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Control theory and fire injury prevention

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ABSTRACT

Fire prevention can be viewed as a set of actions intended to reduce the incidence of fires and associated injuries and fatalities. Typically fire prevention activities will be aimed at particular sub-groups within the population of a geographic area covered by a given fire and rescue service, and types of behaviours associated with fire risk. In this article we examine the application of control theory for fire injury prevention. In particular, we examine the different fire injury prevention activities used by Merseyside Fire and Rescue Service in the North West of England, and how the targeted use of fire prevention activities such as home fire safety checks was assessed and optimised using control theory.

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KEYWORDS Control theory fire prevention

1. Introduction

Home fire safety checks (MFRS, 2023) are the main approach to controlling accidental dwelling fires and associated fire injuries and fatalities in England. The home fire safety check process involves ensuring that dwellings are prepared in case of a fire. The home fire safety check protocol concerns installing and testing smoke alarms, developing escape plans, the assessment of fire hazards, advice regarding fire extinguishers, carbon monoxide detectors, and the importance of regular maintenance of electrical systems and appliances. Home fire safety checks involve the fitting and maintenance of smoke detectors, and providing advice to householders regarding escape routes, and not attempting to fight the fire themselves, as well as other household fire safety advice such as not leaving cooking unattended, switching off electrical appliances at

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night, and closing internal doors at night (AFRS, 2023; DSFRS, 2023). Targeted home fire safety checks contribute to a reduction in the incidence of accidental dwelling fires (ESVFRS, 2022). In Merseyside in the North West region of England, home fire safety checks were targeted to those aged 65+ over the period studied (2011 to 2022), and from 2017 onwards were further targeted to those age 65+ living in higher levels of deprivation since this group had been identified as being the most at risk of accidental dwelling fire injury and fatality. Typically, other mechanisms for fire prevention used in English fire and rescue services include an online home fire safety check tool (NFCC, 2023), fire safety advice delivered via websites and social media, and community/educational events.

Control theory provides a model of self-regulation of systems that can be useful in the analysis of human behaviour systems (Carver & Scheier, 1982). Control theory has been used in many different organisational settings to support the management of operational activities (Arrow, 2015; Chen et al., 2020; White & Censlive, 2015). The rationale for applying control theory to fire injury prevention was that in any system where it is required to take corrective (preventive) action it is important to utilise a feedback loop (Carver & Scheier, 1982) (one of the basic mechanisms of control theory) in order to ascertain if the corrective (preventive) actions are having the desired effect. In order for this to work it is necessary to determine the desired effect (in this case a reduction in accidental dwelling fire injuries), the actions that can achieve this (the different fire injury prevention actions that can be used) and the actual effects resulting from such actions (which requires detailed analysis of accidental dwelling fire injury statistics) so that this can be fed back into fire injury prevention planning. In practical terms of fire injury prevention this means applying control theory to determine how the different fire prevention actions should be optimised (Guo & Fu, 2007; Ma et al., 2021) to achieve the best possible reduction in accidental dwelling fire injuries in terms of who is most at risk of such injuries and what are they most at risk from (in terms of the behaviours with the highest risk of fire injury (Wuschke et al., 2013)). In addition, it is important to determine how well such optimisation of fire injury prevention activities has actually worked via detailed analysis of fire injury data. There would be difficulty in assessing the level of fire prevention control for reducing accidental dwelling fires and associated injuries and fatalities provided by the fire and rescue service's website and social media, since it would be difficult to assess who might actually have viewed such with the region concerned (Ogden, 2020; Stephenson et al., 2018). Web analytics would typically be unable to accurately characterise traffic to the fire and rescue service's website and social media since it would not typically be possible to accurately establish the demographics of those visiting these sites and liking/retweeting/replying to social media posts unless such individuals had provided such demographic details. Similarly, it would be difficult to assess the level of fire injury prevention control provided by community (Lakoma & Murphy, 2023) and education events (Cutello et al., 2020), since it would be difficult to assess who had actually attended when examining fire injury data. This can be problematic since it can be difficult to determine direct cause and effect in practice, and therefore statistical approaches that examine patterns in data over longer time intervals in order to gather sufficient data to conduct meaningful analyses becomes necessary. For any fire prevention action taken it is difficult to determine how long such action may have effect (especially in terms of likely behavioural change) and other factors that may apply. It can be challenging to understand the variation in behaviour and human activity in terms of fire injury prevention (Clemons et al., 2021). For example, any householder to which a fire injury prevention action may have been applied may have a change of circumstances. Such changes in circumstances might include an increase/decrease in alcohol consumption, starting/stopping smoking, starting/stopping medication that may affect awareness that could affect the likelihood of an accidental dwelling fire injury (Karemaker et al., 2022). In addition, installed or maintained smoke detectors forming part of a fire injury prevention intervention could over time run out of battery power (Holborn et al., 2003), or become clogged with dust. Between 2011 and 2022 in England smoke detectors overall failed to operate in over a quarter of dwelling fires. For battery powered smoke detectors over the same period, the failure to operate occurred in over a third of dwelling fires (UKFS, 2023). Standard battery-operated smoke alarms are the cheapest to purchase, however, the batteries need to be replaced every year. The most common reason for a domestic smoke alarm failing to activate was because the fire was outside of its range (MFRSSA, 2023). Overall, statistical analysis of the effects of fire injury prevention over time are the most pragmatic approach to determining how successful fire injury prevention actions have been in practice.

