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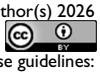

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An analysis of bonfire and firework-related fire incidences

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Abstract

This study examines fire incidents attended by Merseyside Fire and Rescue Service during the Bonfire Night period, 5th November (2015–2024), analysing the circumstances, patterns, and trends of such incidents. In particular, anti-social behaviour fires, deliberate property fires, firework incidents, and violence at work incidents were examined. Anti-social behaviour fires declined from 2016, firework incidents from 2019, and violence at work incidents from 2018, but all subsequently increased in 2024. Deliberate property fires also declined from 2016 onwards. Statistically significant increases occurred on 5th November for firework incidents, 5th and 6th November for anti-social behaviour fires, and 30th October and 5th November for deliberate property fires and violence at work incidents. There was a strong link between the level of deprivation and the number of anti-social behaviour, deliberate property fires, firework incidents, and violence at work incidents over the period studied.

Keywords

bonfire, fireworks, fire incidence, deprivation

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Introduction

The period around Bonfire Night, 5th November, in England places increased demand on fire and rescue services.[1–3] Fireworks and bonfires are associated with potentially serious fire-related injuries,[4,5] including burns and smoke inhalation, which pose significant risks for individuals with respiratory conditions such as asthma.[6] Existing research also indicates that public safety is often overlooked during Bonfire Night celebrations.[7] In recognition of these risks, the sale of fireworks in England is tightly regulated. Retailers in England must be

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licensed to sell fireworks, and sales of fireworks are restricted to 15th October to 10th November for Bonfire Night. Outside of this window, fireworks can only be purchased from retailers with a special year-round licence, and individuals must be 18 or older to buy fireworks. Fireworks must not be set off between 11 pm and 7 am, except until midnight on Bonfire Night.[8] Organised firework events in England should be appropriately planned.[9,10] In Merseyside, Mischief Night is on October 30th, the night before Halloween,[11] and typically involves a variety of incidents, ranging from arson and criminal damage to vandalism and anti-social behaviour (ASB). Mischief Night, 30th October, occurs to a lesser extent in a few other northern England counties. Bonfire Night on 5th November commemorates the failed Gunpowder Plot of 1605, when Guy Fawkes and fellow conspirators attempted to blow up Parliament and King James I.

The research reported in this article concerns the different types of fire incidents attended by Merseyside Fire and Rescue Service in the period around Bonfire Night in Merseyside, England, between 2015 and 2024, to analyse the circumstances, patterns, and trends of such incidents. Merseyside is a densely populated metropolitan county in the Northwest of England covering a geographical area of approximately 650 km^2 with a population of 1.4 m and significant and widespread deprivation, with all five Merseyside boroughs ranking among the top 50 most deprived in England. In the United Kingdom, deprivation refers to people's unmet needs and insufficient access to expected opportunities and resources, including income. Deprivation is broader than poverty and includes non-financial disadvantages such as poor health, unsafe housing, or limited access to services. The research analysed ASB fires (small fires attended by fire crews), deliberate property fires (primary fires attended by fire crews), firework incidents (relating to firework misuse), and violence at work incidents over the study period. English fire and rescue services use nationally standardised criteria set out in the Incident Recording System (IRS) and accompanying Home Office definitions to decide whether a fire is deliberate, or an ASB fire, which is a subcategory of deliberate fires. A fire is recorded as deliberate when the attending crew or fire investigator determines that the motive for ignition was intentional. The definition used by English fire and rescue services is where the motive for its ignition is suspected or thought to be intentional. This can include arson, fires set to one's own property, fires set to someone else's property, or small-scale intentional fires (e.g. bins, grass, and rubbish). The classification is made using physical evidence at the scene, witness accounts, behavioural indicators (e.g. accelerants and ignition points), and the professional judgement of the officer in charge or fire investigator. ASB fires are a subset of deliberate fires. They are typically small-scale, nuisance-type fires linked to ASB rather than targeted arson. Examples include fires in bins, skips, fly-tipped waste. grassland, woodland, or scrub fires, and fires involving abandoned vehicles. The classification is based on the type of item ignited (e.g. rubbish and wheelie bins), the location (e.g. public spaces and derelict land), the context (youth activity, repeated local ASB patterns), and lack of targeted intent (i.e. not aimed at harming a person or property owner). Firefighters in the United Kingdom increasingly face hostility and aggression during emergency response, posing significant risks to their safety and effectiveness.[12] The hostility experienced by UK firefighters can occur in various forms including harassment, objects thrown at firefighters/fire appliances, physical abuse, verbal abuse, and other acts of aggression.[12] The originality of the research reported in this article is the detailed analysis of bonfire and firework-related fire incidents over the period 2015 to 2024 in an English fire and rescue service.

Literature review

Bonfire Night period and emergency services

The Bonfire Night period in England involves increased workloads for emergency services.[13,14] Across England, fire and rescue service crews respond to large numbers of bonfires, firework accidents, and ASB over this period. The English Fire Brigades Union described fire and rescue services as being "pushed far beyond safe limits" over the Bonfire Night period.[15] In 2024 Greater Manchester, the Fire and Rescue Service and Greater Manchester Police recorded the following anti-social instances: 22 attacks on firefighters; police and firefighters receiving more than 1000 hoax calls; 1167 deliberately started fires; and 10,036 incidents of ASB.[16,17] Attacks on emergency service crews, especially fire fighters, are now a common aspect of the Bonfire Night period.[18–21] The UK National Health Service provides guidance on avoiding Bonfire Night period injuries,[22] which cause increased workloads for NHS staff.[14] Bonfire Night is traditionally a busy time for the ambulance service, with additional firework and bonfire-related calls adding to the number of incidents being dealt with by crews and call handlers. In Wales in 2024, the Welsh Ambulance Service received 3433 calls to 999 over the Bonfire Night period and a further 8159 non-emergency calls to NHS 111 Wales.[6] The number of victims of fire incidents involving fireworks that were attended by fire and rescue services in England increased from 25 in 2014/15 to 32 in 2022/23.[23] In comparison, in the United States in 2023, fireworks started an estimated 32,302 fires, including 3760 structure fires, 849 vehicle fires, 27,252 outside fires, and 441 unclassified fires. These fires caused an estimated US$142 million in direct property damage.[24] In the United States in 2023, fireworks were involved with an estimated 9700 injuries treated in US hospital emergency departments, down from 11,400 in 2013.[25] The US National Fire Protection Association provides guidance for bonfire and outdoor fire prevention[26] and firework safety.[24]

