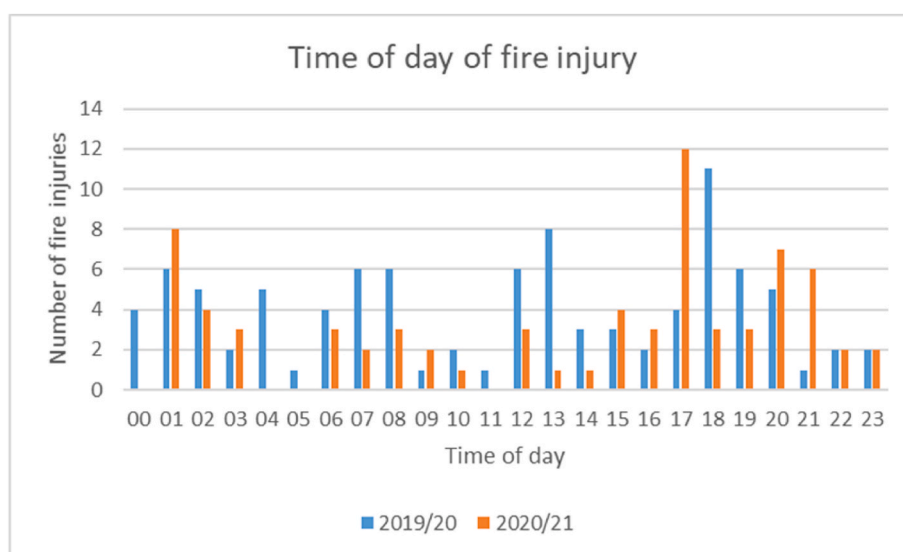


Fig. 14. Time of day during which accidental dwelling fire injuries occurred before and during COVID-19 restrictions in Merseyside UK.

that a fire had started, or assist in evacuating the building in multi-adult households. The late afternoon (15:00 to 17:00) would be a time when cooking was more likely to occur, and early in the morning (01:00 to 02:00, and 03:00 to 04:00) householders would be asleep, so the advantages of having more working age adults present to detect a fire would be diminished in a multi-adult households. The very different and irregular profile of differences between 17.00 and 21.00 might be explained by people cooking at different times during Covid restrictions. Typical working hours of 09:00 to 17:00 would mean that cooking at 17:00 would normally be less likely amongst working-age adults due to the travel time required to return home before cooking, with cooking times pre-lockdown more likely at 18:00 or 19:00 as indicated in Fig. 14. The higher number of fire injuries at 21:00 during lockdown might be due to individuals cooking a late supper at that time in addition to an earlier meal at 17:00.

Overall, the number of accidental dwelling fire injuries in Merseyside had shown a slightly larger decrease during COVID-19 restrictions (April 2020 to April 2021) compared to the typical decrease between the preceding years. During COVID-19 restrictions, compared to the

previous year in Merseyside, there was a decrease in cooking and candle related fire injuries, and fewer slight burns injuries, and injuries associated with individuals being overcome by smoke/toxic fumes. The COVID-19 restrictions did not appear to have had a significant effect on the proportions of fire injuries across areas with different levels of deprivation in Merseyside compared to the previous year.

## 5. Research limitations

A limitation of the research undertaken concerned potential limitations regarding the generalizability of the research findings to other UK fire and rescue services and beyond, since the geographical area covered by Merseyside Fire and Rescue Service included some of the most deprived areas in England. In addition, the Indices of Multiple Deprivation (IMD) decile level data from the UK Office for National Statistics was only available at the Lower Layer Super Output Area level of geography. Also, data concerning the composition of households (number of residents per household, gender and age mixes) was not available, which could have enhanced the understanding of how household

composition during lockdown restrictions related to fire injuries. In addition, there could be a further factor concerning the extent to which some accidental dwelling fires during the COVID-19 restrictions may have been dealt with by householders rather than contacting the fire and rescue service concerned for fear of outside persons entering their house.

## 6. Conclusions

The originality of the research reported in this paper is the detailed analysis of the circumstances associated with accidental dwelling fires injuries before and during COVID-19 restrictions recorded by a fire and rescue service in the North West of England. This research topic is important because dwelling fire injuries have a financial and social impact, and examining the distributions of accidental dwelling fire injuries can inform targeting of fire prevention approaches. The research reported in this paper provides an in-depth analysis of accidental dwelling fire injuries before and during COVID-19 restrictions across different social groups in terms of age, gender, type of housing, and level of deprivation in Merseyside.

The number of accidental dwelling fire injuries in Merseyside in the North West of England had shown a decrease during COVID-19 restrictions compared to the previous year, in line with the other counties in England. In particular, there was a decrease in cooking and candle related fire injuries, and fewer slight burns injuries, and injuries associated with being overcome by smoke/toxic fumes during the COVID-19 restrictions in Merseyside compared to the previous year. The COVID-19 restrictions did not appear to have had a significant effect on the proportions of accidental dwelling fire injuries across areas with different levels of deprivation in Merseyside compared to the year before.

While decreases in accidental dwelling fire injuries were seen overall when making comparisons year to year, there was much variability month to month, both before and after COVID-19 restrictions. Therefore, this demonstrates that tackling fire injuries will not be an easy or straightforward task. So, analysis of the characteristics and behaviours of those injured in accidental dwelling fires before and during COVID-19 restrictions must continue and delve deeper in order to inform fire prevention approaches used by fire and rescue services including home fire safety checks, safe and well assessments, and online fire safety information. It is hoped that the research undertaken into accidental dwelling fire injuries during and before COVID-19 restrictions may be of use to other UK fire and rescue services, and fire and rescue services overseas, in terms of inspiring them to conduct their own deep analyses of the nature of the accidental dwelling fire injuries that occurred, and discover how such analyses can be used for informing fire prevention activities.

The practical implications of the research were that during restrictions having working age adults spending more time at home appeared to reduce the risk of accidental cooking fires and candle fires, since in multi-adult households, more working age adults would be present who could notice that an accidental fire might start, or had started. However, having working-age adults present more often in the home is not something that fire and rescue services can influence. Therefore, further targeting of fire prevention towards more vulnerable groups such as the elderly would be appropriate. In addition, children appeared to be less at risk of accidental dwelling fires during restrictions as there would be more working age adults present to supervise them, in multi-adult households. In terms of response to accidental dwelling fire incidents leading to injury, the times of day when cooking fires were likely to occur were still the main times of day for fire injuries to occur regardless of restrictions.

In terms of future research, it would be useful for further survey-based research to occur in order to better understand the composition of households (number of residents per household, gender and age mixes), and the behaviours of household members, especially in terms of the number of working-age adults in the household, since previous research had indicated that fire injuries tend to occur more in

households with less working age adults who hold daytime jobs away from home, for example older people and single parent households. This could enhance the understanding of how household composition and behaviours of household members relate to fire injuries and potentially enhance fire prevention, especially in households with fewer working-age adults.

## CRedit authorship contribution statement

**H. Francis:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **M. Taylor:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **J. Fielding:** Data curation, Formal analysis, Writing – review & editing. **G. Oakford:** Conceptualization, Data curation, Investigation. **D. Appleton:** Conceptualization, Data curation, Investigation.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data will be made available on request.

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