An Evidence-Based Approach to Home Fire Safety

WPI

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Abstract

The goal of this project was to provide the Metropolitan Fire Brigade (MFB) with evidence based recommendations to improve community resilience activities that promote fire safety in the home. MFB Home Fire Safety Campaigns from 2009-2013, fire incident data from 2008-2013, and other public safety organisations were analysed. Smoking fires, electrical fires, and the presence of a working smoke alarm were isolated as potential focuses of future activities. MFB can use the strategies provided to confront these issues to create a more resilient community.

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Executive Summary

Introduction

An estimated 10,000 residential fires occur every year in Australia.[1] In 2012, the state of Victoria experienced 3,800 residential structure fires that resulted in over $97 million worth of property damage.[2]

One fire safety campaign conducted by MFB's Community Resilience Department, in partnership with CFA, is the annual Home Fire Safety Campaign (HFSC). This campaign runs through the winter months to educate Victorians about the dangers of fires in the home.

The goal of this study is to provide MFB with evidence based recommendations to improve future community resilience activities in relation to home fire safety.

Methodology

The project team examined five years of Home Fire Safety Campaigns (HFSCs) from 2009-13, along with residential structure fire incident data from the Metropolitan District of Melbourne during that time. The project delivers:

1. A comprehensive profile of the Home Fire Safety Campaigns from 2009-2013.
2. An analysis of AIRS residential fire incident data for 2008-2013.
3. Comparison of AIRS data to Home Fire Safety Campaign messages and timing.
4. Suggestions with supporting evidence for best practices in future community resilience activities in relation to home fire safety.

To understand the HFSCs, the team analysed and summarised documentation related to each of the campaigns from 2009-2013 and conducted interviews with MFB personnel.

MFB provided the team with data from the Australian Incident Reporting System (AIRS), and we used a range of techniques to analyse all preventable residential structure fires between 2008 and 2013. Using AIRS data, we developed a measure of relative severity to determine the types of fire that are more severe than average. We also attempted to determine if there was any relationship between fire incident trends and of some the key messages of the HFSCs.

The team also analysed media releases from MFB to determine the extent that they are used to promote home fire safety messages. We researched other public safety organisations to find commonalities between successful campaigns. Lastly, the team isolated potential home fire safety issues that MFB could focus on in future community resilience activities.

[1] System Planning Corporation (2008)
[2] Metropolitan Fire and Emergency Services Board (2014)

Results and analysis

Finding 1: The 2009-2013 Home Fire Safety Campaigns targeted three primary home fire safety issues.

The 2009-13 HFSCs all focused on the dangers of unattended cooking and heater fires. One of the primary risky behaviours advertised was smoking in bed.

Finding 2: There is no evidence that the HFSC had an effect.

Only about four per cent (n=508) of respondents to an evaluation survey conducted in 2012 said they undertook a home fire safety activity because they saw a HFSC advertisement. From the data analysed by the team, it was not possible to state that the HFSCs from 2009 to 2013 had any impact on residential fires during winter.

Our analysis of AIRS data indicates that the distribution of severe fires is not dependent upon the season. Fires occurring in the winter months accounted for about 26 per cent (2667) of all fires. Fires occurring in the winter months accounted for 24 per cent of total dollar loss figures. Winter had the highest percentage of fires confined to their room of origin (92.7 per cent), as well as the fewest fires extending beyond their structure of origin (12). Fires occurring in the winter comprised 26 per cent (2499) of all first alarm fires.

A primary focus of all the HFSCs run since 2009 has been unattended cooking fires. The data showed no evidence that the campaigns had an impact on unattended cooking fires. The team analysed heater fires because they were a key message in the HFSCs. We found that the annual cycle of heater fires had already reached its peak by the time the HFSC was broadcast each year. Smoking in bed was another key HFSC message. The team was unable to find any evidence in the AIRS data to determine if the campaign had an impact of the number of fires resulting from smoking in bed.

Finding 3: Residential structure fires originate from a variety of scenarios that vary broadly between frequency and severity.

The team analysed the frequency and severity of fires in terms of area of origin, cause, source of energy, appliance, time of day, and presence of a working smoke alarm. We found that there is a multitude of ways a fire can start in the home. Few types of fire are both frequent and severe, and provide an obvious target for interventions.

Fires are common in the kitchen, structural areas, living areas and the bedroom. Although kitchen fires were the most common, they were the second least severe area of origin. Of the top five most common fires, those in the structural areas, living areas, and bedrooms above average in terms of severity. Cooking related fires, regardless of the action that caused them, accounted for 36 per cent (3654) of fires. However, cooking related fires also had the lowest relative severity of any cause.

The team's analysis of data related to appliances found that appliances frequently started, or were involved in fires. However, of 41 different appliances categorised, there were only five that were each responsible for over five per cent of fires.

The distribution of fires, both in terms of frequency and severity, is not uniform across all twenty-four hours of the day. Night time was the only period that had a relative severity above the average. Our analysis found that fires are more severe when they occur between the hours of 11 pm and 7 am. Forty-two per cent (14) of all deaths in our dataset occurred during this period.

When the presence of a working smoke alarm is considered, fires that occurred when a smoke alarm was not present or failed to operate had the highest relative severity, indicating that these fires tend to be the most severe.

Finding 4: The evidence suggests three types of fires that MFB could consider as future targets for home fire safety activities.

Based on the evidence we collected, we found that smoking related fires, electrical fires, and working smoke alarms were three key areas that MFB could consider as targets for future home fire safety activities.

Finding 5: A holistic approach and partnerships were two common features of effective public safety activities.

A holistic approach to a public safety issue is one that addresses an identified problem on multiple fronts. This can include raising awareness in the community and taking actions to improve the physical and social environment. The team found that partnerships are useful tool because they allow for the multiplication of resources as well as the opportunity to leverage various skillsets that can contribute in different ways to addressing the problem.

The team also found that using data and statistics to their full advantage could contribute to a better understanding of issues to be targeted.

The team found that MFB media releases related to residential structure fire incidents could include a preventative message and a preparedness message. Examination of these media releases identified that these are currently underused and provide increased opportunities for MFB to use these existing (and cost-free) communication channels to convey home fire safety messages that support the messaging of the HFSC.

Finding 6: Effective campaigns tailor messaging based on the desired outcome and intended audience.

The team found that effective campaigns tailor public safety messages to a specific outcome and audience. We found that to do this, an organisation must conduct

research and proactively analyse data. The team's research of the literature suggested that campaigns can be effective when they focus on simple actions, when they target an emerging risk, and when safety messages are communicated in ways that are primarily entertaining rather than educational.

Conclusions and Discussion

The Home Fire Safety Campaigns from 2009-13 focused primarily on three key messages: unattended cooking, heater fires, and smoking in bed. The team found no evidence that the campaign was effective at changing people's behaviour. Neither was there evidence that the campaign was effective at reducing the frequency of fires. **Because there was no evidence of the campaigns making a difference, MFB should reconsider how to approach home fire safety issues in the future.**

MFB's current approach to home fire safety could be considered a holistic approach, but this could be expanded to include more proactive data collection and analysis, partnerships, media relations, multiple communication channels, and a focus on clearly defined outcomes.

Proactive data collection and analysis would allow MFB to do five things: identify target issues, identify the target audience, develop relevant messages, measure the intervention's success, and determine future courses of action.

Kitchen fires have been addressed in previous HFSCs because they are the most frequent fires. Using the relative severity measure developed in this study, the team found that kitchen fires were, on average, not severe. The team's research identified three issues that could be future targets for MFB: smoking related fires, electrical fires, and working smoke alarms.

Smoking related fires are a significant source of severe fires and fire fatalities and a potential target for future community resilience activities. This could include partnerships with organisations like VicHealth that focus on reducing the number of smokers in the population.

The team's data analysis revealed that electrical malfunction causes a significant number of severe fires. Over half of fires involved electricity, and many fires started from electric infrastructure, lights, or fans that malfunctioned. Fires from electrical infrastructure tend to be more severe than the average fire as they can burn in hard to detect places and spread quickly through the home. MFB could re-establish a partnership with Energy Safe Victoria (ESV) and could consider new activities such as subsidising and/or promoting the ESV Electrical Home Safety Inspection Program.

The most severe fires occurred in homes without working smoke alarms. The data revealed that homes without working smoke alarms had an injury and fatality rate much higher than homes with working smoke alarms, and that the fires with the highest relative severity occurred when smoke alarms either were not present or did not operate. Working smoke alarms are already an issue targeted in the "Change Your

Clock, Change Your Smoke Alarm Battery” campaign. However, the team’s data analysis revealed that this is an important issue that warrants further consideration by MFB.

Behaviour change and risk awareness are complicated fields of psychology, and many models have been developed to attempt to explain peoples’ actions and motivations with the goal of influencing their behaviour. MFB should consider some of these different models in the creation of future campaigns, activities, messages, and materials.

MFB could refine the relative severity measures that the team developed in this study. Relative severity was a measure that we created to find the most severe fires, and it could be used more broadly to help determine major problem areas and make policy decisions based upon data.

The AIRS data that the team analysed had several notable limitations. Some of the data from AIRS was inaccurate when compared to information written in the description field. AIRS does not contain demographic information, making it impossible to track trends across the population. These limitations in AIRS may affect MFB’s ability to identify emerging risks and the team recommends that MFB consider ways to improve the quantity and quality of data.

1. Introduction

An estimated seven to eight million fires are reported to emergency services throughout the world each year. Thirty per cent of these fires originate in a residential structure, while the same fires account for eighty per cent of all fire fatalities.[3] Unsafe cooking practices, dangerous open heat sources, electrical malfunctions, and careless behaviours are all contributing factors to residential structure fire ignition.

According to the Australian Bureau of Statistics, 10,000 residential fires occur every year across the country of Australia.[4] In 2012, the state of Victoria experienced 3,800 house fires, resulting in over $97 million worth of property damage.[5] The State Government of Victoria funds the Metropolitan Fire and Emergency Services Board (MFB) to protect its community from the dangers of fire. MFB confronts the dangers of residential structure fires in both a reactive manner, with operational response, and a proactive manner. MFB's Community Resilience Department runs a multitude of community engagement activities designed to properly educate the community and raise their awareness of fire safety messages.

MFB is responsible for protecting over 1,200 square kilometres of densely populated land.[6] Within this area, there are approximately 1.5 million residences under MFB protection. This number is expected to rise to more than 2 million in the next two decades.[7] One activity executed by the Community Resilience Department is the annual Home Fire Safety Campaign (HFSC). This campaign, run throughout the winter, targets residential fire safety, and is intended to promote safe practices and educate the citizens of Victoria to the dangers of residential structure fires.

Since 2010, MFB has contracted third party agencies to evaluate the HFSC. These evaluations have provided MFB with insight into one aspect of the campaigns success. These evaluations provide only information about Victorian's recall of the campaigns messaging. No connection between campaign messaging and the occurrence of actual fire incidents has been examined. Additionally, comprehensive research into best practices in the space of community education outside of advertising campaigns has not been completed.

The goal of this project was to provide MFB with an evidence based approach to community resilience activities in relation to home fire safety. The team combined an extensive analysis of fire incident data with research in the community education field to provide MFB with evidence for future community resilience activities. The team first

[3] Brushlinsky et al (2006)
[4] System Planning Corporation (2008)
[5] Metropolitan Fire and Emergency Services Board (2014)
[6] Metropolitan Fire and Emergency Services Board (2014)
[7] Metropolitan Fire and Emergency Services Board (2014)

compiled information on the HFSCs implemented from 2009-2013. This information supplied the team with a descriptive profile of the campaigns and allowed common messaging to be identified. The team then analysed Australian Incident Reporting System (AIRS) data, and mapped this data to the profile of the HFSCs to determine the relevance of campaign messaging and timing. The data also provided the team with a representation of the fire incidents of metropolitan Melbourne and allowed the team to identify three potential focuses of future community resilience activities. Finally, the team completed research of other public safety organisations as well as existing research in the field of public safety to identify effective techniques. The combination of fire incident data analysis and public safety research allowed the team to provide MFB with an evidence based approach to fostering a safer and more resilient community.

2. Background

This chapter outlines the context in which MFB works. It describes the changing demographics of Victoria and the issue of residential structure fires. It contextualises the role of MFB by describing the fire and emergency service sector in Victoria. It then outlines the role and activities of MFB's Community Resilience Department. This chapter concludes with a review of literature about behaviour change and risk reduction communication.

2.1 Population and Demographics of Victoria

The state of Victoria covers an area of about 227,000 square kilometres. It has a population of approximately 5,768,600 people, which is growing rapidly.[8] Population projections show that by 2051, Victoria will have 8.7 million people.[9] About 31 per cent of the population are migrants from other countries. There are about 1.9 million households in Victoria, most of which are family homes. As the population of Victoria grows, it is also getting older. The median age of 37 in 2011 will rise to 41 by 2051, and during that time the population aged 85 and older is projected to quadruple to over 400,000.[6] Additionally, the proportion of family households is projected to decrease while the proportion of one-person households increases. Appendix A describes common types of housing in Victoria.

Victoria's main metropolitan centre, Melbourne, covers an area of 7,694 square kilometres. Greater Melbourne is home to 4.1 million people, almost 75 per cent of Victoria's population. Melbourne has had the fastest growth rate of any capital city in Australia, with an increase of 406,600 people in the five years preceding 2012.[10] Population projections predict that the population of Greater Melbourne will increase to 6.5 million in 2051, and that this increase will largely be due to overseas migration. With this large population increase, the amount of households in Greater Melbourne is projected to increase from 1.5 million in 2011, to 2.1 million in 2031. The proportion of one-person households is projected to increase by 2 per cent.[11]

2.2 Residential Structure Fires in Australia

Fire service organisations in Australia attended an average of 109,874 incidents each year from 2003-2013. As assessed by firefighters, there was an annual average of $781.7 million of property loss. Each year, there was an average of 3,325 fire injury hospital admissions as well as 107 fire related deaths.[12]

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[8] Australian Bureau of Statistics (2014)
[9] Department of Planning and Community Development (2012) p. 3
[10] Australian Bureau of Statistics (2013)
[11] Department of Planning and Community Development (2012) p. 8
[12] Steering Committee for the Review of Government Service Provision (2014)
Deaths from smoke, fire and flames due to exposure or undetermined intent. Deaths due to intentional self-harm and assault have been excluded. All locations and types of fire have been included, not just domestic fires. The list includes landscape fires (e.g. bushfires). The 2009 results include 178 people killed in the Black Saturday bushfires in Victoria

Specific groups within the population are more likely to cause a fire, and are more susceptible to injury or fatality. According to the Australasian Fire and Emergency Service Authorities Council (AFAC), the following demographic groups have an increased chance of injury or death in a residential structure fire.