Prevention strategies concerning bonfires and firework fire incidents

UK fire and rescue services and police forces strive to reduce bonfire and firework incidents via website-based information and guidance,[27–31] and in particular, to reduce deliberate fire setting and ASB incidents.[32] UK fire and rescue services and other emergency services collaborate with schools and local authorities to educate young people about firework safety and responsible behaviour[33] and conduct campaigns which stress the importance of attending professionally managed displays and avoiding illegal or reckless activities. In Lancashire, Lancashire Police, Lancashire Fire and Rescue Service, and the Northwest Ambulance Service jointly run a safety campaign ahead of Bonfire Night, aiming to curb ASB and protect communities. This involves local policing teams and partner agencies actively engaging with schools with the aim of educating young people regarding the dangers of fireworks and the importance of behaving responsibly during the Bonfire Night period. The campaign also highlights the potential legal consequences of ASB, including hoax calls and the misuse of fireworks to attack emergency workers and their vehicles.[33] In some parts of the United Kingdom, firework control zones are used, which make it illegal for the public to set off fireworks within certain locations.[34]

Research method

The categories of incidents identified as appropriate for study by the fire and rescue service concerned included ASB fires (which are small fires attended by fire crews), deliberate property fires (which are primary fires involving buildings, vehicles, or outdoor structures attended by fire crews), firework incidents which related to reports of firework misuse, and violence at work incidents which related to reports of violence aimed at the fire and rescue service staff in relation to fire incidents. The period of study appropriate for the research was identified by the fire and rescue service concerned as being 15th October to 7th November each year, since 15th October is the date at which fireworks generally become available for sale in England (apart from shops with a special year-round licence).

The research questions addressed by this research were as follows:

- **Research Question 1 (RQ1):** What types of fire incidents are associated with the Bonfire Night period?
- **Research Question 2 (RQ2):** Does the distribution of Bonfire Night period incidents change over time?
- **Research Question 3 (RQ3):** Does deprivation relate to fire incidence over the Bonfire Night period?

These are important research questions because it is necessary for fire and rescue services to understand how workloads may alter around the Bonfire Night period. Effective workforce planning is an essential aspect of fire and rescue service management.[35] The data used for the analysis were provided by Merseyside Fire and Rescue Service and were combined with Index of Multiple Deprivation (IMD) decile data from the UK Office for National Statistics.[36] The IMD deciles used by the UK Office for National Statistics (ONS) divide England into 10 groups of small areas based on their level of deprivation. Decile 1 is the most deprived 10% of areas, while Decile 10 is the least deprived 10%.[37] The geographical area unit used for the IMD decile analysis was the lower super output area (LSOA). LSOAs comprise between 400 and 1200 households and have a usually resident population of between 1000 and 3000 individuals.[38] There are 909 LSOAs in Merseyside.[39] The research method involved the use of frequency analysis and histograms to examine the distributions of the different types of incidents, z scores to assess outliers in the data (z scores being the number of standard deviations a value lies from the mean), percentages to examine the proportions of the different types of incidents in the most deprived areas, and the chi-square test to compare the expected and observed frequencies of bonfire period incidents by date and also to compare the expected and observed frequencies of bonfire period incidents across the IMD deciles based on the distribution of LSOAs in the different IMD deciles across Merseyside. The software used for the research was Microsoft Excel, since this was advocated by the fire and rescue service concerned and allowed the use of built-in statistical functions, as well as the ease of examination of the data and statistical calculations for verification of results.

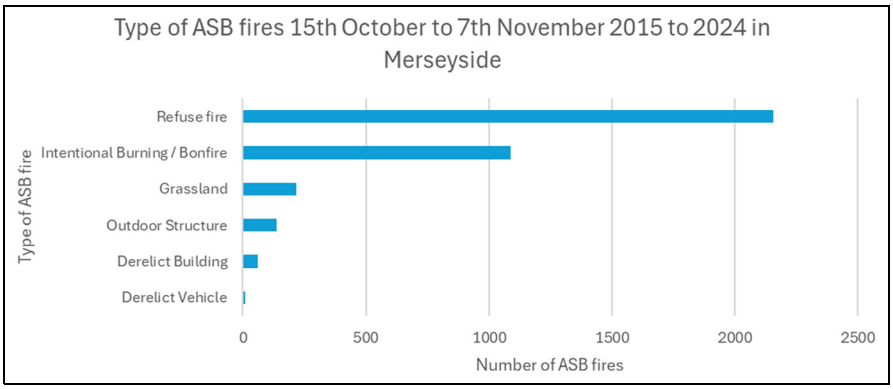

Figure 1. ASB fire incidents from 15th October to 7th November 2015 to 2024 in Merseyside.

Results

Types of fire incidents associated with the Bonfire Night period

The types of fire incidents identified by the fire and rescue service studied as being associated with the Bonfire Night period included ASB fires, deliberate property fires, firework-related fires, and violence at work incidents. ASB fires are small nuisance fires attended by fire crews. The number of different types of ASB fire incidents over the period studied (2015–2024) is shown in Figure 1. Property fires concern primary fires attended by fires crews, including motor vehicle fires (e.g. cars, vans, caravans, motorhomes, buses, lorries, and motorcycles), residential dwellings, non-residential buildings (e.g. hostels, care homes, schools, police stations, prisons, garages, banks, factories, shops, offices, pubs, supermarkets, and sports clubs), outdoor structures (e.g. storage facilities, post boxes, telephone boxes, bottle banks, and rubbish tips), outdoor equipment (e.g. garden equipment and agricultural machinery), and grassland, woodland, and crops.

Figure 1 shows ASB fire incidents from 15th October to 7th November 2015 to 2024 in Merseyside and indicates that refuse fires were the main type of ASB fire, followed by intentional burning of bonfires.

Figure 2 shows deliberate property fire incidents from 15th October to 7th November 2015 to 2024 in Merseyside and indicates that road vehicle fires were the main type of deliberate property fire, followed by dwelling fires.