The legal requirements for fire safety in private dwellings can vary significantly between countries, and in the majority of countries smoke detectors in private houses is not something that is required. In England, dwelling fire safety is primarily governed by the Regulatory Reform (Fire Safety) Order 2005 (RRFSO, 2005) which covers fire safety in non-domestic premises. For private dwellings in England, the Building Regulations 2010 (BRO, 2010) set out specific fire safety requirements to ensure that buildings are designed to limit fire spread and facilitate safe evacuation.

The originality of the research reported in this article is the application of control theory to the management of accidental dwelling fire injury prevention in terms of providing a richer understanding of fire injury prevention strategy planning, fire injury prevention actions, the assessment of the effects of fire injury prevention actions, and the feedback of such assessments into fire injury prevention strategy planning.

2. Literature review

2.1. Control theory

Control theory is a general approach to the understanding of self-regulating systems (Carver & Scheier, 1982). Control theory is used in many disciplines of engineering from simple machinery such as thermostats to sophisticated safety engineering systems such as power plant control (Schwaninger, 2015; Yang et al., 2023). One aspect of control theory is the concept of controllability. A dynamic system can be described as controllable if it is possible to apply controls that can change the system to a given state within a finite amount of time (Klamka, 2013). This concept may also be termed reachability. Observability concerns the ability to determine the system's internal state from its output (Liu et al., 2013). These are useful concepts with regard to fire prevention strategy planning in terms of how fire injury prevention actions may control (reduce) the observable numbers of accidental dwelling fire injuries, and in terms of reachability, that is how best to reach those individuals and groups that are most at risk of accidental dwelling fire injury. In terms of observability, accidental dwelling fire injury data can be used to estimate the system state since this cannot actually be measured, since the majority of accidental dwelling fires in England go out themselves, or are put out by householders, not by a fire and rescue service (UKHO, 2023). In terms of feedback design, it is important to modify fire injury prevention actions as appropriate based upon analysis of the output of the system (accidental dwelling fire injury data) in order to improve the effects of fire injury prevention actions. Previous research had identified that old age and deprivation were significant factors in terms of dwelling fire injury (Bell et al., 2009; Runefors et al., 2017; Taylor et al., 2023) but had not examined how to implement such information into a feedback loop to control and improve fire injury prevention. Control theory has been used as an integral aspect of the hierarchy of controls for occupational safety, which ranks interventions from the most to least effective, starting with the elimination of hazards (Lyon & Popov, 2019). Control theory has also been used in various industrial sectors such as manufacturing (Wang et al., 2019), aerospace (Chai et al., 2021), and energy management (Peng et al., 2020). Control theory has been utilised for fire safety in terms of fire dynamics modelling (Lin et al., 2023) and wildfire management (Rochoux et al., 2010).

The research presented in this article builds upon and complements previous research into fire injury analysis, by demonstrating how such analyses can be feedback into fire injury prevention strategies.

2.2. Application of control theory by organisations

In organisations, managers can only reasonably be held accountable for the actions and results that they can significantly influence and are able to control. Therefore, in any organisation it is important to attempt to understand the level of control that different management actions can potentially achieve (Hasani et al., 2015). Control theory can be used to encapsulate the dynamic decision process, via clear aims, knowledge of the state of the system to be controlled, and a model of the system to be controlled (FSO, 2023). Control theory can be used to provide systemic approaches to risk and safety for organisations (Bakx & Nyce, 2017). In health care, McAvoy et al. (2020) argued that traditional and current approaches to modelling the impacts of interventions focus on detail complexity and other conditions remaining the same and thereby ignore wider system impacts. When complexity arises, the approach to risk (and safety measures intended to reduce risk to a tolerable limit) should be systemic. McAvoy et al. (2020) argued that control theory and other systems dynamics approaches can offer theoretical and practical advantages over conventional methodologies and the qualitative assessment tools that have informed emergency health care.