- People aged 65 years and older
- Children aged between 0-4 years
- Adults affected by alcohol consumption
- Males
- Adults aged 20-44 years
- People of low socio-economic status
- People with poor educational background
- Ethnic minorities
- Individuals who smoke [13]

In the state of Victoria, from 2003-2013, there was an average of 23,067 incidents attended by fire service organisations each year. There was an annual average of $213.2 million of property loss, an average of 659 fire injury hospital admissions, and 39 fire related deaths.[14] Appendix B provides a brief background of residential structure fires with a focus on the United States.

2.3 Fire Services in Victoria

The fire and emergency management sector in Victoria is comprised of the Metropolitan Fire Brigade (MFB), Country Fire Authority (CFA), State Emergency Service (SES), Land, Fire and Environment Group – Department of Environment and Primary Industries (DEPI). These agencies are overseen by the Emergency Management Commissioner and his office, Emergency Management Victoria (EMV). The sector has adopted a common vision of "A safer and more resilient community".[15] Other emergency services such as Victoria Police and Ambulance Victoria reside outside the EMV framework, but all agencies work closely together.

MFB provides firefighting, emergency medical response, rescue, urban search and rescue, road rescue, marine rescue, and hazardous material incident response services to the Metropolitan District (MD) of Melbourne. The MD covers an area of more than 1,200 square kilometres. MFB protects almost four million Melbourne residents, workers, and visitors, as well as billions of dollars of assets and infrastructure. All MFB firefighters are full time employees. MFB's rank structure is located in Appendix C. Firefighters respond out of 47 fire stations throughout the Metropolitan District shown in Figure 1.[16]

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[13] Australasian Fire Authorities Council (2005) pp. 3-4

[14] Steering Committee for the Review of Government Service Provision (2014)
Deaths from smoke, fire and flames due to exposure or undetermined intent. Deaths due to intentional self-harm and assault have been excluded. All locations and types of fire have been included, not just domestic fires. The list includes landscape fires (e.g. bushfires). The 2009 results include 178 people killed in the Black Saturday bushfires in Victoria.

[15] Fire Services Commissioner Victoria (2012)

[16] Metropolitan Fire and Emergency Services Board (2014)

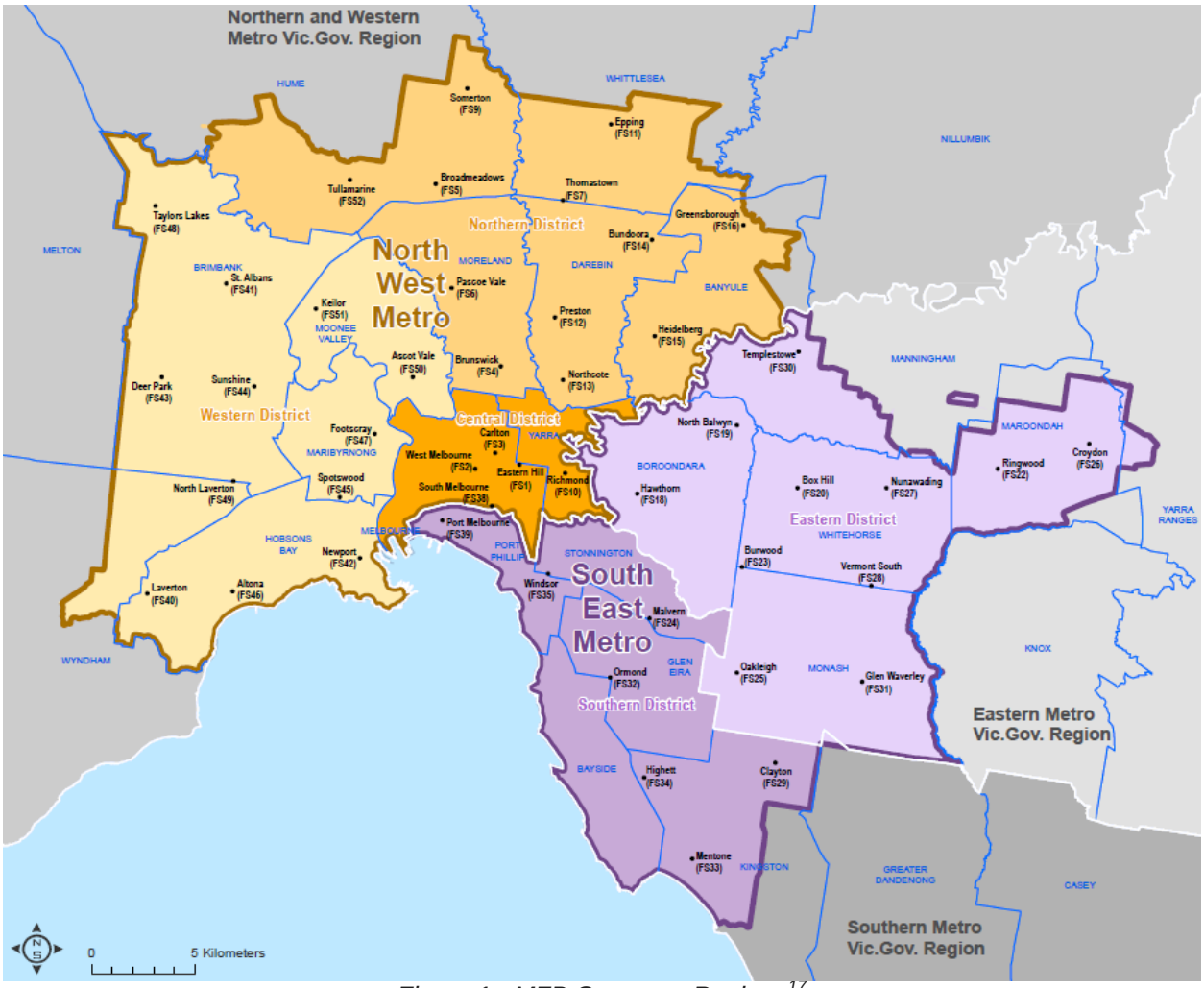

Figure 1 - MFB Coverage Regions[17]

CFA is comprised of 1,126 brigades that are responsible for the areas of Victoria that lie outside of the Metropolitan District. CFA firefighters are primarily volunteers, but there are career firefighters based in Melbourne's outer suburbs, regional cities and large towns. Like MFB, CFA provides a range of emergency response services. Appendix D shows CFA's areas of coverage.[18]

[17] Map was provided by MFB Strategic Analysis and Reporting Unit
[18] Country Fire Authority (2014)

SES is a volunteer based organisation. It is the control agency during natural disasters such as floods and earthquakes, and the agency primarily responsible for road rescue in Victoria. It also assists in search and rescue activities and major bushfire incidents.[19]

DEPI's primary focus is on protecting the environment, and fire prevention and firefighting activities on public land is a small part of that. Most DEPI firefighters work on a seasonal basis.[20] The DEPI areas of coverage are located in Appendix D.

2.4 MFB Community Resilience Department

Improvements in fire safety are a result of MFB's emergency response and community resilience activities. MFB's Community Resilience Department uses a variety of approaches to achieve the goal of "A safer and more resilient community". The *Community Resilience Strategy* focuses on three key strategies: building stronger communities, making firefighters safer, and working in partnership with other organisations for the best possible outcome.[21]

The range of activities and approaches used by Community Resilience include:

- Research
- Development of strategies, treatments, polices and messaging
- Program development and delivery (Fire Ed for Prep, Fire Ed For Upper Primary, Seniors Fire Safety, Flames)
- Advocacy and lobbying for improved safety outcomes via external frameworks (inclusion of home fire safety information in qualifications) for community care workers, and legislation (legislation requiring all homes to have a smoke alarm)
- Workplace Emergency Management and safety advice for business and industry
- Participation in state and local events such as fairs, festivals, etc.
- Campaigns

Community Resilience, in partnership with CFA, develops and delivers an annual cycle of advertising campaigns. CFA leads the Summer Fire Safety Campaign to increase preparedness and knowledge about bushfires. The Change Your Clock Change Your Smoke Alarm Battery campaign runs shortly after the end of the bushfire season to coincide with the end of daylight savings. This is a national campaign based on a partnership between fire services from other states and territories and Duracell, a consumer battery company, to promote the importance of a working smoke alarm.

MFB leads the annual Home Fire Safety Campaign that is the focus of this paper.

2.5 Literature Review

This section outlines a review of literature conducted by the team. The aim of the literature review was to discover background information to help inform and interpret the findings of this project. In the first two weeks of the study, the team created a list of keywords and phrases. The team then used *Google Scholar* and MFB's library

[19] Victoria State Emergency Service (2014)
[20] Department of Environment and Primary Industries (2014)
[21] Metropolitan Fire and Emergency Services Board (2013) p. 2

catalogue to find relevant information based on these keywords. The team read and discussed each article to determine relevant information for the literature review.

2.5.1 Perception of Risk from Fire

Many people have the attitude that fires will not happen to them[22] and as such, are not concerned about fire safety in their own homes.[23] Being prepared for a fire by having a working smoke alarm can make people less likely to think that their family would be hurt in a fire or that house fires are a serious problem.[24, 25] People generally underestimate the dangers of fire, having a higher perception of risk in buildings that are not their own home, even though risk of injury or fatality is greater in their own home. People often underestimate the danger of fire, because they do not realise that smoke, not heat, causes an estimated 90 to 95 per cent of deaths.[26]

Most people who have experienced a fire say that it could easily have been prevented.[27] However, Hooper (2003) found that most respondents to a survey viewed home safety "in terms of how to react to a fire, rather than how to prevent it." The same study found that of people who had a fire in their home, "only 64 per cent stated that the risk of fire was worth making the home more fire safe."[28]

In terms of fire safety communication, research has shown that there is a need to highlight both how and why fire is a danger to the community. [29] Organisations should take believability, personal relevance, and significance into account when communicating safety messages.[30] Research has found that losing one's home or possessions is the most believable consequence of a fire, while death is not a believable consequence of fire and serious burns are seen as highly unlikely.[31]

Fire risk and prevention is a complex issue because fires can start in many different ways. The "wicked problem" approach suggests that it is not effective to attempt to solve problems that involve complex social factors by focusing on a single cause.[32] Simpson et al (2013) conducted research into children's injuries; many of the principles from this research apply to home fire safety. There are complex and interactive contexts in which events occur, so it is hard to focus on the prevention of injury (or fire) as there are so many complex causes. [33] However, it is important to identify what common issues can be addressed while recognising that unintentional events will still occur.[34]

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[22] Bird et al (2011) p. 4
[23] Litmus (2013) p. 6
[24] Parker (2013) p. 608
[25] Hooper (2003) p. 29
[26] Hooper (2003) p. 27
[27] Research International (2011) p. 15
[28] Hooper (2003) p. 29
[29] Hooper, 2003, p. 29
[30] Research International (2011) p. 48
[31] Research International (2011) p. 39-41
[32] Simpson et al (2013) p. 1649
[33] Simpson et al (2013) p. 1647
[34] Simpson et al (2013) p. 1652

2.5.2 Theory, Complexity, and Models of Behaviour Change

Often the research process makes too many assumptions and over-simplifies the social world in which we live.[35] Sociological perspectives characterise people as "predictably irrational, sometimes rational, cultural and social animals." [36] This characterisation underlines the complexities faced by organisations attempting to change behaviour in a community.

A fundamental notion in behaviour change theory is that one of the strongest motivators of behaviour change is emotion. This is supported by the theory that likely triggers to behaviour change are major life events, whether they are celebratory or mournful.[37,38,39,40] Additionally, research shows that the responsibility for a consequence is a primary emotional driver of behaviour change. [41]

To effectively influence behaviour change, public safety organisations must overcome a wide range of behavioural factors. Some of these factors include:

- The difficulty in overcoming an ingrained habit[42,43 ,44]
- The differing capacity of people to make good choices
- The need of good choices to be attractive, available, and affordable
- The importance of social norms in shaping an individual's choice[45]

People do not instantly adopt safety messages. Instead, behaviour change has various stages of contemplation, preparation, action, and confirmation.[46] One model that attempts to provide a framework to address each of these stages is the social marketing model. This model, summarised in Figure 2, outlines four steps that social marketing must accomplish to successfully influence behaviour change.[47]

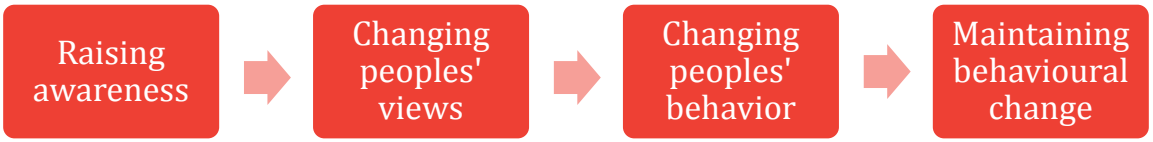

Figure 2 - Social Marketing Model

[35] Lloyd and Roen (2001), p. 7
[36] Fuller (2010) p. 5
[37] Research International (2010)
[38] Litmus Limited (2014)
[39] Baum (2004) p. 17
[40] Bird et al, p. 1
[41] Research International (2011) p. 52
[42] Fuller (2010) p. 5
[43] Bird et al, Page 3
[44] Fuller (2010) p. 5
[45] Fuller (2010) p. 5
[46] Hooper (2003) p. 29
[47] Martin Jenkins (2012) p. 2

Individuals' attitudes towards what is required, their ability to perform what is required, and their understanding of why it is required all contribute to whether or not the maintenance or confirmation stage is reached. [48,49] Another model, called the Health Belief Model, describes the factors that affect an individual's perceptions towards preventative behaviour change. These factors are:

- Perceived susceptibility
- Perceived severity
- Perceived benefits of performing the preventative behaviour
- Perceived barriers to performing the preventative behaviour
- Cues to action
- Self-efficacy (belief in one's own ability to perform preventative behaviour) [50]