Distribution of Bonfire Night period fire incidents over time

Figure 3 shows the distribution of ASB fires over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. There appeared to be a general decrease in ASB fires from 2016 onwards, apart from an increase in 2024. This did not overall appear to be related to the day of the week on which Bonfire Night (5th November) occurred. Bonfire Night occurred on a Saturday in 2016 and 2022, and on a Sunday in 2017 and 2023.

Figure 4 shows a heat map of the geographical distribution of ASB fires over the Bonfire Night period (15th October to 7th November) between 2015 and 2024 in Merseyside. This indicated that ASB fires were concentrated in a number of areas within Merseyside.

Figure 2. Deliberate property fire incident from 15th October to 7th November 2015 to 2024 in Merseyside.

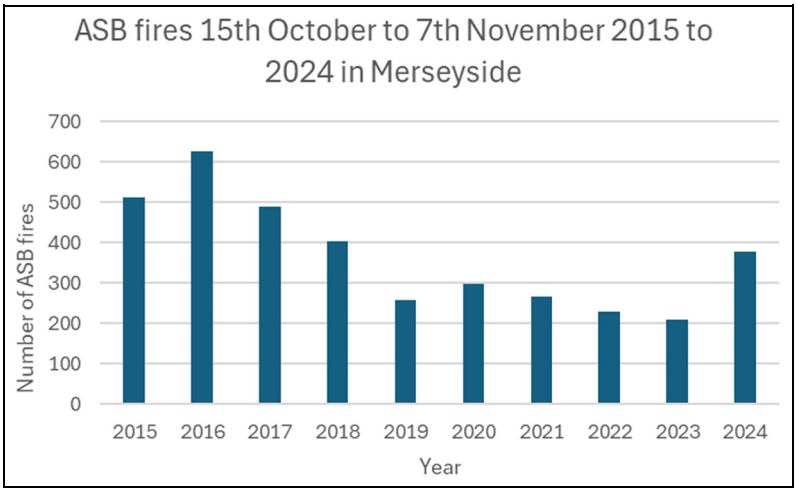

Figure 3. Anti-social behaviour fires from 15th October to 7th November 2015 to 2024 in Merseyside.

Figure 5 shows the distribution of deliberate property fires over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. There appeared to be a general decrease in deliberate property fires from 2016 onwards. This did not overall appear to be related to the day of the week on which Bonfire Night (5th November) occurred. Bonfire Night occurred on a Saturday in 2016 and 2022, and on a Sunday in 2017 and 2023.

Figure 6 shows a heat map of the geographical distribution of deliberate property fires over the Bonfire Night period (15th October to 7th November) between 2015 and 2024 in

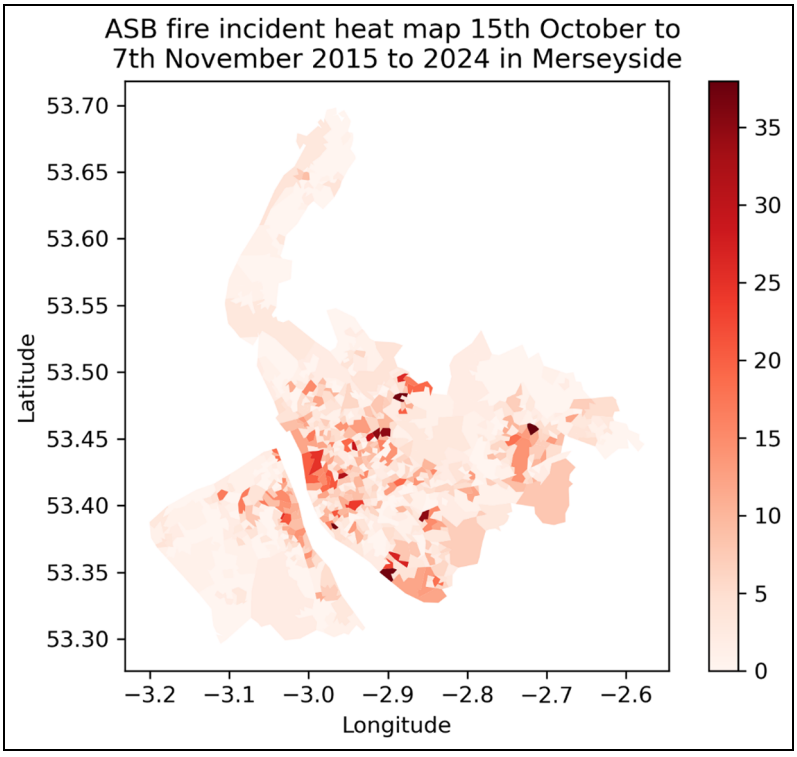

Figure 4. ASB fires heat map from 15th October to 7th November 2015 to 2024 in Merseyside.

Figure 5. Deliberate property fires from 15th October to 7th November 2015 to 2024 in Merseyside.

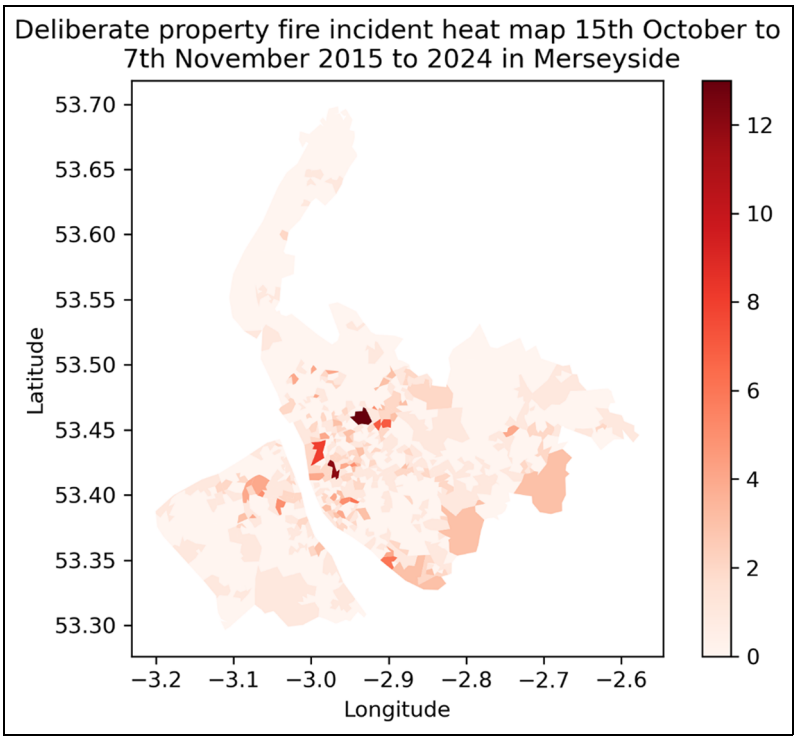

Figure 6. Deliberate property fires heat map from 15th October to 7th November 2015 to 2024 in Merseyside.