Overall, although control theory has been used to model the management of operational activities in a variety of organisations, there appears to have been limited research into the application of control theory for fire prevention in general, and accidental dwelling fire injury prevention in particular. The originality of the research presented in this paper is the detailed analysis of the use of control theory for supporting accidental dwelling fire injury prevention.

3. Research method

The research method adopted for the research into the application of control theory for fire prevention was control theory modelling of accidental dwelling fire injury data between 2011 and 2022 from Merseyside Fire and Rescue Service in the North West of England.

The research questions posed by the research were:

- What actions can be used to prevent accidental dwelling fires and associated injuries and fatalities?
- How can the effects of fire prevention actions be assessed?
- How can optimal use of fire prevention actions be achieved?

In control theory terms this research examines: what controls exist to reduce accidental dwelling fires/injuries/fatalities; the measurement of the effects of such controls; and how such controls can be optimised. These are important research questions since accidental dwelling fires have both social and economic costs (UKHO, 2023). In England in 2020 the average anticipation costs (that is costs associated with measures designed to prevent fires from occurring or protective measures to mitigate the damage and impact of fires) per fire incident was £57,100. The average direct and indirect costs that occur as a result of fire, such as property damage, loss of business, human injury, and fatalities was £20,500 per fire incident, and the average cost of fire and rescue services responding to a fire incident was £500. Overall, the estimated total economic and social cost of fire in England, in the year ending March 2020, was £12.0 billion (UKHO, 2023). The estimated cost of all physical and emotional harms to individuals caused by fire in England in 2020 was £362 million. In 2021, in the United States, property damage caused by dwelling fires was estimated at $15.9 billion (NFPA, 2022).

Data concerning the actions used to prevent accidental dwelling fires and associated injuries and fatalities over the period studied was provided by Merseyside Fire and Rescue service, along with data concerning fire prevention targeting approaches, and data concerning accidental dwelling fire injuries recorded in the UK Home Office Fire Incident Reporting System (FIRS, 2023) by Merseyside Fire and Rescue Service between 2011 and 2022. Population data concerning Merseyside was obtained from the UK Office for National Statistics (ONS, 2023). There were 1041 accidental dwelling fire injuries over the period studied, with the most common type of fire injury being overcome by smoke or toxic fumes (473 fire injuries) which constituted 45% of the fire injuries. The average number of home fire safety checks carried out by Merseyside Fire and Rescue Service per year over the period studied was approximately 37,000.

In order to perform the application of control theory to practice it was necessary to have detailed fire injury data over a reasonable period of time (in this case 2011 to 2022) in order to have sufficient fire injury records to detect patterns and changes to patterns. The UK Fire Incident Recording System that was used to obtain the data is a comprehensive database used by fire and rescue services to record details regarding fire incidents that are categorised into primary fires (more serious incidents), secondary fires (smaller outdoor fires), and chimney fires. However, not all fire incidents are reported to a fire and rescue service (and are therefore not recorded), and data may potentially be categorised differently by different fire and rescue services. Whilst some other countries have developed fire incident recording systems, the UK Fire Incident Recording System is notable for its structured approach and comprehensive data collection. In most countries, however, there are ongoing efforts to improve fire incident data accuracy and consistency (Manes et al., 2023).

It is important to understand the communication aspects of fire injury prevention. Typical fire injury prevention communication methods include face-to-face communication with householders as part of a home fire safety check, online home fire safety check tools, community or education events, and information provided via websites/social media and leaflets distributed to local residents in England as part of the Freedom of Information Act 2000. Merseyside Fire and Rescue Service used a combination of home fire safety checks, community and education events, and information provision via their website/social media channels and leaflets distributed to local residents during the study period (MFRS, 2023). An online home fire safety check tool was introduced by Merseyside Fire and Rescue Service in June 2022, shortly after the study period.

4. Results

4.1. Fire injury prevention actions

The types of fire injury prevention actions that can be undertaken by UK fire and rescue services include Home Fire Safety Checks, Web/social media based information, home self-assessment apps, community engagement events and educational events (MFRS, 2023). Figure 1 shows a control diagram for fire injury prevention management.