2.5.3 Holistic Approach to Public Safety Communication

Fuller (2010) argues that an advertising mindset is easy for government agencies to adopt, but that a more comprehensive view incorporating knowledge about human behaviour is needed.[51] A holistic approach to public safety includes various activities that work in conjunction to address a public safety issue. Research has found that, "fire prevention and response education is most effective if it is community-based, continuous, and uses a range of strategies." [52]

The Haddon Matrix is useful to demonstrate the array of potential measures available to public safety organisations. It was originally developed in the context of traffic accident prevention, but has been applied to many other injury prevention situations. The Haddon Matrix combines the concept of *host*, *agent*, and *environment* as targets of intervention with the concept of *primary*, *secondary,* and *tertiary* prevention. [53] The most appropriate application of the matrix is to identify multiple prevention measures for a single problem. Table 1 provides an example of the Haddon Matrix applied to the problem of unattended cooking fires.[54]

[48] Martin Jenkins (2012) p. 14
[49] Hooper (2003) p. 29
[50] Parker et. al (2013) p. 600
[51] Fuller (2010), p. 4
[52] New Zealand Council for Education Research (2000)
[53] Haddon (1980)
[54] Adapted from Runyan (1998)

Table 1 - Haddon Matrix

	Host (the cook)	Agent (stove top, cooking utensils, food)	Physical environment (kitchen)	Social environment (community norms, rules)
Pre-event (before the fire starts)	• Teach safe cooking practices • Pay attention	• Improve appliance safety (e.g. automatic shutoff) • Maintenance of cooking appliances	• Lower flammability of surrounding structures	• Improve efforts to encourage safe cooking
Event (during the fire)	• Knowledge of home escape plans • Fire safety training (appropriate use of fire blankets and extinguishers)	• Design appliance with safety systems • Reduce flammability of materials	• Presence of working smoke alarms/ sprinklers • Ease of access to fire extinguisher and blanket	• Legislate for smoke alarms and sprinklers • Ensure adequate fire service response
Post-event (after the fire)	• Knowledge of first aid	• Ensure safe operation of appliances	• Rebuild kitchens with less toxic materials	• Adequate support • Insurance coverage • Raise awareness

The Haddon Matrix illustrates that a safety issue can be addressed in multiple ways.

2.5.4 Simplification of Messaging

Due to the complexity of behaviour change, an intervention is more likely to be successful if the targeted behaviour for change is a single action rather than a habit.[55] It is more beneficial to provide people with specific, actionable messages than to overload them with multiple messages.[56] A person will be more likely to change their behaviour if they can make a series of small changes.[57] Because of this, education for behaviour change should focus on simple and achievable steps with clear outcomes.[58] People want to know what to do in certain situations, not just to know that some things are risky. [59] As such, it is important, and more effective, to instruct people with pertinent messages detailing specific actions to take and describing how to perform those actions.[60]

[55] Wakefield et al. (2010) p.1268
[56] NZCER (2000)
[57] UK Department of Health (2011)
[58] NZCER (2000)
[59] Ross (2012) p. 22
[60] TNS (2006)

2.5.5 Communication Channels

There are many ways to communicate safety information to the public. Television is a favoured and effective means of communicating safety messages. In the context of online communication, research is consistent in supporting that users prefer entertaining content to instructional/educational content on social media websites.[61] Localised, personally relevant, and funny information is useful to keep the audience interested.[62] Lister et al (2013) found that entertaining videos have greater potential to have a public health impact than educational videos. They propose the Laugh Model in which public health videos are primarily entertaining, with discreet health messages.[63] Through any channel of communication, humour,[64,65] stories, and visualisation of scenarios are effective ways to communicate messages.[66]

2.5.6 Difficulties of Measuring Success in Public Education

Programs and activities conducted by public safety organisations need a specific goal, with appropriate measures of success directly linked to this goal.[67] It is important to invest in research to discover what is occurring and how best to address risks.[68] Unfortunately, it is difficult to evaluate the success of a program because there are a variety of internal and external factors that can affect its success. Programs can have an accumulated effect over time, more than one program may be running at once, and wider social influences may exist. It is not always possible to link changes specifically back to the programs.[69] Appendix E provides a description of public safety campaign evaluation methods.

2.5.7 Risk Reduction Through Harm Avoidance

Public safety organisations handle the reduction of risk differently. One framework of risk reduction is the harm avoidance model. This model focuses on the reduction of risk levels, rather than the reduction of risks themselves. [70]

Malcolm Sparrow summarises why a harm avoidance model is beneficial to public safety organisations:

> Regulatory agencies should not feel obligated to prove causality. They should be content to demonstrate publicly their ability to focus on specific risks, to design and implement creative solutions, and to determine when the risk has abated sufficiently to permit them to move onto other priorities. A substantial collection of problem-solving success stories, accumulated over time, none of them claiming

[61] Lister et al (2013)
[62] Ross (2012) p. 68-73
[63] Lister et. al (2013)
[64] TNS (2006)
[65] Lloyd et. al (2001) p. 3
[66] Lloyd and Roen (2001), p. 3
[67] Martin Jenkins (2012) p. 5
[68] Martin Jenkins (2012) p. 14
[69] Martin Jenkins (2012) p. 7
[70] Martin Jenkins (2012) p. 29

> causality, constitutes a compelling public account of intelligent resource allocation and agency effectiveness.[71]

In the application of the harm avoidance model, emerging risks are identified and interventions are enacted to reduce the level of risk. A successful adoption of this principle requires proactive monitoring of data, allowing the early identification of emerging risks and the application of a successful intervention. [72]

[71] Sparrow (2008)
[72] Martin Jenkins (2012) p. 29

3. Methodology

The goal of this project was to provide MFB with evidence based recommendations to improve future community resilience activities in relation to home fire safety. The project team examined five years of Home Fire Safety Campaigns (HFSCs) from 2009-13, along with residential structure fire incident data from the Metropolitan District of Melbourne during that time. This project provides:

1. A comprehensive profile of Home Fire Safety Campaigns from 2009-13
2. An analysis of Australian Incident Reporting System (AIRS) residential fire incident data for 2008-13
3. A comparison of AIRS data to Home Fire Safety Campaign messages and timing
4. Suggestions with supporting evidence for best practices in future community resilience activities in relation to home fire safety

The project methodology follows the five steps shown in Figure 3. Each of these steps is described in more detail in this chapter.

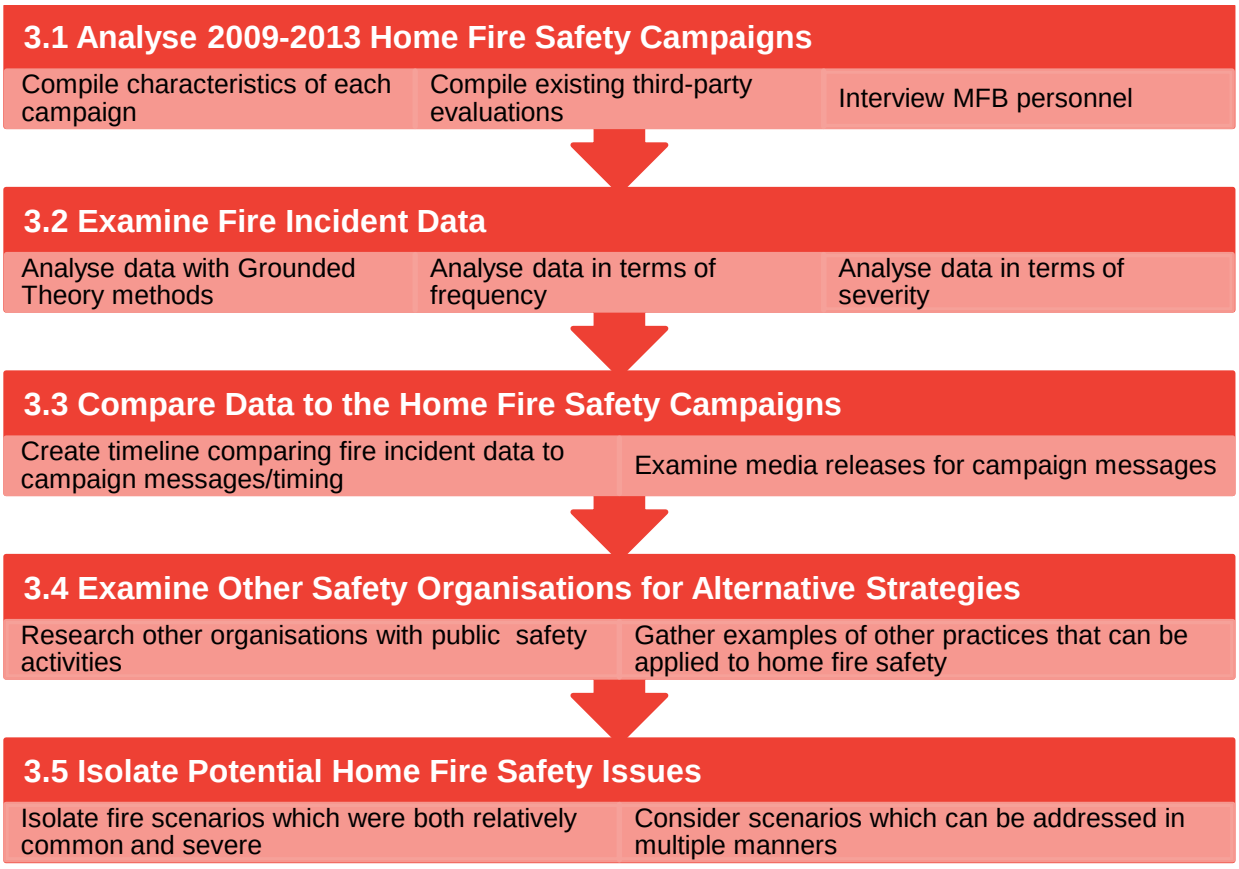

Figure 3 - Methodology Flowchart

3.1 Analysis of Home Fire Safety Campaigns

The project team analysed each of the HFSCs from the past five years to create a frame of reference to compare with residential structure fire incident data. The team conducted interviews with MFB personnel in addition to a review of all documentation to develop a profile of the past five campaigns. The team analysed the eight campaign components described in
Table 2.

Table 2 - HFSC Aspects

Component	Description
Budget	Total amount of money spent on each campaign
Campaign Duration	Start and end dates
Target Demographics	The audience that the campaigns intended to reach
Partnership Organizations	Companies that helped develop and run the campaigns
Themes	Main messages and slogans of each campaign
Advertisement Strategy	Types of media used in campaign material dissemination
MFB Community Level Involvement	Interaction of MFB personnel with community members
Third-Party Evaluations	Campaign evaluations completed by outside agencies

The team examined the financial records of each campaign to answer the following questions:

- How much money was spent on each campaign?
- How was the money distributed between the campaigns' functions?
- What difference exists between the budgets of the five campaigns?

The team documented the duration of the campaigns to understand:

- When the campaigns were run,
- If the campaigns began or ended during a transition period between seasons.

To determine the advertising strategy of the campaigns, the team examined the campaign materials and the media outlets used to broadcast and promote the campaign. The campaign materials included newspaper and radio advertisements, posters, and online advertisements. The team inspected these materials in order to determine:

- What was the primary theme(s) for each campaign?
- What were the major issues targeted?
- What were the key messages?

To fill in gaps in the information available from campaign records, the team conducted semi-structured interviews with MFB personnel. The personnel included the past and current directors of the Home Fire Safety Campaign, Commander Frank Stockton and Commander John Rampling (Manager Public Education), and MFB Community Engagement Strategist, Marc Florio. The list of interview questions is in Appendix F.

The team examined third-party evaluations of the campaigns from 2010 through 2013. The evaluations included data on the "reach" of different types of media. Reach data

provides an estimate of the number and demographics of people who saw advertisements. Independent surveys conducted in 2012 and 2013 provided information about the effectiveness of the campaign messages in changing behaviour.

The team compiled and analysed this data in order to highlight the differences between the campaigns in terms of these variables. This consolidation allowed the team to compare and contrast the different campaigns, as well as to compare the campaigns to fire incident data.

3.2 Examination of Fire Incident Data

Most fire services in Australia use AIRS for recording and reporting information about emergency events. Any incident that MFB turns out to (not just fires, but also other types of incident such as rescue, hazardous material incident, or false alarm) is recorded in the AIRS database. Incident controllers – usually firefighters of station officer or senior station officer rank – use a web interface to complete an incident report that consists of a mixture of mandatory and optional fields. Some information is pre-filled using data generated from another system, FireCom, at the time of the incident. One field in AIRS that is of particular importance to this study is the description field. This free text field gives the incident controller a chance to provide additional details about the incident that could otherwise go unrecorded.

MFB provided the team with an extraction from the AIRS database that comprised all attended residential structure fire incidents (excluding suspicious fires) in the Metropolitan District for the period 2008-13. Appendix G contains a list of the data fields provided.

3.2.1 Time of Year

The team analysed the data based on the time of year in which fires occurred. The dates for Australia's seasons are:

Spring: 1 September – 30 November
Summer: 1 December – 28 February
Autumn: 1 March – 31 May
Winter: 1 June – 31 August

The team used the following process for the analysis:

1. Isolate fires occurring in each month for the six years and calculate monthly totals, yearly totals, average amount of fires per month, and percentage of all fires occurring in each month.
2. Organise fire into seasons and calculate seasonal totals, average number of fires per season, and percentage of all fires occurring in each season using monthly data.

3.2.2 Area of Origin

To compile the various areas within residential structures in which fires originated, the team organized the data into easily understandable groups. There were originally 60 areas of origin represented within the data set. We compiled them into the following groupings that correspond to the areas of a typical residence:

- Kitchen
- Bedroom
- Living Area
- Connecting Areas
- Facilities
- Utility Areas
- Storage Areas
- Garage
- Outside Areas
- Structural Areas
- Other
- Unknown

3.2.3 Grounded Theory Analysis of AIRS Data

Grounded Theory is a model typically used in social research to dynamically identify trends in qualitative data.[73] The team used Grounded Theory to categorise fires by analysing the qualitative data contained within the description section of AIRS. We developed a system for classifying each individual fire further by creating five additional fields for the dataset. Table 3 contains the new fields and a sample of their contents.