Merseyside. This indicated that deliberate property fires were mainly concentrated in a small number of areas within Merseyside.

Figure 7 shows the distribution of firework incidents over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. There appeared to be a general decrease in firework incidents from 2019 onwards, apart from an increase in 2024. This did not overall appear to be related to the day of the week on which Bonfire Night (5th November) occurred. Bonfire Night occurred on a Saturday in 2016 and 2022, and on a Sunday in 2017 and 2023.

Figure 8 shows a heat map of the geographical distribution of firework incidents over the Bonfire Night period (15th October to 7th November) between 2015 and 2024 in Merseyside. This indicated that firework incidents were spread across a number of areas within Merseyside.

Figure 9 shows the distribution of violence at work incidents over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. There appeared to be a general decrease in violence at work incidents from 2018 onwards, apart from an increase in 2024. This did not overall appear to be related to the day of the week on which Bonfire Night (5th November) occurred. Bonfire Night occurred on a Saturday in 2016 and 2022, and on a Sunday in 2017 and 2023.

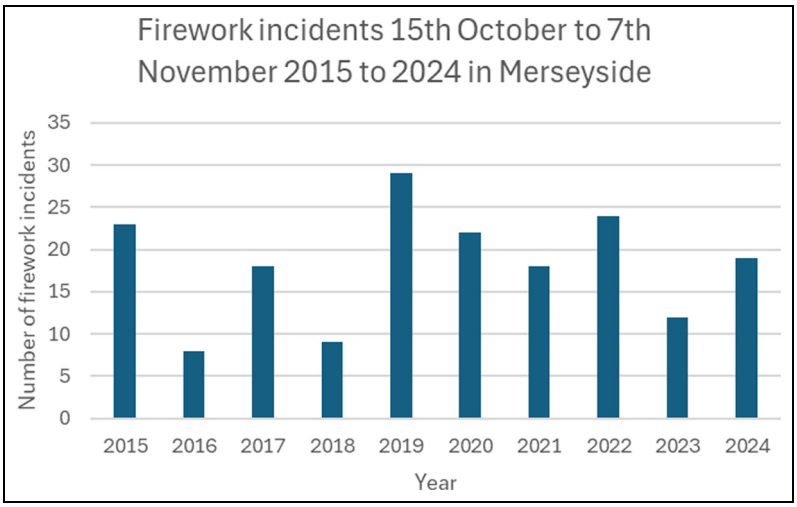

Figure 7. Firework incidents from 15th October to 7th November 2015 to 2024 in Merseyside.

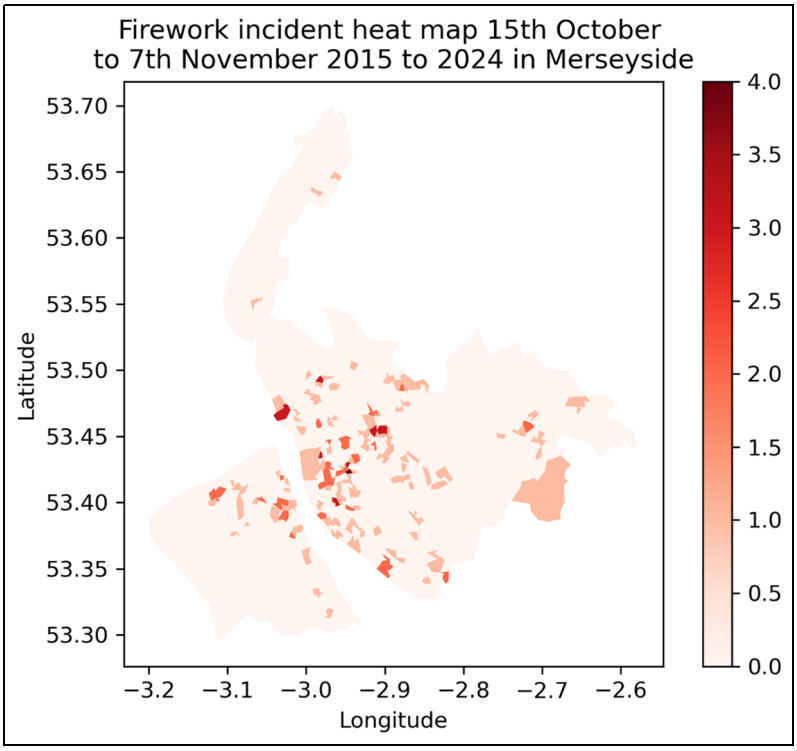

Figure 8. Firework incident heat map from 15th October to 7th November 2015 to 2024 in Merseyside.

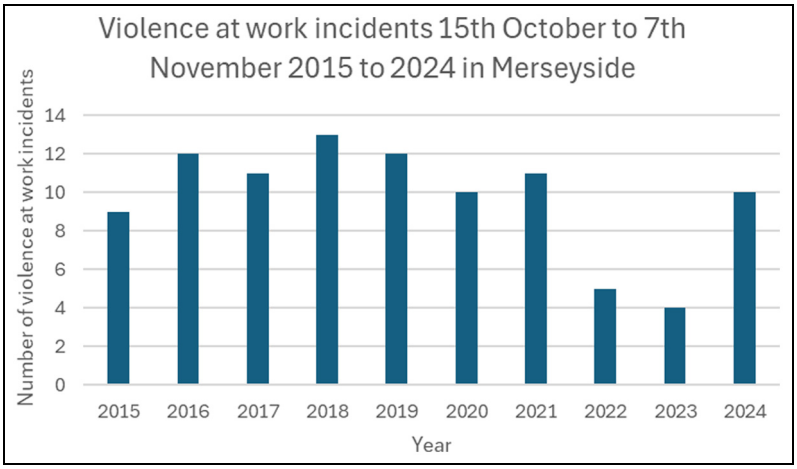

Figure 9. Violence at work incidents from 15th October to 7th November 2015 to 2024 in Merseyside.