Figure 1 depicts how a combination of home fire safety checks, website and social media campaigns and community and education events can effect positive behavioural change towards fire safety. Home fire safety checks can also provide increased physical fire safety via the installation and maintenance of smoke detectors. Both physical fire safety mechanisms and positive behavioural change can then assist in reducing accidental dwelling fire injuries. In terms of control theory, behavioural change occurs if an individual detects a discrepancy between the current perceived conditions and their own desired conditions (their reference point). The reference point for the individuals being targeted (those most at risk of fire injury) would concern the ability to detect a fire (through working smoke alarms) and the ability to appropriately respond to a fire. The fire and rescue service's actions might help such individuals understand the need for working smoke detectors, and the need to reduce risks associated with fire, such as leaving cooking unattended even for a short time period. The sensitivity of the number of home fire safety checks on the results (that is an estimation of the benefits of an increase in home fire safety checks) could be estimated by comparing the average proportion of fire injuries in properties that had had a home fire safety check with a given time period (for example the past year) with those properties that had

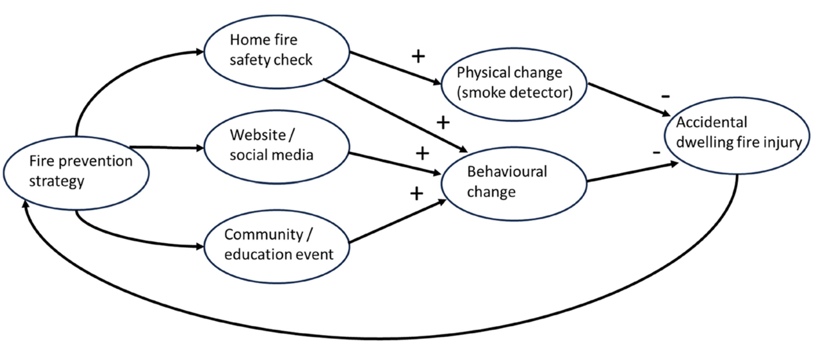

Figure 1. Control diagram for fire injury prevention management.

not had a home fire safety check within that time period. The diagram indicates how fire and rescue services can improve physical and behavioural aspects of fire safety, and can learn from changes in the patterns of accidental fire injury to further improve fire safety. This research examined the overall pattern of fire injuries in relation to the control that fire prevention activities (such as home fire safety checks) could exert. This could be further refined by examining the control that such fire prevention activities could exert in relation to different communities and different demographical factors. In addition, further research could examine the impact of inspection and maintenance of smoke detectors (as part of home fire safety checks) upon fire injury levels.

4.2. Assessing the effects of fire injury prevention actions

Assessing the effects of targeting home fire safety checks to those aged 65+ in Merseyside (and from 2017 onwards further targeting to those age 65+ and living in higher levels of deprivation) was undertaken via frequency analysis of the numbers of accidental dwelling fire injuries overall and amongst those aged 65+ per year and the related percentage decreases over the period studied, as well as analysis of the effects of other home fire safety check aspects including advice not to attempt to tackle a domestic fire, advice regarding escape routes in the event of a domestic fire, alcohol management advice (and referral to NHS services where appropriate), and smoke detectors installation and maintenance.

Figure 2 shows the decreases in accidental dwelling fire injuries overall, and amongst those age 65+ over the period studied. The percentage decrease in overall accidental dwelling fire injuries over the period studied was 47.93% (down from 121 to 63 injuries). In comparison the percentage decrease in age 65+ accidental dwelling fire injuries over the same period was 63.16% (down from 38 to 14 injuries). In 2021/22 the overall rate of accidental dwelling fire injuries per 100,000 of population in Merseyside was 4.39, and the rate of accidental dwelling fire injuries per 100,000 of age 65+ population in Merseyside was 5.10. This would appear to indicate that the targeting of home fire safety checks to those aged 65+ had contributed towards lessening the risk of accidental dwelling fire injury to the most vulnerable (age 65+) group. However, other factors could have been influential, for example, the reporting of domestic fire fatalities on national or local news media which could have raised awareness of fire risks.