Table 3 - AIRS Analysis Categories

Field	Sample Content
Cooking Related	Yes/No
Source of Energy	Gas/Electric/Open Flame/Cigarette/Other/Unknown
Cause	Mechanical Failure/Improper Use/Not Paying Attention/Other/Unknown
Insignificant	Yes/No
Appliance	Various Appliances (e.g. Stove, Fan, etc.)

Significance

In many cases, the incidents recorded in AIRS were insignificant. The team coded an incident as insignificant if a fire did not actually occur (e.g. a smoke alarm operating due to burnt toast) or if there was no substantial response by MFB (e.g. self-extinguished burnt foodstuffs). Any incident where the occupant was not at home or incapable of response (asleep or impaired) was deemed significant regardless of how inconsequential the fire was.

Significance was a useful tool for the team to identify fires that were particularly frequent but not necessarily severe. The team later disregarded the significance field in comparative analysis, replacing it with the more encompassing relative severity measure explained in Section 3.2.5.

[73] Denscombe (2008) p. 88

Cause
The team isolated five major causes as the reason for a fire. These causes are:

- *Cooking:* A fire that occurred during the process of cooking.
- *Mechanical Failure:* A fire that was caused by the failure of an appliance regardless of nature (e.g. electrical or mechanical) as well as failures due to a lack of maintenance and improper installation.
- *Improper Use:* A fire that resulted from the incorrect use of an appliance or object.
- *Not Paying Attention:* A fire that were caused by a lack of attention, primarily a lack of attention to a heat source (e.g. stove, candle, etc.)
- *Other:* Fires that could not be classified into the above groupings, e.g. accidents.
- *Unknown:* Fires that did not have sufficient data available to classify.

The team then further analysed kitchen fires by using the incident description field to attempt to classify the human behaviours associated with kitchen fires in the not paying attention category. We created four subsections of this cause:

- *Unattended*: A fire that began while someone was distracted but at home.
- *Left House*: A fire that began after people left their home.
- *Falling Asleep*: A fire that began after people went to sleep for the night or dozed off inadvertently.
- *Impaired*: A fire that began following people not paying attention due to a physical, mental, or other impairment such as drugs or alcohol.

Source of Energy
The team classified six primary sources of energy. These sources are:

- Electric
- Gas
- Open Flame
- Cigarette
- Other
- Unknown

Appliance
Forty-one separate appliances were isolated in the analysis of the data. The ten most common appliances are:

- Stove
- Cigarette
- Heater
- Oven
- Electric Infrastructure
- Light
- Toaster
- Microwave
- Candle
- Fan

The team defined electric infrastructure as anything that brought power to another appliance (wiring, powerpoints, powerboards, etc.) The full list of 41 appliances is located in Appendix H.

3.2.4 Casualties from Residential Structure Fires

Fires have the potential to be a threat to human life. Preventing fires from claiming casualties is a vital aspect of building a safer and more resilient community.

Fatalities

MFB's Fire Investigation Unit provided the team with data about all fatalities within the Metropolitan District from 2008-13. The team excluded fatalities that were a result of homicide or suicide from the data set to isolate preventable residential fire fatalities. The team then grouped fatal fires by cause. A note was made if the victim was either aged 65+ or under the influence of alcohol or other drugs.

Injuries

The team used AIRS data to obtain injury statistics for all residential structure fires. We organised the fires by the number of injuries they caused. In addition to AIRS data, MFB also collects data from the Victorian Injury Surveillance Unit (VISU). A sample of VISU data from 2011 contains 184 hospital admissions and 170 hospital presentations for fire related injuries in the Metropolitan District. Of both admissions and presentations, adults aged 20-39 years comprised the majority. Unintentional actions caused 85 per cent of all admissions and 88 per cent of all presentations.[74] Due to the general nature of the VISU injury data, the team could not link individual injuries to AIRS incident data.

3.2.5 Severity

The team attempted to develop a measure of the severity and rate of recurrence of fires, so that different types of fires could be analysed in terms of both their frequency and severity. The team found that the *estimated dollar loss*, *extent of flame damage*, and *alarm level* fields from AIRS approximated the top 5, 10, and 20 per cent of fires in terms of severity. The team also explored the option of including injury and fatality data as severity measures, but these were disregarded due to the small sample size of these fields.

The team examined data from the three fields alongside one another in order to establish a basis with which to classify an individual fire as severe. The criteria were also compared against one another to confirm that they were internally consistent; this comparison is located in Appendix I.

Estimated Dollar Loss

The team used the AIRS field *Estimated Dollar Loss* to obtain cost statistics on the fires. The estimated dollar loss is a value determined on scene at the time of the incident by the incident controller. This value, while an estimate, provides an indication of the destructiveness of the fire. The team separated fires into dollar loss brackets to establish levels of severity in terms of dollar loss. The brackets and the number of fires contained in each bracket for the entire time period are located in Table 4.

[74] Victorian Injury Surveillance Unit (2013)

Table 4 - Estimated Dollar Loss Distribution

Est. Dollar Loss	# of Fires	% of Fires	Est. Dollar Loss	# of Fires	% of Fires
<$100	3443	34.0%	$50k-100k	241	2.4%
$100-1k	2527	25.0%	$100k-250k	259	2.6%
$1k-$5k	2125	21.0%	$250k-500k	135	1.3%
$5k-$10k	545	5.4%	$500k-1m	50	0.5%
$10k-50k	779	7.7%	$1m+	8	0.1%
Severe Total	**# of Fires:**	**2017**	**% of Fires:**	**19.9%**	

Fires above $5,000 in damage comprise 19.9 per cent (2017) of fires.

Extent of Flame Damage

The team used the AIRS field *Extent of Flame Damage* to obtain statistics on the containment of fires. Extent of flame damage is an important measure of success of firefighting operations. MFB aims to contain 90 per cent of all fires to the room of origin, and MFB reports this key performance indicator to government annually. We used fires that spread past their room of origin as a second measure to determine fire severity. The AIRS categories for extent of flame damage and the numbers of fires within each category are located in Table 5.

Table 5 - Extent of Flame Damage Distribution

Extent of Flame Damage	# of Fires	% of Fires
No damage of this type.	910	9.0%
Confined to the object of origin.	5705	56.4%
Confined to part of room or area of origin.	1904	18.8%
Confined to room of origin	658	6.5%
Confined to floor of origin.	193	1.9%
Confined to structure of origin.	510	5.0%
Extended beyond structure of origin.	111	1.1%
Unclassified	121	1.2%
Severe Total	**814**	**8.0%**

Fires extending beyond the room of origin comprised the worst eight per cent (814) of fires.

Alarm Level

The team used the AIRS field *Alarm Level* to determine MFB's weight of response to residential fires. When MFB receives a call, the incident is automatically classified as a first alarm fire. The on-scene incident controller determines if the personnel and equipment dispatched at alarm level one can suppress the fire. Should the incident controller require additional resources to suppress the fire, either individual resources can be requested, or the alarm level can be raised, triggering the dispatch of an

additional suite of fire appliances and other resources to the incident. The number of fires reaching each alarm level during the period of the study are located in Table 6.

Table 6 - Alarm Level Distribution

Alarm Level	# of Fires	% of Fires
1	9444	93.39%
2	647	6.40%
3	20	0.20%
4	1	0.01%
Severe Total	**668**	**6.6%**

Fires that generated a response at a second alarm level or above comprised the worst 6.6 per cent (668) of fires.

3.2.6 Establishment of Relative Severity

To compare the severity of various types of fires, the team established a value of relative severity. The team developed the following formulas to calculate relative severity.

$$Severe\ Percentage = \frac{\#\ of\ Severe\ Fires\ in\ Type}{Total\ Severe\ Fires}$$

$$Total\ Percentage = \frac{\#\ of\ Fires\ in\ Type}{Total\ Fires}$$

The team then calculated the ratio between the severe percentages and the total percentages. The team called this ratio the relative severity. A relative severity of one indicated that the distribution of a specific type of fire, matches the distribution of all fires. This established a baseline of severity that the team then used to determine whether subsets of the data were more or less severe than average. A relative severity value above one indicated a type of fire where incidents are, on average, more severe. A relative severity value below one indicated a type of fire where incidents are, on average, less severe.

The team used the relative severity measure to compare the following subsets of fires in the dataset:

- Season
- Area of Origin
- Cause
- Source of Energy
- Appliance (or Object)
- Time of Day
- Presence of a Working Smoke Alarm

3.3 Comparing Data to the Home Fire Safety Campaigns

The team made a comparison between AIRS data and MFB media releases and the 2009-2013 Home Fire Safety Campaigns. The team completed two main goals in order to accomplish this task: a graphed timeline of different types of fires and their incident trends while the campaigns were running, and an analysis of MFB media releases.

3.3.1 Creation of Timeline to Compare Messaging of HFSC

The team created a series of timelines to display incident data with respect to the timing of the various campaigns. We then compared incident rates for 2009-13 to campaign messages to see if certain incidents were more or less common at specific times of the year. We graphed residential structure fires, unattended cooking fires, smoking in bed fires, and heater fires on a timeline from 2009 to 2013. We highlighted the number of incidents occurring during each of the campaigns in order to isolate any trends and discover if fire incidents decreased in the presence of the HFSC.

3.3.2 Analysis of Media Release Messaging

The team examined media releases generated by MFB during 2013. The goal of this analysis was to estimate the amount of media releases relating to residential structure fires that included one or more home fire safety messages. The team noted if releases in the sample period (2013) contained a prevention message, a preparedness message, or a smoke alarm message. The team defined a prevention message as a specific action that could be taken to prevent a fire. A preparedness message was one that specifically stated what someone could do to be prepared for a fire. A smoke alarm message was one that contained a statement about the need for a working smoke alarm, not just if a smoke alarm was present during a fire.

The team did not analyse whether subsequent media coverage included home fire safety prevention or preparedness messaging. This is a potential area for future research.

3.4 Examination of Other Safety Organisations

In order to gain a better understanding of community resilience and risk communication strategies, the team examined the activities of other organisations with public safety initiatives. We conducted research into various campaigns and other activities to find out what had been successful for other organisations. Based on our literature review, which had provided us with several approaches to risk communication, we sought out specific activities and campaigns that had used these approaches effectively.

3.5 Isolation of Potential Home Fire Safety Issues

Using the evidence generated through analysis of the AIRS data, the team isolated three specific fire scenarios. The goal in isolating these scenarios was to find specific situations that the evidence suggested might be a useful area for MFB to focus on in the future. The team considered three criteria to select the fire scenarios: frequency, severity, and potential for targeting.

First, the team isolated the types of fires that occurred most often AND were relatively severe (i.e. a relative severity above one). These results are presented in Chapter 4.

Next, the team considered the potential for the type of fire to be targeted by a community resilience activity. In this consideration, the team isolated scenarios that could be addressed in multiple ways, and not just through an advertising campaign akin to the HFSC.

3.6 Limitations of this Study

Some limitations exist with the findings of this study. Primarily, these limitations arise from the data. First, due to the scope of this project, the study only considered data from the Metropolitan District. No CFA fire data was analysed even though the HFSC is run in partnership with CFA. Additionally, no demographic information is available in AIRS, so no analysis of high-risk groups or emerging risks related to demographics are presented in this study. Finally, inconsistency and inaccuracy are present in AIRS. Data can be recorded incorrectly, or a more general field can be chosen when a more specific field is available. Because this study focused heavily on the qualitative data within the description field, the accuracy of the data is limited to the amount of detail provided.

3.7 Conclusion

In order to gain further knowledge about the Home Fire Safety Campaigns, the team analysed each of the campaigns from 2009-13. Then the team investigated all preventable residential structure fires in AIRS from 2008-13. We then mapped the fire incident data to common HFSC messaging. The team also analysed media releases from MFB to see if they could be further used to promote home fire safety. The group researched other public safety organisations to find commonalities between successful campaigns. Lastly, the team isolated potential home fire safety issues that MFB could focus future community resilience activities on.

4. Results and Analysis

This section describes the six primary findings of this research project.

- Finding 1: The 2009-2013 Home Fire Safety Campaigns targeted three primary home fire safety issues.
- Finding 2: There is no evidence that the HFSC had an effect.
- Finding 3: Residential structure fires originate from a variety of scenarios that vary broadly between frequency and severity.
- Finding 4: The evidence suggests three types of fires that MFB could consider as future targets for home fires safety activities.
- Finding 5: A holistic approach and partnerships were two common features of effective public safety activities.
- Finding 6: Effective campaigns tailor messaging based on the desired outcome and intended audience.

4.1 The 2009-2013 Home Fire Safety Campaigns

Finding 1: The 2009-2013 Home Fire Safety Campaigns targeted three primary home fire safety issues.

The team conducted an analysis of the five years of HFS campaigns to determine some basic characteristics of the campaigns. A summary of this analysis is located in Appendix J.

All HFSCs ran during the winter months, with campaigns lasting 92 days on average. The campaigns' start and end dates coincided with the beginning and end of winter respectively.

Over the five-year period, the budget for each campaign averaged $221,636. The majority of every campaign's budget (75 per cent on average) was spent on media buy through Master Agency Media Service (MAMS). The components of each year's media buy included print media (newspaper and magazine), radio advertisements, outdoor advertisements, and digital media. As required by the Victorian Government, at least 10 per cent of the budget (usually more) was spent on Culturally and Linguistically Diverse (CALD) advertising.

Additionally, MFB spent about $10,000 per year on external evaluations, apart from 2009 when no evaluation was completed. The evaluations attempted to provide MFB with information about the success of the campaigns in terms of reach and behaviour change. The evaluations of behaviour change will be discussed in Section 4.2. Table 7 provides a summary of the evaluation of marketing reach for 2013. Each type of media reached approximately 50-60 per cent of their potential audience. Potential audience is the number of people each media type is theoretically capable of reaching. Print media offered the most cost effective option, reaching about 48 people per dollar spent.

Table 7 - Marketing Reach of 2013 HFSC

Media Type	# of People Reached (18+)	% of Potential People Reached (18+)	Amount of Money Spent	People (18+) Reached per Dollar
Print	2,041,000	61.8%	$42,189	48
Outdoor	N/A	64.6%	$36,540	N/A
Radio	1,723,000	47.7%	$66,668	25

The HFSC targeted demographics that MFB considered vulnerable or at risk. The HFSCs from 2009-13 primarily targeted families and older people. Beginning in 2012, the campaigns also began focusing on those who cook, those aged 65 years or older, and males aged 18-34.