Figure 10 shows a heat map of the geographical distribution of violence at work incidents over the Bonfire Night period (15th October to 7th November) between 2015 and 2024 in Merseyside. This indicates that violence at work incidents were spread across a number of areas within Merseyside.

Figure 11 shows the distribution of ASB fire incidents by day of the month over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. The chi-square value for the distribution of ASB fire incidents by day of month was 1560.2 with 23 degrees of freedom and with a $p < 0.001$, indicating that the increase in numbers of incidents in the peak days of 30th October and 5th and 6th November was unlikely to be due to chance. The increased number of incidents on 30th October corresponds with Mischief Night in Merseyside, which only occurs to a lesser extent in a few other northern England counties. As the Z scores for 5th and 6th November are above 2, this indicates that the values for these days are statistically significant outliers, that is the values are much higher than average.

Figure 12 shows the distribution of deliberate property fire incidents by day of the month over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. The chi-square value for the distribution of deliberate property fire incidents by day of the month was 135.8 with 23 degrees of freedom and with a $p < 0.001$, indicating that the increase in numbers of incidents in the peak days of 30th October and 5th November was unlikely to be due to chance. As the Z scores for 30th October and 5th November are above 2, this indicates that the values for these days were statistically significant outliers. The increased number of incidents on 30th October corresponds with Mischief Night in Merseyside, which only occurs to a lesser extent in a few other northern England counties.

Figure 13 shows the distribution of firework incidents by day of month over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. The chi-square value for the distribution of firework incidents by day of month was 572.6 with 23 degrees of freedom and with a $p < 0.001$ indicating that the increase in numbers of incidents in the peak days of 30th October and 5th November was unlikely to be due to chance. The increased

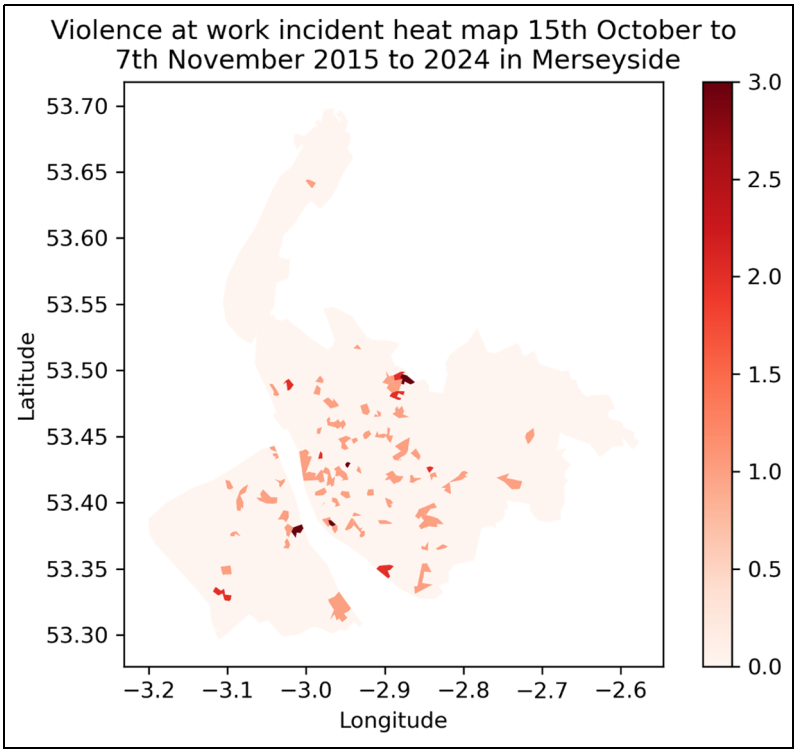

Figure 10. Violence at work heat map from 15th October to 7th November 2015 to 2024 in Merseyside.

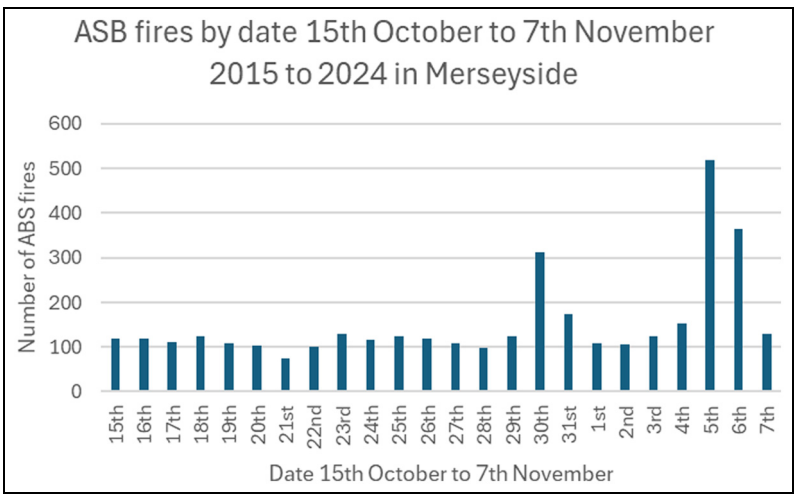

Figure 11. ASB fire incidents by day of month from 15th October to 7th November 2015 to 2024 in Merseyside.

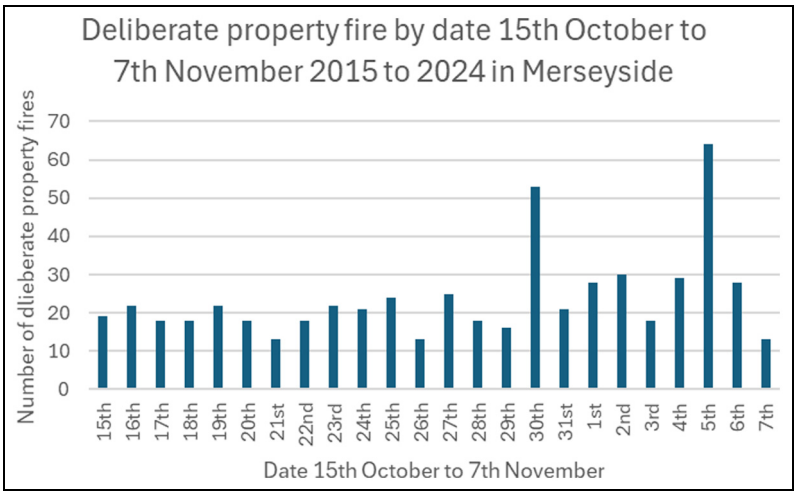

Figure 12. Deliberate property fire incidents by day of month from 15th October to 7th November 2015 to 2024 in Merseyside.