In terms of the effects of advice not to attempt tackle accidental dwelling fires provided during home fire safety checks and specific website and social media information and advice, Figure 3 shows the frequency of fire injuries sustained attempting to fight a domestic fire overall, and for those aged 65+ over the time period studied. The percentage decrease in accidental dwelling fire injuries sustained attempting to fight the fire over the period studied was 38.89% (down from 18 to 11 injuries). In comparison the percentage decrease in age 65+ accidental dwelling fire injuries

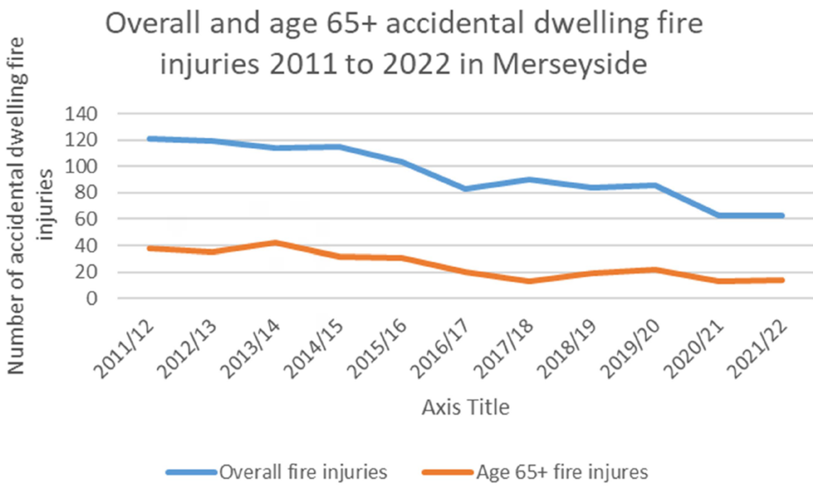

Figure 2. Overall and age 65+ accidental dwelling fire injuries 2011 to 2012 in Merseyside.

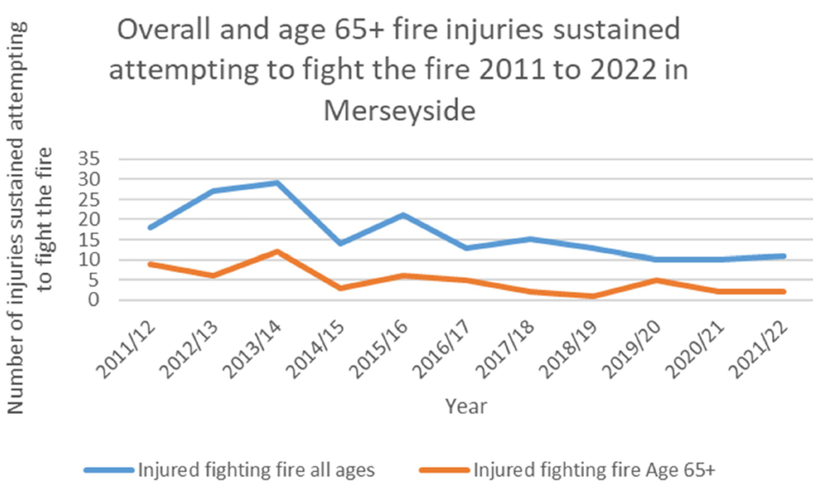

Figure 3. Overall and age 65+ accidental dwelling fire injuries sustained attempting to fight the fire 2011 to 2012 in Merseyside.

over the same period was 77.78% (down from 9 to 2 injuries). In 2021/22 the overall rate of accidental dwelling fire injuries sustained attempting to fight the fire per 100,000 of population in Merseyside was 0.77, and the rate of accidental dwelling fire injuries sustained attempting to fight the fire per 100, 000 of age 65+ population in Merseyside was 0.73.

Figure 4 shows the overall and age 65+ accidental dwelling fire injuries sustained attempting to escape the fire. Since there were only very small

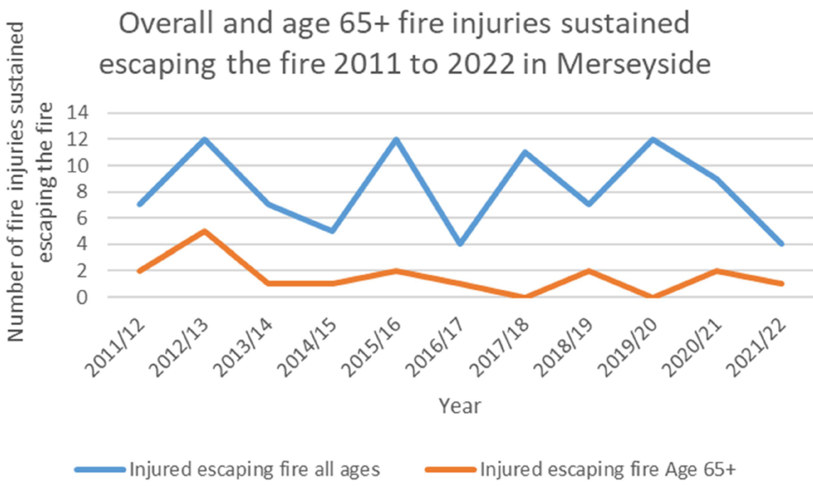

Figure 4. Overall and age 65+ accidental dwelling fire injuries sustained attempting to escape the fire 2011 to 2012 in Merseyside.