Every HFSC is run in partnership with CFA. In 2009, 2010, and 2011, the campaign also partnered with Energy Safe Victoria (ESV). ESV is the safety regulator responsible for electrical and gas safety in Victoria. ESV funded television advertisements to promote safe cooking practices and safe use of electric blankets. In 2010 and 2011, the HFSC partnered with Archicentre, the building advisory service for the Australian Institute of Architects (AIA). Archicentre works with the building industry and with community in building design, advice and home inspections including pre purchase residential inspections and as part of a Victorian State Government free home safety inspection service for older people and people with disability.

The overall goal of the HFSC throughout the period from 2009-13 was to raise the Victorian community's awareness of home fire safety issues during the winter months. **The 2009-13 HFSCs all focused on the dangers of unattended cooking and heater fires.** Figure 4 shows a 2010 campaign advertisement warning Victorians of the danger of unattended cooking. Additional campaign materials for all five years are located in Appendix K.

Figure 4 - A 2010 HFSC Advertisement in the Herald Sun Newspaper

Beginning in 2012, the HFSC shifted its theme to one of personal responsibility. The campaigns began targeting risky behaviour with call to action messages based around personal responsibility. **One of the primary risky behaviours advertised was**

smoking in bed. Figure 5 shows a 2013 campaign poster advertising the dangers of smoking in bed.

Figure 5 - A 2013 HFSC Advertisement

4.2 Effect of the 2009-2013 Home Fire Safety Campaigns

Finding 2: There is no evidence that the HFSC had an effect.

The team analysed campaign evaluations and AIRS data from 2009-13, attempted to determine if there were any trends in the AIRS data that could potentially show the impact of advertised HFSC messages such as unattended cooking, smoking in bed, and heater fires.

4.2.1 Campaign Evaluations

In 2010 and 2011, Enhance Research evaluated the HFSC. These evaluations show that a significant portion of survey respondents took actions to keep their home safe from fire. For example, about half of respondents tested their smoke alarms and took extra care to minimise distractions. However, these evaluations did not attempt to isolate whether respondents took these actions specifically because of the campaign.

In 2012 and 2013, another media company, Wallis, attempted to measure behaviour change resulting from the campaign. These evaluations showed that very few survey respondents had taken any action to increase their home fire safety after seeing a HFSC advertisement. **Only about four per cent of survey respondents (n=508) undertook a home fire safety activity because they saw a HFSC advertisement.** Appendix J contains a summary of the results from the four years of evaluation.

4.2.2 Winter as a Campaign Time Period

On average the winter months of June, July, and August accounted for 26 per cent (2667) of all fires for the years of 2008 to 2013. The even distribution of fires by month and season is shown in Figure 6.

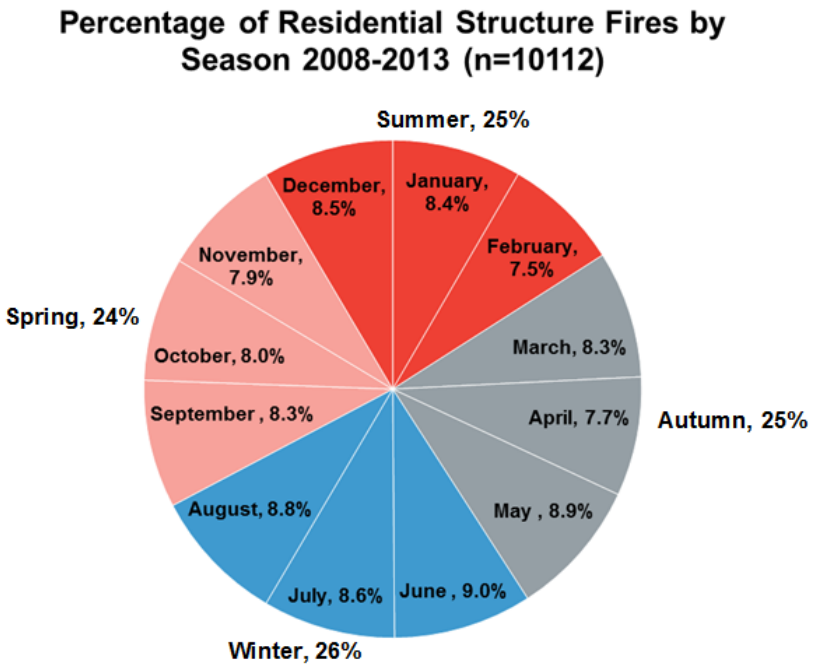

Figure 6 - Percentage of Residential Structure Fires by Season 2008-2013

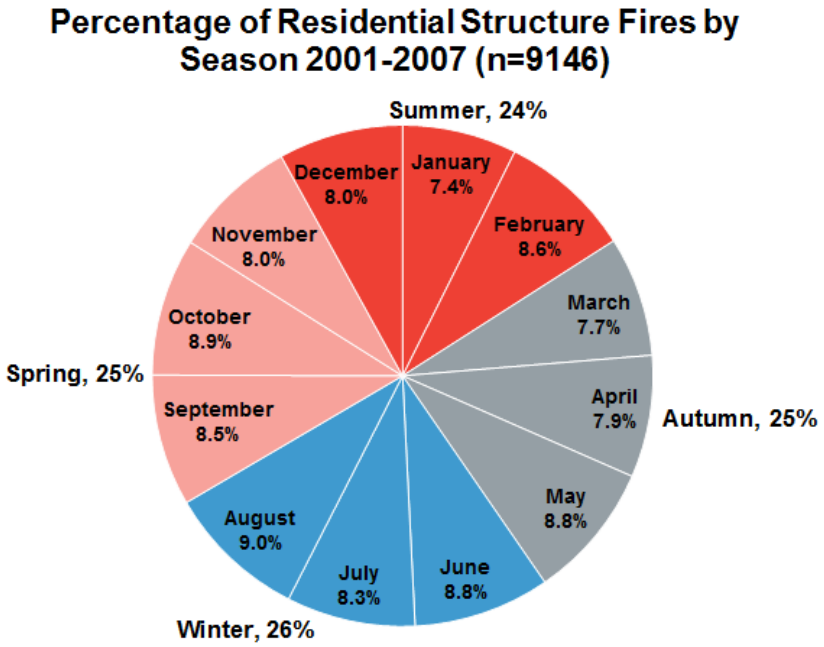

Figure 7 - Percentage of Residential Structure Fires by Season 2001-2007

To attempt to determine if this distribution was due to the impact of the HFSCs, the team obtained additional AIRS data for residential structure fires from 2001-2007. The even distribution of these years is in Figure 8 shows that the number of winter fires did not decline in the past thirteen years. **From this data, it is not possible to state that the HFSCs from 2009 to 2013 had an impact on residential fires during winter.**

However, although the overall number of fires has trended slightly upwards, this has occurred in the context of a rapidly rising population.

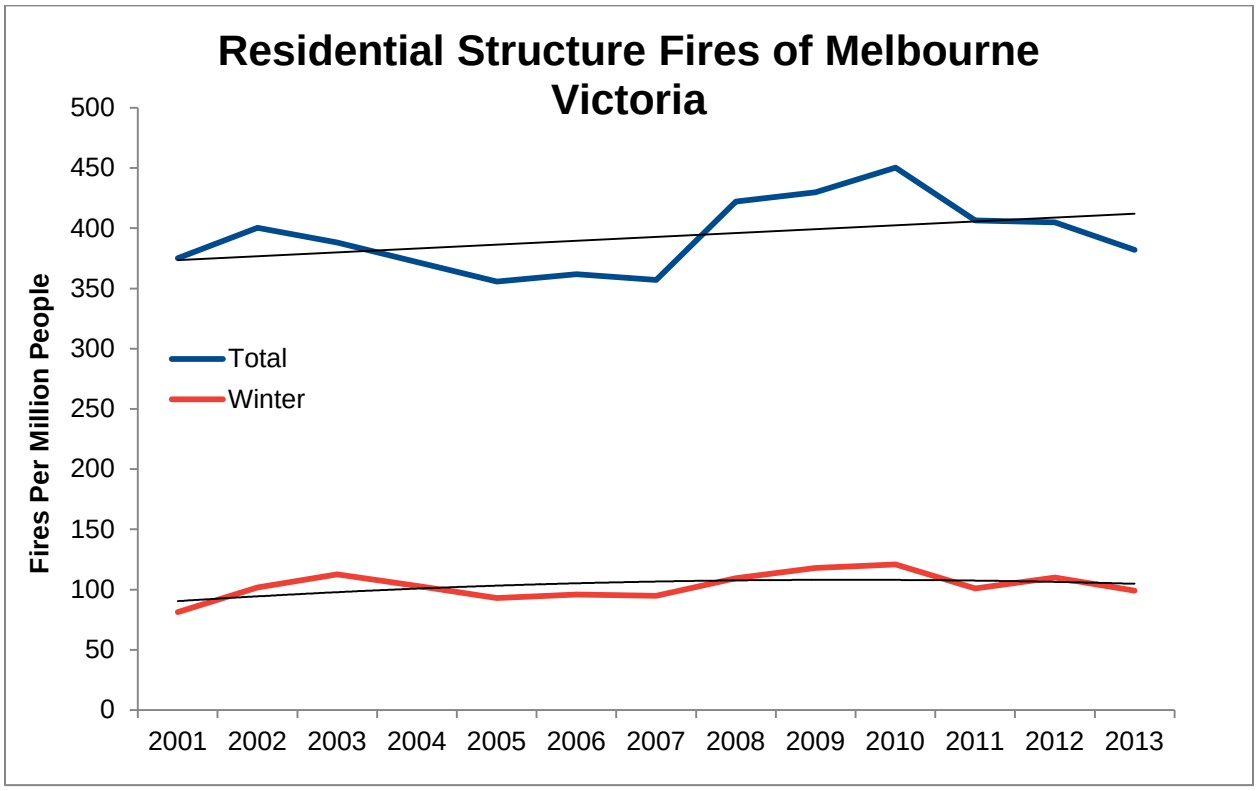

Figure 8 - Residential Structure Fires of Winter 2001-2013

The team calculated the statistical significance of the difference in the number of fires from season to season and found that the difference between seasons was statistically insignificant. The probability of the variation being statistically insignificant was greater than 99 per cent. This calculation is in Appendix L.

The team also examined the severity of winter fires and found that on average, winter accounted for 24.7 per cent of severe fires across the three indicators of severity. Additionally, when analysed with regards to relative severity, each season has a value at or near one. **This indicates that the distribution of severe fires is not dependent upon the season.**

Between 2008 and 2013, residential structure fires caused an estimated $164,981,374 in damage with an average dollar loss per incident of $16,315. **Fires occurring in the winter months accounted for 24 per cent of total dollar loss figures**, with an average dollar loss per incident of $14,516. The lower average dollar loss per incident of winter is shown in Figure 9.

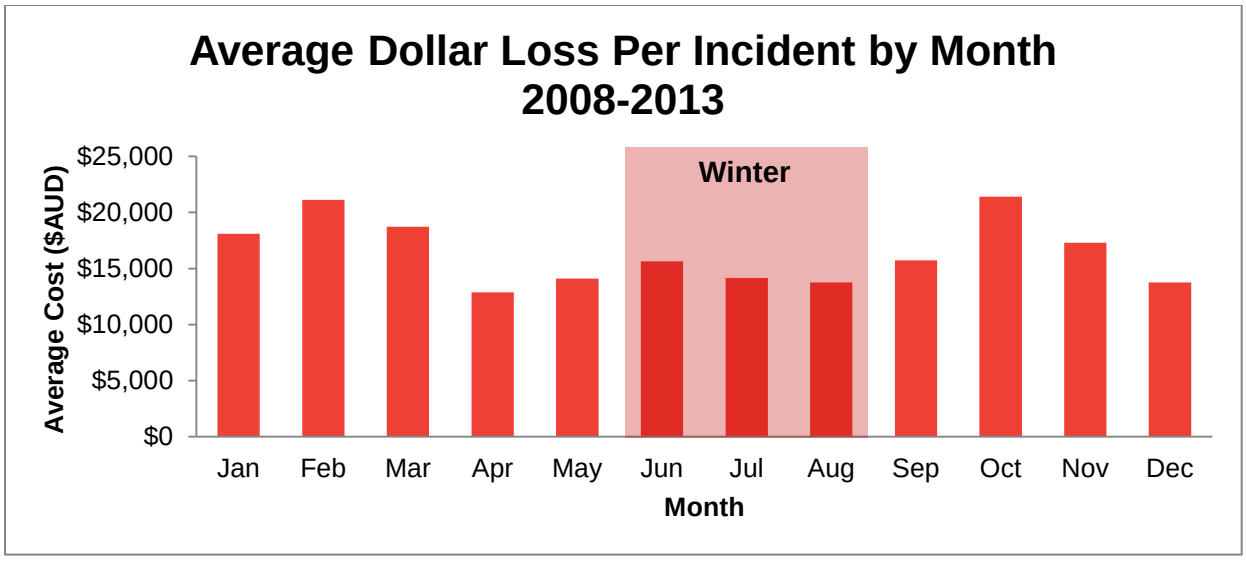

Figure 9 - Average Dollar Loss per Incident by Month from 2008-2013

In total, **winter had the highest percentage of fires confined to their room of origin** (92.7 per cent), as well as the **fewest fires extending beyond their structure of origin** (12). **Fires occurring in the winter comprised 26 per cent (2499) of all first alarm fires**. In terms of casualties, winter comprised 27 per cent (94) of injuries and 24 per cent (8) of fatalities.

4.2.3 Kitchen and Unattended Cooking Fires

A primary focus of all the HFSCs since 2009 has been unattended cooking fires. As such, the team graphed unattended cooking fires on a timeline along with all residential structure fires from 2009 to 2013. Figure 10 shows that variations exist in both unattended cooking fires and all residential structure fires for the five-year period.