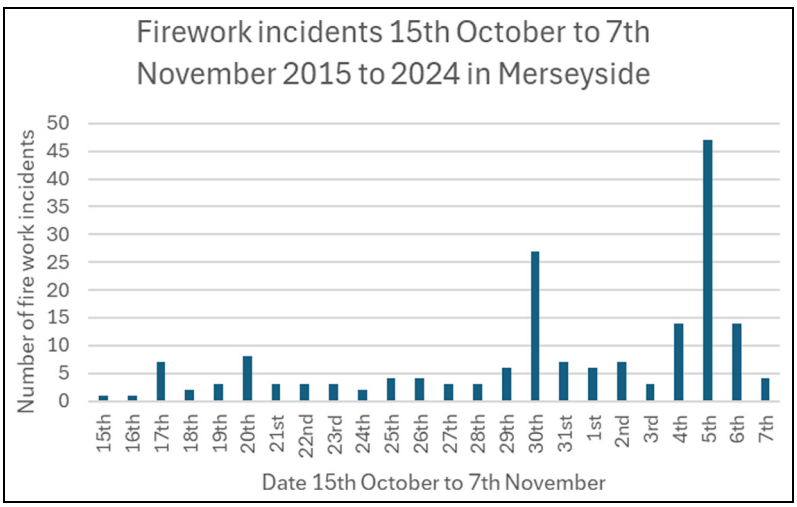

Figure 13. Firework incidents by day of month from 15th October to 7th November 2015 to 2024 in Merseyside.

number of incidents on 30th October corresponds with Mischief Night in Merseyside, which only occurs to a lesser extent in a few other northern England counties. As the Z score for 5th November is above 2, this indicates that the value for this day is a statistically significant outlier.

Figure 14 shows the distribution of violence at work incidents over the Bonfire Night period (15th October to 7th November) between 2015 and 2024. The chi-square value for

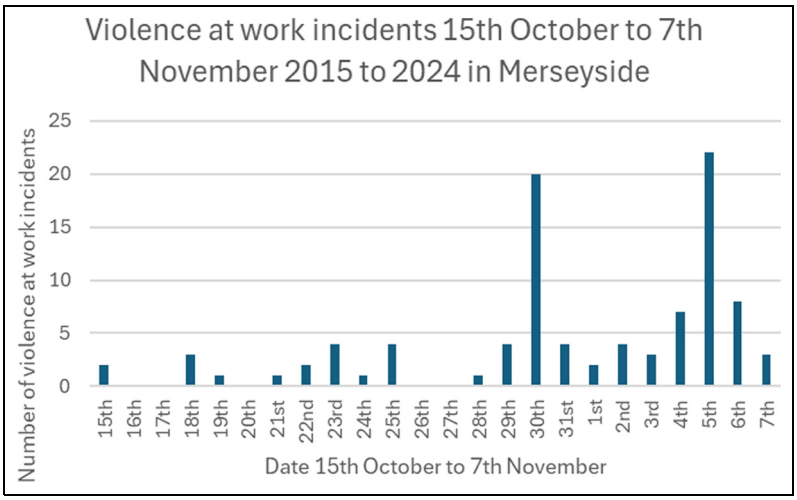

Figure 14. Violence at work incidents from 15th October to 7th November 2015 to 2024 in Merseyside.

the distribution of violence at incidents by day of month was 134.1 with 23 degrees of freedom and with a $p < 0.001$ indicating that the increase in numbers of incidents in the peak days of 30th October and 5th November was unlikely to be due to chance. As the Z scores for 30th October and 5th November are above 2, this indicates that the values for these days are statistically significant outliers. The increased number of incidents on 30th October corresponds with Mischief Night in Merseyside, which only occurs to a lesser extent in a few other northern England counties.

Relationship between deprivation and Bonfire Night period incidents

Figure 15 shows the number of LSOAs in the different IMD deciles in Merseyside. The percentage of LSOAs in IMD decile 1 was 34.1%. If the level of deprivation was not related to the number of bonfire period incidents, then it would be expected that the distribution of such incidents across the IMD deciles would be similar to the distribution of LSOAs across the IMD deciles. The chi-square test was used to compare the expected and observed frequencies of bonfire period incidents across the IMD deciles based on the distribution of LSOAs across the IMD deciles.

Figure 16 shows the distribution of ASB fires by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside. The percentage of ASB fires in IMD decile 1 areas was 67.0%. The chi-square test was used to compare the expected (based on the distribution of LSOAs across the IMD deciles) and observed frequencies of bonfire period incidents across the IMD deciles. The chi-square value for the ASB fires was 1987.4 with a $p < 0.001$. This indicated that there was a statistically significant difference between the expected and observed frequencies of ASB fires across the IMD deciles, with far more ASB fires occurring in areas with a higher level of deprivation than would be expected based on the numbers of different IMD decile areas within Merseyside.

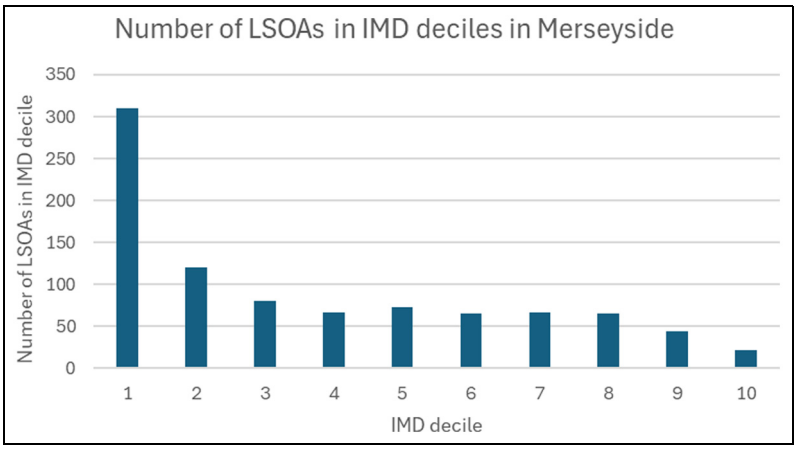

Figure 15. Number of lower super output areas (LSOAs) in the different IMD deciles in Merseyside.