numbers of householders injured attempting to escape an accidental dwelling fire per year over the period studied, it was difficult to assess how the discussion of escape routes with individuals provided during home fire safety checks might have affected the numbers of such injuries.

Figure 5 shows the overall and age 65+ alcohol related accidental dwelling fire injuries. Since there were only relatively small numbers of alcohol related accidental dwelling fire injuries per year over the period studied, it was difficult to assess how alcohol management advice provided during home fire safety checks, or website/social media campaigns regarding the fire risks associated with alcohol consumption might have affected the numbers of such injuries. However, there did appear to be an overall downward trend in the numbers of alcohol related accidental dwelling fire injuries per year over the period studied.

Figure 6 shows the frequency of accidental dwelling fire injuries per year where there was no smoke detector present in the property. The percentage decrease in overall accidental dwelling fire injuries where there was no smoke detector present in the property over the period studied was 51.52% (down from 33 to 16 injuries). In comparison the percentage decrease in age 65+ accidental dwelling fire injuries where there was no smoke detector present in the property over the same period was 66.67% (down from 9 to 3 injuries). In 2021/22 the overall rate of accidental dwelling fire injuries per 100,000 of population in Merseyside where there was no smoke detector present was 1.12, and the rate of accidental dwelling fire injuries per 100,000 of age 65+ population in Merseyside where there was no smoke detector present was 1.09. This would appear to indicate that the targeting of home fire safety checks to those aged 65+ has contributed towards lessening the risk of accidental dwelling fire injury

Figure 5. Overall and age 65+ alcohol related accidental dwelling fire injuries 2011 to 2012 in Merseyside.

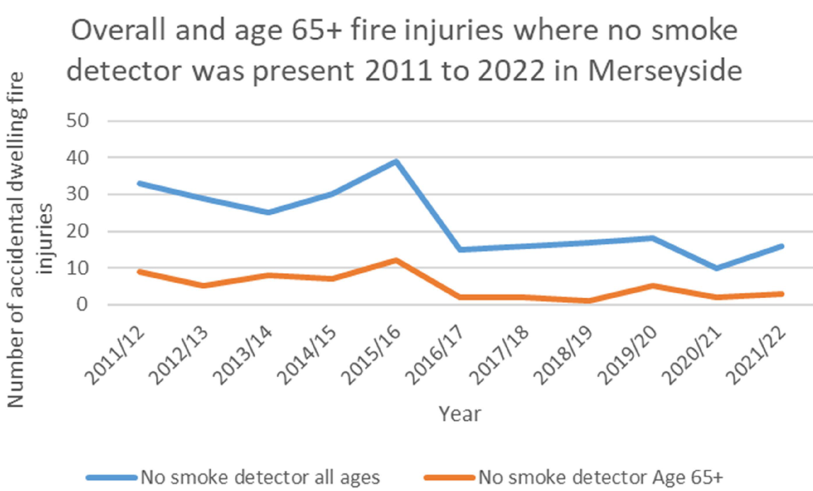

Figure 6. Overall and age 65+ accidental dwelling fire injuries where no smoke detector present 2011 to 2012 in Merseyside.

to the most vulnerable (age 65+) group via increased numbers of working smoke detectors amongst that age group.

Figure 7 shows the frequency of accidental dwelling fire injuries per year where there the smoke detector present in the property did not activate. The percentage decrease in overall accidental dwelling fire injuries where the smoke detector present in the property did not activate was 21.05% (down from 19 to 15 injuries). In comparison there was no decrease