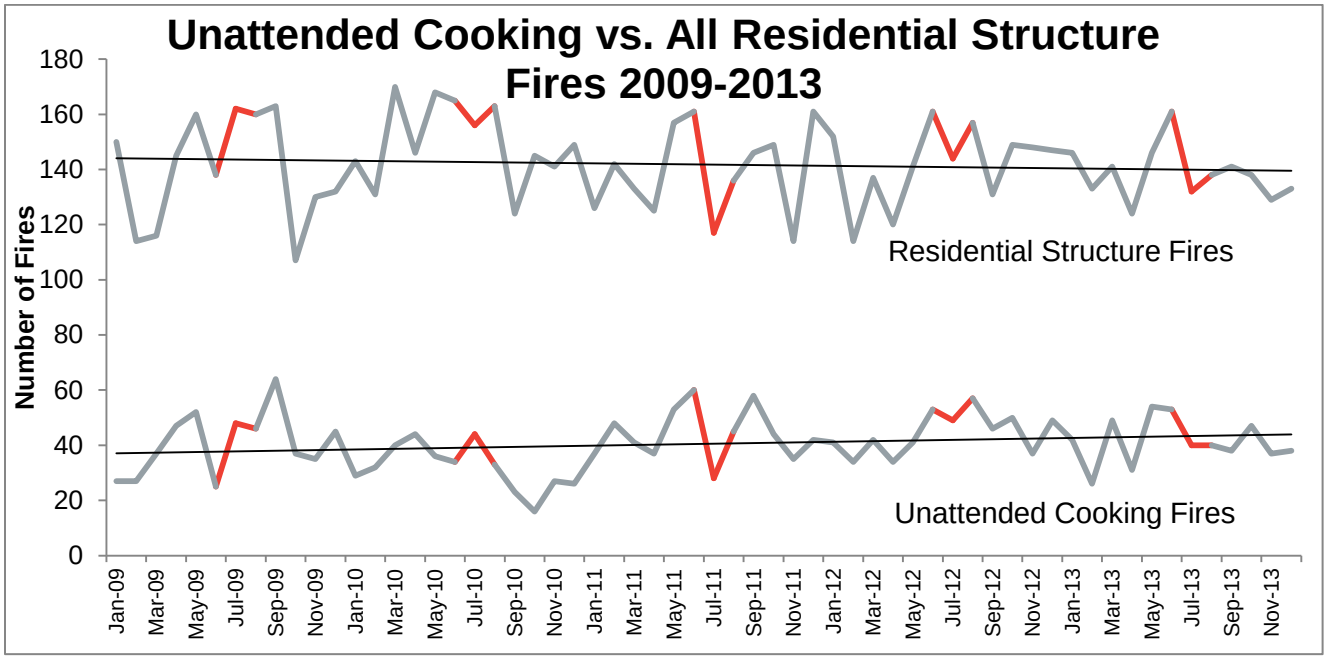

Figure 10 - Unattended Cooking vs. All Residential Structure Fires 2009-2013

In Figure 10, the red portions of the lines represent the HFSC periods while the grey portions represent the time when the campaign was not running. The lower line represents all of the unattended cooking fires with respect to each month from 2009-2013. Unattended cooking fires included those caused by people who left the kitchen for just a minute, people who became distracted, and even people who left the house.

Throughout all months, including the months of the campaigns, there is no clear trend. The two black lines are trend lines of their respective line graphs, each with very small slopes indicating little to no trend. This figure illustrates that the team found **no evidence that the campaigns had an impact on unattended cooking fires.**

4.2.4 Heater Fires

Figure 11 shows that heater fires exhibited an obvious trend in relation to month of occurrence. Similar to Figure 10, the red portions of the line indicate the times when the HFSC was running. The team also investigated heater fires to determine if any particular cause occurred more often during any specific month(s). The team hypothesised that fires resulting from mechanical failure of heaters would occur more frequently in the months before winter as heaters are beginning to be used for the first time in months. The team found that the only two causes that exhibited any trend, not paying attention and improper use of heaters, followed the same trend as heater fires overall.

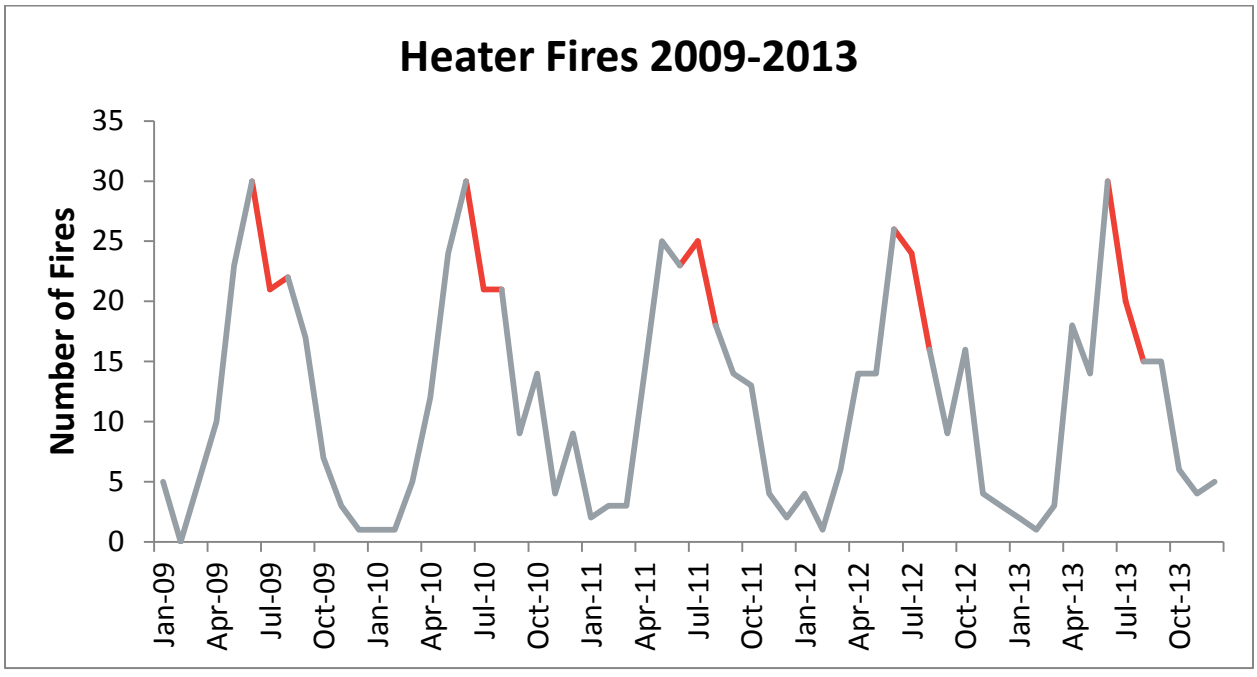

Figure 11 - Heater Fires 2009-2013

Overall, the trends evident in Figure 11 suggest that the **HFSCs have focused on heater fires when they are already occurring, rather than advertising earlier when heater fires are beginning to increase in frequency.**

4.2.5 Smoking in Bed

One of the main messages of the 2012 and 2013 HFSCs was the danger of smoking in bed. The team produced a timeline of all residential structure fires caused by smoking in the bedroom (as a proxy for smoking in bed) from 2008-13. The team found no trend in smoking in bed in terms of time of the year. This is likely to be due to the small sample size of smoking in bed incidents. The team was aware that smoking in bed was likely to be a focus of the HFSCs due to the relatively high incidents of fatalities from smoking (about 40 per cent of all deaths). We were **unable to find any evidence in the AIRS data to determine if the campaign had an impact on the number of fires resulting from smoking in bed**.

4.3 Definition of the Home Fire Safety Problem

Finding 3: Residential structure fires originate from a variety of scenarios that vary broadly between frequency and severity.

The team analysed the frequency and severity of fires in terms of area of origin, cause, source of energy, appliance, time of day, and presence of a working smoke alarm. A full list of these results is in Appendix H. We found that there are a multitude of ways a fire can start in the home. **There are very few types of fires that are both frequent and severe, and therefore these would provide an obvious target for interventions to improve safety outcomes.**

4.3.1 Area of Origin

Fires are common in the kitchen, structural areas, living areas and the bedroom. Kitchen fires accounted for 50 per cent (5026) of fires, structural areas accounted for 11 per cent (1151), and living areas and bedrooms both accounted for eight per cent (820 and 846 respectively). The other eight areas accounted for the remaining 23 per cent (2269) of fires.

Although kitchen fires were the most common, they were also the second least severe area of origin (the least severe was utility areas). Of the top five most common fires, those in the structural areas, living areas, and bedrooms all had relative severities above one, indicating a severity above average. **Garage fires were found to be the most severe fires, however they were one of the least common**. Fires in the other and unknown categories were among the highest in terms of relative severity, however neither is suitable as a potential target for intervention due to the varied or unknown nature of these incidents. Refer to Figure 12 for information on the relative severity and occurrence of all ten areas of origin.

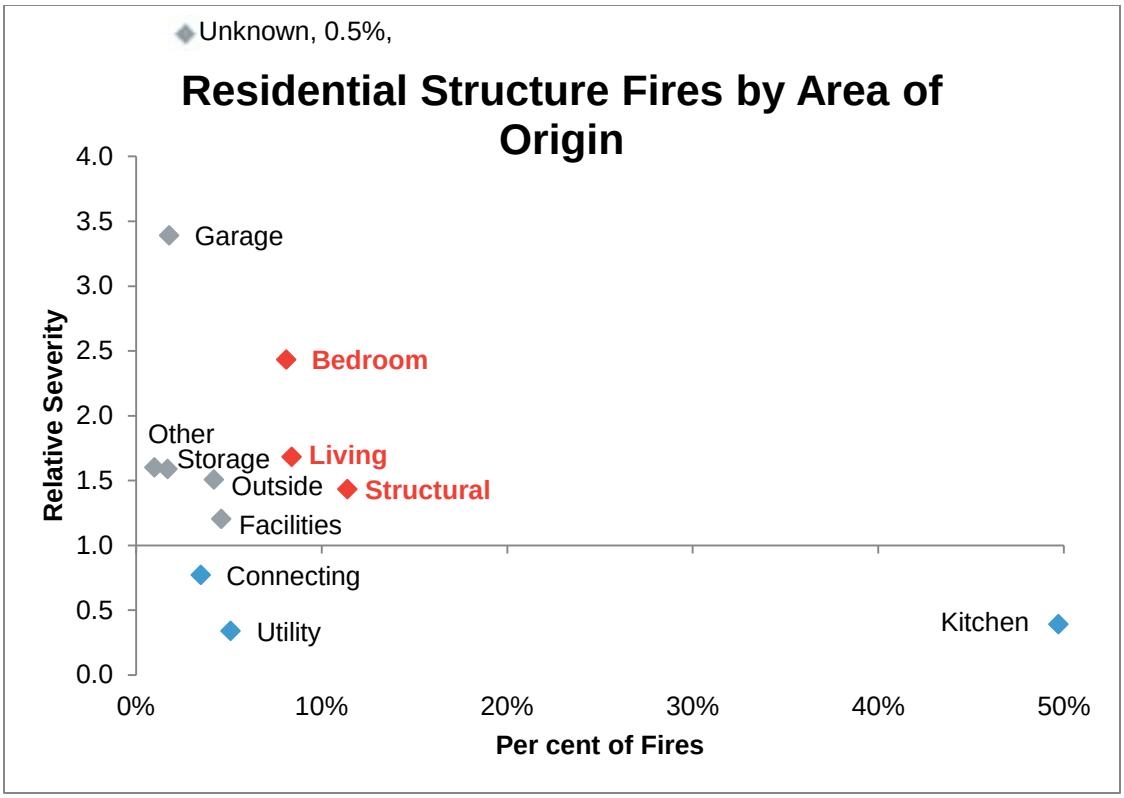

Figure 12 - Severity of Residential Structure Fires by Area of Origin

4.3.2 Cause

Cooking related fires, regardless of the action that caused them, accounted for 36 per cent (3654) of fires. However, **cooking related fires also had the lowest relative severity of any cause**, and comprised twelve per cent (4) of deaths. In the kitchen, unattended cooking fires, those which could be (and have been) advertised and easily prevented accounted for 23 per cent (2267) of fires. **Fires caused by a person not paying attention (excluding cooking) were the most severe fires, but comprised only 4.2 per cent (423) of all fires**. Mechanical failure fires comprised 36 per cent (3654) of fires and we found them to be average in severity. Improper use fires accounted for 12 per cent (1232) of fires and were more severe than mechanical failure fires. Fires in the other and unknown cause groupings were again among the most severe but are not a suitable target for potential intervention.

4.3.3 Source of Energy

The most common source of energy associated with fires was electricity, comprising 52.2 per cent (5282) of fires in the dataset, followed by gas accounting for 23.9 per cent (2413) of fires. Both of these sources of energy produced fires with a relative severity of less than one, indicating that on average these fires were less severe. However, electric appliances caused at least nine deaths (27 per cent). Fires caused by an open flame produced the highest relative severity, but only accounted for 5.6 per cent (563) of fires. Figure 13 shows that **the fires that are more severe, also happen to be the fires that are less common**. Fires in the other and unknown category were among the most

severe, but again are not a suitable intervention target due to the lack of information about these types of fire.