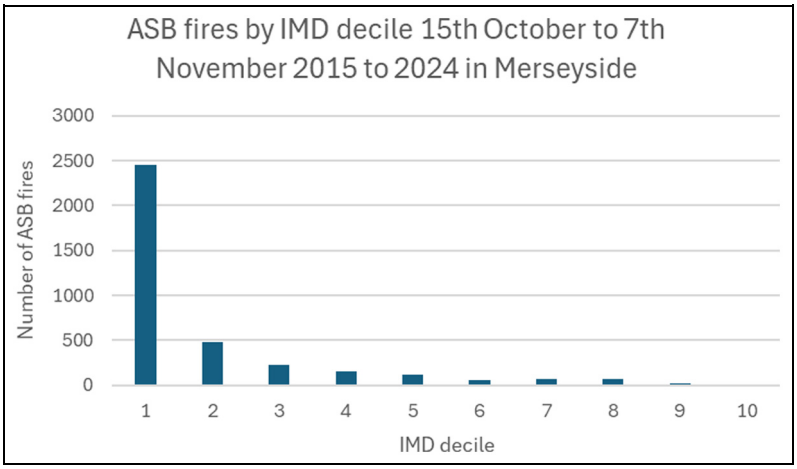

Figure 16. ASB fires by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside.

Figure 17 shows the distribution of ASB fires by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside. The percentage of deliberate property fires in IMD decile 1 areas was 65.3%. The chi-square value for the deliberate property fires was 285.26 with a $p < 0.001$. This indicated that there was a statistically significant difference between the expected and observed frequencies of deliberate property fires across the IMD deciles, with far more deliberate property fires occurring in areas with a higher level of deprivation than would be expected based on the numbers of different IMD decile areas within Merseyside.

Figure 18 shows the distribution of firework incidents by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside. The percentage of firework incidents in IMD decile 1 areas was 75.8%. The chi-square value for the firework incidents was 97.2 with a p

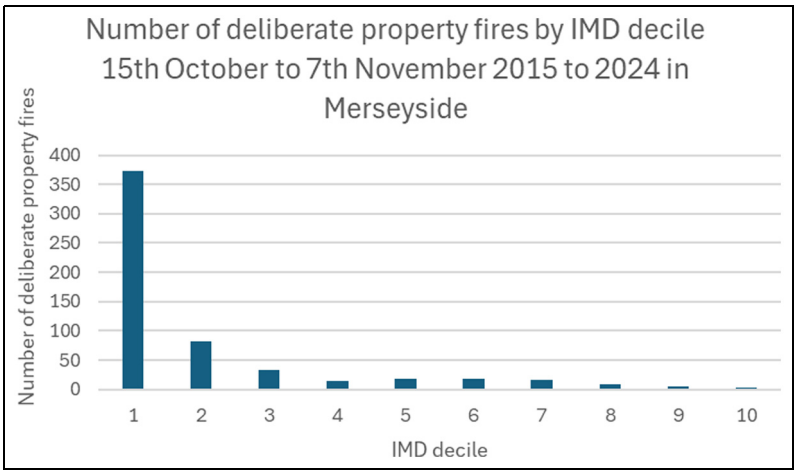

Figure 17. Deliberate property fires by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside.

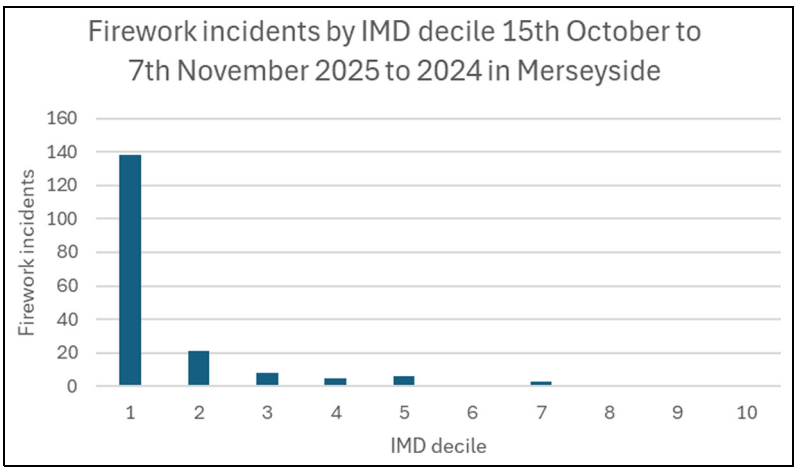

Figure 18. Firework incidents by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside.

< 0.001. This indicated that there was a statistically significant difference between the expected and observed frequencies of firework incidents across the IMD deciles, with far more firework incidents occurring in areas with a higher level of deprivation than would be expected based on the numbers of different IMD decile areas within Merseyside.

Figure 19 shows the distribution of violence at work incidents by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside. The percentage of violence at work incidents in IMD decile 1 areas was 69.1%. The chi-square value for the violence at work incidents was 51.7 with a $p < 0.001$. This indicated that there was a statistically significant

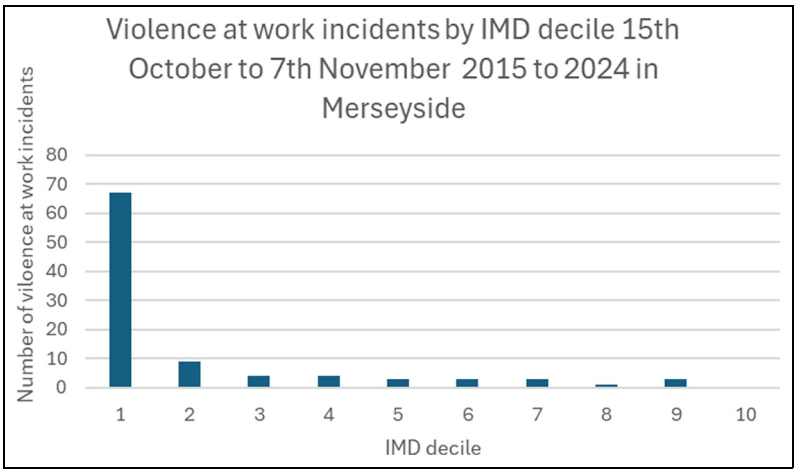

Figure 19. Violence at work incidents by IMD decile from 15th October to 7th November 2015 to 2024 in Merseyside.

difference between the expected and observed frequencies of violence at work incidents across the IMD deciles, with far more violence at work incidents occurring in areas with a higher level of deprivation than would be expected based on the numbers of different IMD decile areas within Merseyside.