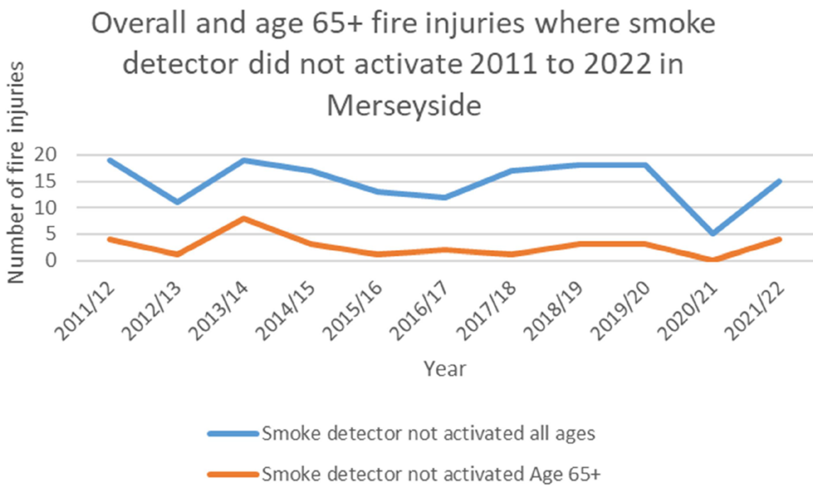

Figure 7. Overall and age 65+ accidental dwelling fire injuries where smoke detector did not activate 2011 to 2012 in Merseyside.

in age 65+ accidental dwelling fire injuries where the smoke detector present in the property did not activate. Since there were only relatively small numbers of accidental dwelling fire injuries where the smoke alarm did not activate per year over the period studied, it was difficult to assess how maintenance and maintenance advice regarding smoke detectors given during home fire safety checks, or website/social media campaigns might have affected the numbers of such injuries. However, there did appear to be an overall downward trend in the numbers of fire injuries where the smoke detector did not activate per year over the period studied.

Figure 8 shows the overall and age 65+ fire injuries in the most deprived areas of Merseyside (those with an IMD decile of 1) between 2011 and 2022. IMD decile 1 represents the most deprived areas in England, and IMD decile 10 represents the least deprived areas in England and is calculated by the UK Office for National Statistics (IMD, 2023). Home fire safety checks in Merseyside were targeted to those aged 65+ over the period 2011 to 2022, and from 2017 onwards were further targeted to those age 65+ living in higher levels of deprivation.

The percentage decrease in overall accidental dwelling fire injuries in the most deprived areas in Merseyside over the period 2017 (when Home fire safety checks were further targeted to those age 65+ living in higher levels of deprivation) to 2022 was 38.18% (down from 55 to 34 injuries). In comparison the percentage decrease in age 65+ accidental dwelling fire injuries in the most deprived areas of Merseyside over the same period was 60.00% (down from 15 to 6 injuries). In 2021/22 the overall rate of accidental dwelling fire injuries in the most deprived areas of Merseyside per 100,000 of population in Merseyside was 2.37, and the rate of

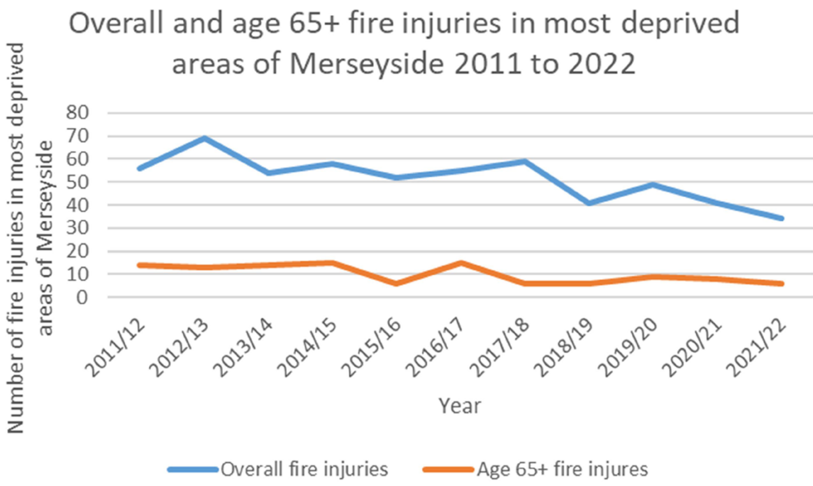

Figure 8. Overall and age 65+ fire injuries in the most deprived areas of Merseyside 2011 to 2022.

accidental dwelling fire injuries in the most deprived areas of Merseyside per 100,000 of age 65+ population in Merseyside was 2.19 This would appear to indicate that the further targeting of home fire safety checks to those aged 65+ and living in the most deprived areas in Merseyside from 2017 onwards had contributed towards lessening the risk of accidental dwelling fire injury to this more vulnerable (age 65+ and living in higher levels of deprivation) group. However, given the very low numbers of fire injuries concerned, other factors could also be of influence, as indicated by the dip in fire injury numbers in 2014/15.