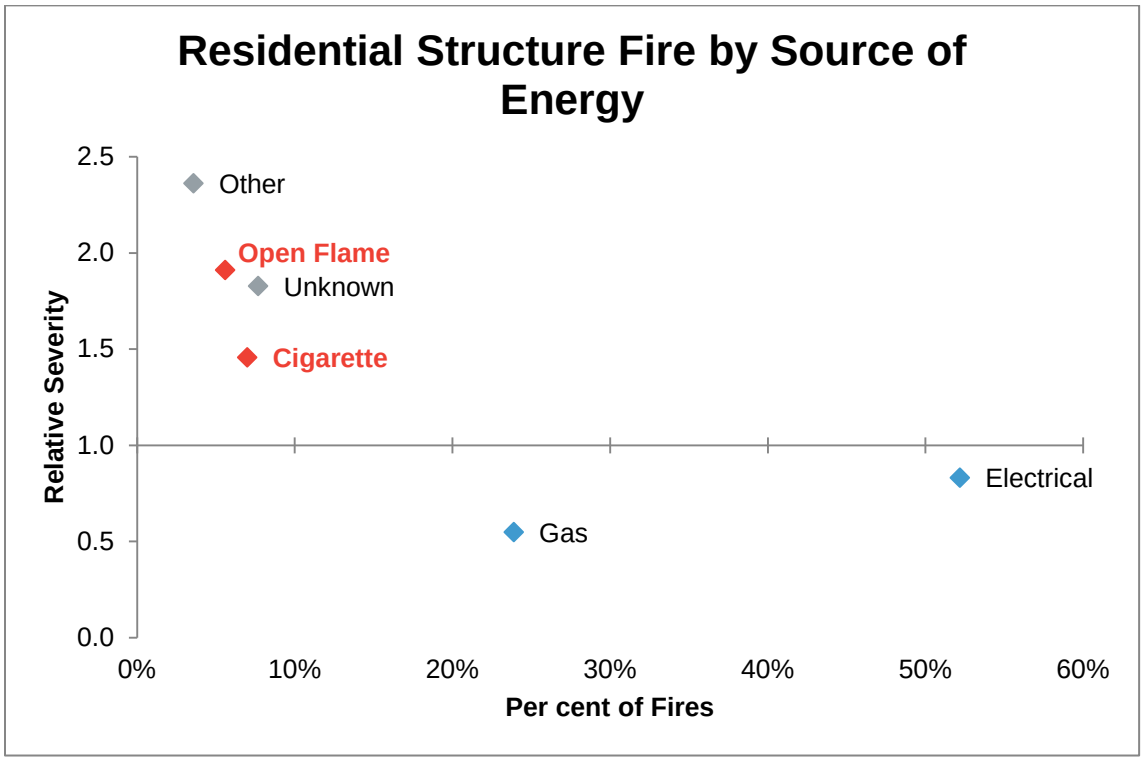

Figure 13 - Severity of Residential Structure Fires by Source of Energy

4.3.4 Appliances

The team's data analysis found there were a large number of appliances that started or were involved in fires. However, **out of 41 different appliances categorised, there were five that were individually responsible for more than five per cent of fires**, with stove being the largest.

Figure 14 shows the top ten appliances that caused or were involved in a fire. **Only three appliances in the top ten have a relative severity above one, indicating a type of fire that is more likely to be severe**. Stoves were the most common appliance comprising 27 per cent (2769) of all fires. Of the top ten, the four appliances typically found exclusively in the kitchen (stove, oven, toaster, microwave) have the lowest relative severity figures. We found that cigarettes were relatively severe and accounted for 7 per cent (714) of fires. Smoking was also the cause of 39 per cent (14) of fires resulting in fatalities. Candle fires were high in severity, but accounted for only two per cent (224) of fires. Electrical infrastructure fires accounted for 8.9 per cent (897) of fires and were relatively severe. Heaters comprised 6.8 per cent (687) of fires and had a relative severity below one. However, heater fires did account for five deaths (15 per cent). Fires in the unknown category were the most severe, while fires in the "other" category were more severe than all but cigarette, candle, and unknown fires.

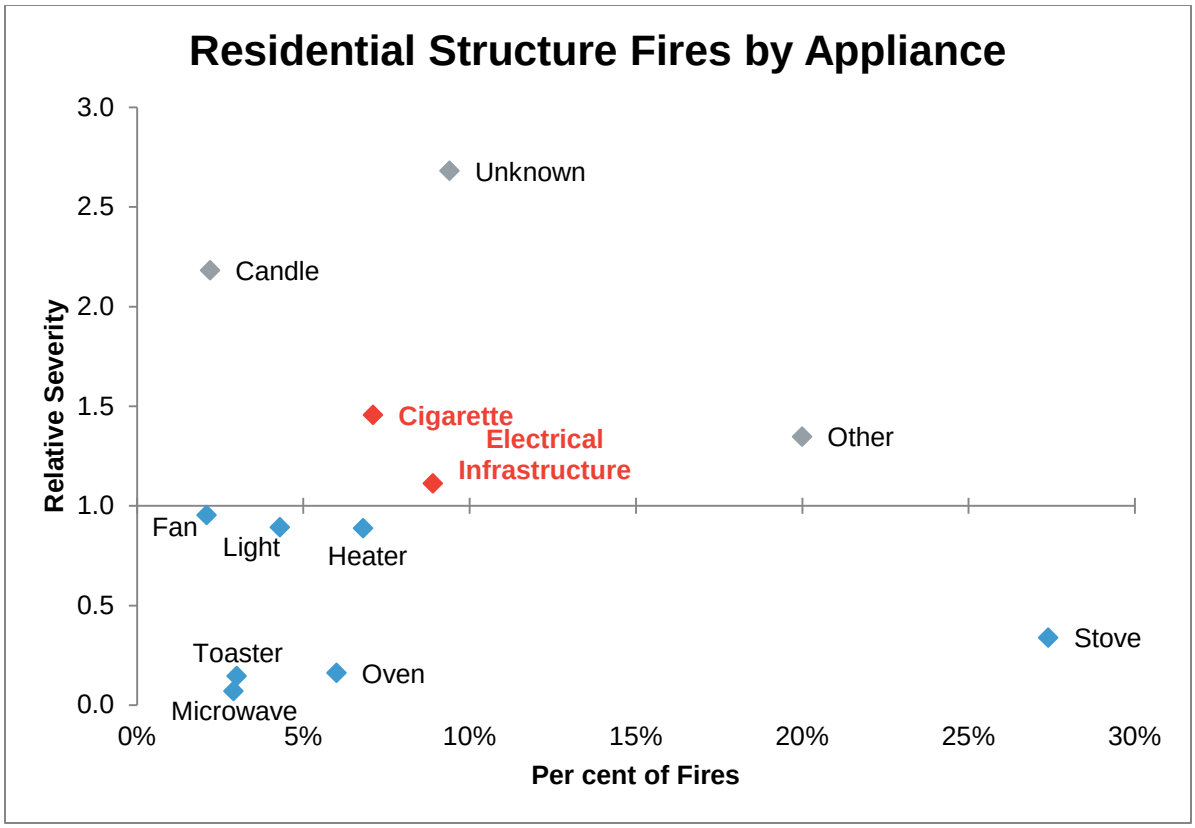

Figure 14 - Residential Structure Fires by Appliance

4.3.5 Time of Day

The distribution of fires, both in terms of frequency and severity, is not uniform across all twenty-four hours of the day. Of the three periods that the team split the 24 hours of a day into, night-time was the only period which had a relative severity above one, indicating that **fires are more severe when they occur between the hours of 23:00 and 7:00 and comprised 42 per cent (14) of all deaths.** However, fires at night also encompassed only 16.1 per cent (1630) of fires. Fires during the evening (15:00-23:00) encompassed 50.4 per cent (5100) of all fires but were found to have the lowest relative severity.

4.3.6 Presence of a Working Smoke Alarm

When the presence of a working smoke alarm is considered, fires where a smoke alarm was not present or failed to operate had the highest relative severity, indicating that **fires tend to be the most severe when smoke alarms fail or are not present**. Additionally, the injury rate (injuries per 100 fires) increased by nearly 66 per cent (4.9 vs. 3) when a smoke alarm was not present or failed to operate. The fatality rate (fatalities per 1000 fires) also increased by nearly five times when a smoke alarm was not present or failed to operate (7.3 vs. 1.5).

4.4 Three Prominent Home Fire Safety Issues

Finding 4: The evidence suggests three types of fires that MFB could consider as future targets for home fires safety activities.

Using the criteria from Section 3.6, the team identified three HFS issues that had a balance between severity and frequency.

4.4.1 Smoking Related Fires

Fires caused by a cigarette comprised seven per cent (714) of all fires. Cigarette fires also had a high relative severity, indicating a severity well above average. In addition, fires involving cigarettes were the most common cause of fatalities, accounting for 13 deaths (39 per cent). Smoking also features prominently in a variety of areas of origin. Cigarette fires comprised ten per cent (77) of living area and 18 per cent (135) of bedroom fires. Cigarettes pose a high threat due to their capability to bring a source of heat in contact with a variety of flammable materials. Additionally, reckless disposal of cigarettes can often cause ignition. An example of this happened in 2012 when a discarded cigarette caused the ignition of tan bark, which quickly spread to the structure of a house. The fire resulted in approximately $110,000 of damage, spread throughout the structure of origin and required a second alarm response from MFB.

4.4.2 Electrical Fires

As a source of energy, electricity featured in 52 per cent (5,282) of all fires. Because of the vast array of appliances that are powered by electricity in the home, the team looked closely at fires involving the electrical infrastructure in the home. Fires originating from electric infrastructure accounted for nine per cent (897) of fires, while also having a moderately high relative severity. Fires originating in electrical infrastructure are typically hidden and therefore are more likely to be severe because the fire can spread unnoticed for an extended amount of time. An example of this occurred in 2011, when an electrical fault in the roof space of a home cause a fire, which quickly began to spread. By the time the fire was under control it had caused an estimated $280,000 in damage, spread throughout the entire roof space, and required a second alarm response from MFB.

4.4.3 Working Smoke Alarms

The presence of a working smoke alarm reduces the risks associated with residential structure fires. Fires where a smoke alarm either failed to operate or was not present had a relative severity well above one, while fires in which a smoke alarm was present had a relative severity well below one. The injury rate increases by 66 per cent when a smoke alarm was not present or failed to operate. Additionally, smoke alarms were not present in 42 per cent (14) of fatalities. Smoke alarms are integral to home fire safety in their ability to alert an occupant to the presence of a fire. Residents are highly vulnerable to a fire when sleeping when there is no functional smoke alarm. This is supported by our finding that fires occurring between the hours of 23:00 and 7:00 had the highest relative severity in terms of time of day. An example of this type of incident occurred in 2008, when just before 1AM a fire started in the bedroom of an unregistered

boarding house with no smoke alarms. Three people were able to evacuate in time but three people lost their lives in the fire.

4.5 A Holistic Approach to Public Safety Concerns

Finding 5: A holistic approach and partnerships were two common features of effective public safety activities.

A holistic approach to a public safety issue, as discussed in Section 2.5.2, is one that addresses an identified problem on multiple fronts. This can include raising awareness in the community, but also taking actions to improve the physical and social environment. The team found that partnerships are a useful tool because they allow for the multiplication of resources as well as the opportunity to leverage various skillsets that can contribute in different ways to addressing the problem.

The team also found that **using data and statistics to their full advantage could contribute to a better understanding of which issues to target**. This can better inform decisions an organisation makes regarding its strategy to address a particular safety concern. The following case study provides an example that the team found of a successful holistic approach to the road safety problem in Victoria, Australia.

4.5.1 Case Study: Transport Accident Commission's Holistic Approach to Road Safety

The Transport Accident Commission of Victoria (TAC) is a State Government organisation dedicated to improving road safety. TAC focuses all its actions towards an aspirational goal of no deaths and injuries on the road. They take a holistic approach to reducing the number and severity of road accidents by approaching the problem of road safety in more than one way by targeting "safer roads, safer vehicles, safer speeds, safer people". [75]

A large part of this strategy is the partnerships that TAC has with VicRoads, Victoria Police, and the Department of Justice to implement the Victorian Government's road safety strategy. The road safety strategy is a multifaceted approach to road safety that combines, "targeting high risk behaviour, road-safety law enforcement, education and public awareness initiatives, research and development, and improvements to Victoria's road network." [76]

TAC uses crash statistics as well as injury and fatality data to analyse causation. They use data to concentrate their efforts on trends where they believe they can make the biggest impact. They also conduct research to gain a better understanding of high-risk groups, emerging issues of concern, peoples' views of road safety, and the success of their programs, among others.[77]

[75] Transport Accident Commission (2014)
[76] State Government Victoria Department of Justice (2014)
[77] Transport Accident Commission (2014)

TAC runs education and road safety campaigns that target a range of driving behaviours and a range of ages to encourage safer people. The major objectives underpinning TAC's public education campaigns are:

- To place road safety on the public agenda and create an environment where behaviour change can be fostered
- To deter drivers from unsafe behaviour by increasing their perceived risk of being involved in a crash, and their perceived risk of being caught by police
- To provide a supporting rationale for police to conduct enforcement activities
- To provide information that supports drivers to adopt safer behaviours

TAC's road safety campaigns commonly have the following features:

- Integration with other initiatives such as enforcement and regulation
- Guidance from market researchers to ensure effective communication of key messages to target audiences
- An emotive style of advertising designed to be attention grabbing
- Complementary advertising to highlight police enforcement capabilities
- Television as the prime medium supported by radio, press, outdoor and direct contact approaches that either reinforce or complement the main messages.
- Strong public relations activity designed to enhance newsworthiness and sensitise the public to the campaign
- Evaluation to assess impact of the campaign and to guide future approaches[78]

TAC also partners with a local soccer team and the cricket league in Australia to help promote the *safer speeds* message to sports fans.[79]

To contribute to its *safer vehicles* initiative, TAC conducts vehicle safety research and testing. They also run the *Safer Road* Infrastructure Program (SRIP) spending $100 million per year on road safety measures aimed at the most prevalent causes of accidents.[80] TAC and its partners have been very successful in decreasing the road injuries and the road toll. Victoria's road toll has decreased by about 700 deaths a year since the 1970s, and the injuries have decreased almost 50 per cent since 1987. In 2013, the road toll was a record low.

4.5.2 Media Releases

The team identified that MFB media releases about residential fire incidents are a potential area where a more holistic approach to home fire safety could be adopted. The team found that **most MFB media releases about residential structure fire incidents did not include a preventative message, and none included a preparedness message.**

[78] Cockfield (2011)
[79] Transport Accident Commission (2014)
[80] Transport Accident Commission (2014)

In 2013, MFB produced 62 media releases related to residential structure fire incidents. Of these media releases, none mentioned a preparedness message. 22.6 per cent mentioned a smoke alarm message, and 6.5 per cent mentioned a prevention message. While the cause of some of these fires was likely to be unknown at the time the media release was produced, **only 40 per cent of preventable fires mentioned a home fire safety prevention measure.** Figure 15 is an example of a media release:

> The house fire in Sandringham was believed to have started by a heater with clothes being dried next to it.
>
> The working smoke alarms alerted the occupant to the fire and she safely escaped with minor burns to the hands and arms and slight smoke inhalation. The female occupant was then transported by Ambulance to hospital for further observation.
>
> The fire was contained to a small section of the lounge room on the ground floor and brought under control in approximately 5 minutes.
>
> Approximately 11 firefighters attended.