Discussion

Only those fire incidents reported to the fire and rescue service concerned over the Bonfire Night periods studied were included in the analysis, since these were the only incidents for which recorded data were available. In terms of data quality, accidental dwelling fire incidence data are recorded in the English Fire IRS by fire officers attending the fire incidents. Although the recording of the fire incidence data relies upon the judgement of the fire officer in charge, the data are reviewed by the fire and rescue service's internal quality assurance team. In addition, the UK Home Office undertakes monthly monitoring for unusual data patterns and performs variance checks against data from previous years. The UK Home Office and English fire and rescue services work together to improve the data within the Fire IRS and minimise inconsistencies or errors. Potentially, there could have been underreporting of incidents at such a very busy time of the year. A limitation of the research concerns the generalisability of the research to other UK fire and rescue services, due to the high levels of deprivation within Merseyside compared with other counties. In addition, Mischief Night, 30th October, activities only occur to a lesser extent in a few other northern England counties. Media reinforcement with local Liverpool press often reporting Mischief Night incidents may be sustaining awareness of the tradition.[40] With regard to violence at work incidents, the UK National Fire Chiefs Council advocates the use of body worn cameras which a number of fire and rescue services use, to provide vital evidence to the courts.[41] In Scotland fireworks, control zones have been used in parts of Glasgow and Edinburgh between 31 October and 9 November, making it illegal for the public to set off fireworks

within certain areas.[34] In terms of deliberate fires, Lithium-ion batteries used to power equipment such as e-bikes and electric vehicles are increasingly linked to serious fires in residential buildings. Lithium-ion battery fires are difficult to quell, and larger batteries such as those used in electric vehicles may reignite hours or even days after the event, even after being cooled. In the United Kingdom in 2023, 338 fires involving Lithium-ion batteries were caused by e-bikes and e-scooters.[42] The UK Department for Transport has produced guidance on how to safely buy store and charge e-cycles and e-scooters.[43] The UK National Fire Chiefs Council (NFCC) stated that UK fire and rescue services face growing challenges tackling lithium-ion battery fires, which are complex, can reignite after being extinguished, and release toxic gases. In the United Kingdom, lithium-ion fires are becoming more frequent, placing increasing operational and resource pressures on fire and rescue services, who are usually the first to respond when these batteries ignite. Lithium-ion battery fires are currently not specifically recorded in the English Fire IRS, and therefore, data relating to such fires were not available for analysis. Deliberate property fires involving electric vehicles could potentially be more of an issue over bonfire periods in the future, since vehicle fires were the largest category of deliberate property fires over the previous bonfire periods studied and in terms of the length of time required to deal with a lithium-ion vehicle battery fire. The NFCC has called for updates to Building Regulations guidance to reflect fire risks from storing and charging energy technologies in homes and public spaces, and investing in ongoing research to improve firefighting tactics and training for incidents involving energy technologies. In the United Kingdom, there is currently no formal reporting mechanism for fire and rescue services to accurately record lithium-ion battery fire incidents.[44]

Conclusion

There was an overall decrease in the number of ASB fires and deliberate property fires in the period studied per year from 2016 onwards (apart from 2024 for ASB fires), a decrease in violence at work incidents from 2018 onwards (apart from 2024), and a decrease in firework incidents from 2019 onwards (apart from an increase in 2024). There were statistically significant increases in ASB fires on the 5th and 6th November across the period studied, statistically significant increases in deliberate property fires and violence at work incidents on the 30th October and 5th November across the period, and statistically significant increases in deliberate firework incidents on the 5th November across the period. The reductions in ASB fires, deliberate property fires, and violence at work incidents may be due to Merseyside Fire and Rescue Service (MFRS) strengthening coordination with police, councils, youth services, and community–safety partnerships. MFRS has significantly invested in youth-focused programmes designed to divert young people away from ASB and runs annual campaigns, especially around Bonfire Night and Halloween, to reduce ASB fires, dangerous bonfires, and firework misuse. The population of Merseyside increased slightly over the period studied; however, overall the incidents all showed a general decrease.

There was a strong relationship between the level of deprivation and the numbers of ASB fires, deliberate property fires, firework incidents, and violence at work incidents over the Bonfire Night periods studied. There were statistically significant differences in the observed and expected frequencies of ASB fires, deliberate property fires, firework incidents, and violence at work incidents based on the distribution of LSOAs in the different IMD deciles in Merseyside. In other words, far more incidents occurred in the most deprived areas of

Merseyside than would be expected from the number of such areas in Merseyside. The practical implications of the research were the need for advance planning of cover for the Bonfire Night period, in particular the 30th October and 5th and 6th November. In addition, the targeting of Bonfire Night fire prevention activities to more deprived areas could potentially reduce the far higher incidences of ASB fires, deliberate property fires, firework incidents, and violence at work incidents in these areas. Potentially, further study of why 30th October (Mischief Night) incidents occur in Merseyside when they only occur to a lesser extent in a few other northern England counties might illuminate ways to reduce such incidents on that date.

In Merseyside and elsewhere in England, fire and rescue services treat firework and bonfire-related ASB as a seasonal, predictable risk that requires a mix of operational tactics, prevention work, and multi-agency coordination. Fire prevention approaches can proactively map and monitor areas with a history of ASB and deliberate fires. This can include identifying hotspots for illegal bonfires or firework misuse, deploying targeted patrols with partner agencies (police, councils, housing associations), and early removal of combustible materials before they can be used to build illegal or unsafe bonfires. UK fire and rescue services can work closely with police forces for enforcement, dispersal orders, and responding to attacks on crews, and local authorities for waste removal, youth engagement, and community messaging. This may require dynamic risk assessment due to potential attacks on firefighters, use of police escorts in high-risk areas, and maintaining safe standoff distances when fireworks are being misused

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