4.3. Optimising fire injury prevention actions

In terms of the optimal use of fire injury prevention actions, the approach adopted by Merseyside Fire and Rescue Service over the period studied was to target specific demographics which had been identified as being most at risk of fire injury. In Merseyside, those aged 65+ had previously been identified as the population sub-group most at risk of accidental dwelling fires. In 2020 in Merseyside those aged 65+ constituted 19.12% of the 1,434,300 population. Over the period studied, the optimisation of fire prevention activities was achieved through identification of those most at risk of accidental dwelling fires (those aged 65+) and targeting home fire safety checks towards this group. In addition, in terms of targeted website/social media and paper-based information leaflets, optimisation of fire prevention was undertaken via identifying those behaviours posing the greatest accidental dwelling fire risk, such as unattended cooking and alerting the public to such. Geographical analysis of the occurrence of accidental dwelling fire injuries provided a means of identifying communities most at risk, enabling the targeting of relevant community and educational events. Feedback from the assessment of the effects of the targeting of these fire prevention actions was then used to inform future fire prevention strategy planning. In terms of the application of feedback design, analysis of accidental dwelling fire injury data over the time period studied indicated that the numbers of age 65+ accidental dwelling fire injuries were reducing more than those for the population of Merseyside overall (which was also reducing), and the fire injury rate per 100,000 of population for those age 65+ was reducing to a level more similar to the fire injury rate per 100,000 of the overall population of Merseyside. In this manner a negative feedback loop appeared to be operating, in that the fire injury prevention targeting approach was reducing the number of fire injuries and fire injury rate per 100,000 of those age 65+ (the targeted most vulnerable group), to be more in line with the overall fire injury rate for the population of Merseyside, whilst at the same time the number of fire injuries and fire injury rate per 100,000 for the overall population of Merseyside were also decreasing. In other words, the targeting of fire injury prevention actions to those aged 65+ did not appear to be detrimentally affecting fire injury rates amongst other age groups in Merseyside. In addition, based upon analyses of accidental dwelling fire injuries in relation to deprivation, from 2017 onwards home fire safety checks in Merseyside were further targeted to those age 65+ living in higher levels of deprivation. This appeared to reduce the number of fire injuries and fire injury rate per 100,000 of those age 65+ living in higher levels of deprivation (the further targeted most vulnerable group) and to not detrimentally affect fire injury rates amongst other age groups and social groups in Merseyside.

4.4. Limitations

Only those domestic fire injuries in the Merseyside area where Merseyside Fire and Rescue Service were called to attend would have been recorded in the UK Fire Incident Recording System, and therefore available for analysis. The majority of domestic fires in England go out themselves, or are put out by householders, not by a fire and rescue service (UKHO, 2023). The data recorded for fire injuries in England in the UK Fire Incident Recording System does not include whether the individual lived alone, or whether a home fire safety check had been conducted at the property previously, or had involved the individual that was injured in the fire.

5. Conclusions

The benefits of using a control theory view of fire injury prevention management were a more detailed understanding of how fire injury prevention strategies translate into fire injury prevention actions, how these actions relate to physical and behavioural fire safety changes in households, and how analysis of accidental dwelling fire injury data can be used to feedback and inform fire injury prevention strategy planning. A control theory view of fire injury prevention management assisted in understanding the targeting approach used for fire injury prevention. That is the identification of the population sub-group most at risk of accidental dwelling fire injury (those aged 65+ and living in higher levels of deprivation), and the behaviours most likely to increase accidental dwelling fire injury (such as leaving cooking unattended). A control theory approach also informed the need for further analysis of fire injury data to provide feedback information for fire prevention strategy planning, in this case comparison of overall and age 65+ accidental dwelling fire injury data, (which was not routinely produced) in order to support assessment of the impact of targeting home fire safety checks to age 65+ individuals living in higher levels of deprivation over the period studied.

Recording whether a home fire safety check (or multiple home fire safety checks) had been previously undertaken at the property concerned and the date(s) of such would be useful to include in the UK Fire Incident Recording System. In this manner the relationship between home fire safety checks and accidental dwelling fire incidences, injuries, and fatalities could be analysed in more depth. The originality of the research reported in this article is the use of control theory to examine how fire injury prevention activities can be assessed in terms of their effect upon the incidence of accidental dwelling fire injuries. It is hoped that the results of the research may be of use to other fire and rescue services.

Disclosure statement

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Data availability statement

The dataset used is available upon request.

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