Figure 15 - Sample MFB Web Media Release

MFB produced this media release during the period of the 2013 HFSC. The fire was preventable and the cause was known at the time of the media release. There is no prevention or preparedness message in the release. The release does mention a smoke alarm, but the importance of having a working smoke alarm is not emphasised. This example illustrates **that there are opportunities for MFB to used existing (and cost-free) communication channels to convey home fire safety messages that support the messaging of the HFSC**.

4.6 Methods to Establish an Effective Campaign

Finding 6: Effective campaigns tailor messaging based on the desired outcome and intended audience.

The team found that effective campaigns tailor public safety messages to a specific outcome and audience. We found that to do this, **an organisation must perform research and proactively analyse data**. Data and statistics contribute to a better understanding of common or sometimes emerging risks that exist. It can also help an organisation better understand its target audience. The team found specific examples of successful public safety campaigns, which tailored their messaging based on their desired outcome and intended audience.

4.6.1 Case Study: Advertising a Simple Message with the Fire Department of Austin, Texas

The team's research of the literature (Section 2.5.4) suggested that **a campaign can be effective when it focuses on a simple action.** The following case study illustrates a campaign that effectively focused on simple action.

The Austin Fire Department in Austin, Texas, USA runs a campaign called 'Put a Finger On It' promoting fire safety. It uses a simple actionable message to encourage people to test their smoke alarms.

A series of fatal house fires in early 2002 set the year on course to be one of the deadliest years for house fires in Austin's history. A fire fatality task force was established to try to determine a pattern of the deaths. They found that the only common characteristic of the fatal fires was that each of the fires occurred in a house that had a smoke alarm that was not operational. Austin had previously run public education campaigns about the importance of having a smoke alarm in homes. This message had been effective, but the spate of fatalities highlighted the need for a new message to be tailored to the emerging risk of non-operational smoke alarms.

The city created a slogan and message that would inspire people to test their smoke alarm. From research, the task force knew that most homes had smoke alarms and a majority of people knew that the way to test them was to put a finger on the button. To that purpose, the character Freddy Finger was created with the slogan "Put a Finger On It" as seen in Figure 16.

Figure 16 - Put a Finger On It Logo[81]

The campaign was unveiled in front of the media and residents of the city. The next day there was a fire fatality from a young woman that had been smoking in bed and fell asleep. There was a non-operating smoking alarm outside her bedroom. The fire department used the media attention drawn by this fatality to jumpstart the launch of the campaign. The campaign resulted in an improved safety outcome for the Austin community with zero fire fatalities for the two years following the campaign.

'Put a Finger On It' was a popular and effective campaign because it was simple and focused on a concrete action. The campaign did not seek to change habits and ingrained behaviour patterns, but instead to reduce injuries and fatalities by improving the environment that people lived in. The campaign also took advantage of the media attention from fires to spread lifesaving messages. [82]

[81] Fire Prevention Campaigns (2013)
[82] Baum (2004) pp. 15-17

4.6.2 Addressing an Emerging Risk with New Zealand Fire Service's Don't Drink and Fry Campaign

As the research (Section 2.5.7) suggests, **a campaign can be effective when an emerging risk is targeted.** The following case study illustrates a campaign that effectively targeted an emerging risk.

The New Zealand Fire Service (NZFS) has demonstrated the ability to successfully reduce an emerging risk with their Don't Drink and Fry campaign.

Through an analysis of fire data, NZFS found that 50 per cent of all fatal residential structure fires involved alcohol, and that these fatalities were often due to intoxicated people coming home from the pub and falling asleep while cooking. Armed with this information, NZFS launched the 'Don't Drink and Fry' campaign. They tailored the campaign to intoxicated people to encourage them to get take away food rather than going home to cook while drunk.[83]

The primary outlet for the campaign was television, although posters, billboards, and even pizza boxes were also used. An example of one of the campaign posters is shown in Figure 17.

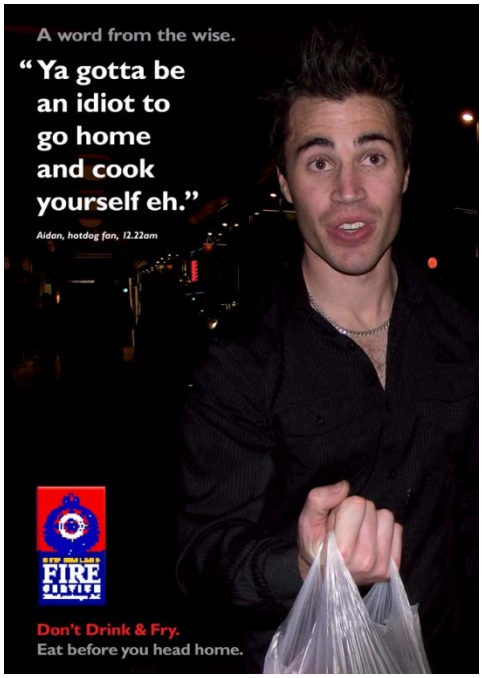

Figure 17 - Don't Drink and Fry Poster

There were four different television commercials that featured various intoxicated people being interviewed on the street about the dangers of drunk cooking, advising that getting take away is the safe thing to do. NZFS also partnered with Hell Pizza which agreed to put the don't drink and fry message on over a million pizza boxes as well as 100,000 scratch tickets. The campaign targeted the younger population,

[83] Fahy, Ben (2011)

using humour as a marketing tool. This was accomplished through the actual advertisements, which used amusing interviews with members of the public, as well as a spin-off of the popular "don't drink and drive" slogan. The campaign appeared to be effective with a decrease of almost 40 per cent in unattended cooking fires in 2009 to 2010.[84]

4.6.3 Advertising without Advertising with Melbourne Metro's Dumb Ways to Die

Research (Section 2.5.5) shows that **advertising in such a way that does not appear to be advertising is an effective way to advocate public safety messages.** The following case study illustrates an example of a campaign created with this intent.

In 2012, Metro Trains of Melbourne, Victoria created its campaign called 'Dumb Ways to Die'. Data suggested that there were several preventable accidents on the train system so the intention of this campaign was to advocate safe behaviour around trains. Campaign messages were conveyed through newspapers, radio, outdoor advertising, YouTube, and via a smartphone application. John Mescall, the creator of the campaign said, "The aim of this campaign is to engage an audience that really doesn't want to hear any kind of safety message…"[85] Mescall said that he understood that people, especially young people, do not like being told what to do, and "what's really interesting about this work is it never tells you not to do it…"[86] The campaign was tailored to this type of audience and was created to be an ad that did not look like an ad, entertainment rather than advertising, because "no one shares advertising".[87] The campaign video featured cartoon creatures dying in various 'dumb', yet amusing, ways. A catchy song narrating various deaths in a cheerful manner accompanied the video. They took a serious safety message and used dark humour in a joyful way to engage the intended audience. Figure 18 is an example poster from the campaign.

[84] Ballard (2012)
[85] Campaign Brief (2014)
[86] Moses, Asher (2012)
[87] Moses, Asher (2012)

Figure 18 - Dumb Ways to Die Poster

Within 24 hours, the song had made the top ten list on iTunes, and within 48 hours, the video had received 2.7 million views on YouTube.[88] An article published by *The Age* newspaper two weeks after the release of the video estimated that it had generated more than 700 mentions in the press.[89] The campaign subsequently won multiple awards for various features such as animation, branded content, and music.[90] According to Mescall, "ultimately the success of the campaign was getting young people talking – and evidently even singing – about rail safety."[91]

A viral video and a number of awards were not the only success that the campaign achieved. There was a decrease from 13.29 near misses per million kilometres of track from November 2011 to January 2012 to 9.17 near misses for the same period one year later.[92] The year 2013 then saw a drop in fatalities (excluding suspected suicides) from ten in 2012 to five in 2013. There was also a drop in serious injuries from 41 in 2012 to 26 in 2013.[93]

[88] Dumas, Daisy (2012)
[89] Moses, Asher (2012)
[90] Mumbrella (2014)
[91] Mumbrella (2014).
[92] Cauchi, Stephen (2013)
[93] Transport Safety Victoria (2014)

5. Conclusions and Discussion

The Home Fire Safety Campaigns from 2009-13 focused primarily on three key messages: unattended cooking, heater fires, and smoking in bed. The team found no evidence that the campaign was effective at changing peoples' behaviour. An evaluation survey found that only four per cent of respondents said they changed their behaviour as a result of the campaign. Neither was there evidence that the campaign was effective at reducing the frequency of fires, as incidents related to the campaign messages did not decrease during the study period. **Because there was no evidence for the campaign making a difference, MFB should reconsider how to approach home fire safety engagement with the public in the future.** MFB's current approach to home fire safety includes a variety of activities that could be considered part of a holistic approach. However, this approach could be expanded to include more proactive data collection and analysis, partnerships, media relations, a focus on desired outcomes, and the use multiple communication channels.

Proactive data collection and analysis would allow MFB to do five things: identify target issues, identify the target audience, create relevant messages, measure each intervention's success, and determine future courses of action. Using this data will enable MFB to make evidence-based policy decisions. Proactive data analysis would enable MFB to identify risks, emerging and pre-existing. By identifying target issues, MFB could effectively tailor its messaging to target audiences to achieve the greatest efficacy. MFB could determine how effective its activities are by taking steps to ensure that success can be measured, such as pre- and post- intervention surveys, and effective evaluations. Once the impact of the activity is measured, a future course of action can be determined. Through continuous re-evaluation, MFB can make its activities more effective and reallocate the resources of activities that are not being successful.

Previous HFSCs addressed cooking fires because they are the most frequent fires. The relative severity measure developed in this study found that kitchen fires were on average not severe fires. Most fires in the kitchen started from cooking left unattended. Previous Home Fire Safety Campaigns have targeted unattended cooking fires, but there is no evidence that these campaigns have been effective. The team's research identified three issues that could be future targets for MFB: smoking related fires, electrical fires and working smoke alarms.

Smoking related fires are a significant source of severe fires and fire fatalities, and are a potential target for future community resilience activities. While smoking inside is targetable, it is a difficult behaviour to change because it mandates that a person break a long held habit. VicHealth is a Victorian organisation dedicated to "promoting good health and preventing chronic disease."[94] One of VicHealth's main priorities is to reduce the number of people that smoke.[95] VicHealth already partners with other organisations,

[94] VicHealth (2014)
[95] VicHealth (2014)

such as Quit Victoria, an organisation that supports people who are trying to quit smoking, and is receptive to new partners. [96] To reduce smoking related fire fatalities and injuries, MFB could partner with VicHealth or other similar organisations to warn smokers of the danger of smoking inside and in bed.

The team's data analysis found that a significant number of severe fires are caused by electrical malfunction. Over half of fires involved electricity, and many fires started from electrical infrastructure, lights, and fans that malfunctioned. Fires starting within electrical infrastructure tend to be more severe than the average fire as they can burn in hard to detect places and spread quickly through the entire house. Electrical infrastructure fires are not a direct result of the day-to-day behaviour of the occupants of the house. While occupants can ensure that they are using appliances safely and are not overloading power boards or power points, these make up only a small portion of fires related to electrical infrastructure. The main problem is the complexity and difficulty of properly inspecting electrical infrastructure.

Energy Safe Victoria (ESV) is "the independent technical regulator responsible for electricity, gas and pipeline safety in Victoria" [97] and offers an Electrical Home Safety Inspection which "is an inspection on the condition of an existing domestic electrical installation, to identify any electrical safety concerns or deficiencies"[98]. MFB could consider subsidising Electrical Home Safety Inspections. ESV has partnered with MFB in the past and renewing the partnership could benefit both organisations. In 2010, ESV produced television commercials that promoted the safe use of cooking appliances such as barbeques. These television commercials, which ran during the 2010 HFSC were funded by ESV and featured MFB firefighters. Evaluations of the HFSC in this period indicate that these commercials were more effective than radio or print advertising.

The most severe fires occurred in homes without working smoke alarms. Since a significant number of severe fires occur at night, working smoke alarms are the most effective way to alert sleeping residents to the danger of these fires. The data revealed that homes without working smoke alarms had an injury rate much higher than that of homes with working smoke alarms. In addition, fires with the highest relative severity occurred when smoke alarms either were not present or did not operate. Working smoke alarms are already an issue targeted in the "Change Your Clock, Change Your Smoke Alarm Battery" campaign. However, the team's data analysis found that this is an important issue and warrants further consideration by MFB.

The team's analysis of media releases found that they rarely included fire safety messages. Including these messages could give them more exposure in the media. The team did not conduct an analysis of the extent that actual media coverage of house fires includes prevention and preparedness messages. This could be a worthwhile area for future study. Austin, Texas successfully used media attention to promote the Freddy Finger Campaign in 2002. They used the media attention following a fire fatality to

[96] VicHealth (2014)
[97] Energy Safe Victoria (2014)
[98] Energy Safe Victoria (2014)

emphasise the importance of working smoke alarms. Kevin Baum, who was involved in the creation of the campaign, writes, “firefighters must highlight tragedy in order to communicate important safety information to their citizens”[99].

Behaviour change and risk awareness is a complicated field of psychology and many models have been developed in an attempt to explain peoples’ actions and motivations with the goal of influencing their behaviour.[100] Research outlined in Section 2.5.2 shows that it is more difficult to change ingrained habits than it is to have someone perform a simple action. MFB should consider some of these different models in the creation of future campaigns, activities, messages, and materials.

MFB could refine the relative severity measure developed in this study. Relative severity was a measure we created to find the most severe fires, and it could be used more broadly to help determine major problem areas and make policy decisions. Taking into account severity provides MFB with another tool to analyse data in order to target messages.

The AIRS data that the team analysed had several notable limitations. Some of the data from AIRS was inaccurate when compared to what was written in the description field, which is a problem when attempting to determine emerging trends within the data. Finally, AIRS does not contain demographic information, making it impossible to track trends across the population. These limitations in AIRS may impact MFB’s ability to identify emerging risks. MFB should work to ensure the accuracy, reliability, and usefulness of the data input into AIRS.

[99] Baum (2004) p. 17
[100] See Section 2.5.2

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Appendix A: Residences of Victoria and the Regulations Protecting them from Fire

Victorians live in a wide variety of homes. Housing situations can be broken down into two main categories, private housing and social housing. Social housing encompasses both public housing and community housing. The Department of Human Services (DHS) in Victoria provides public housing for Victorians that need housing support. Not-for-profit housing agencies and DHS manage community housing in partnership. The gradual rise of private housing in Victoria is shown in Figure 19.

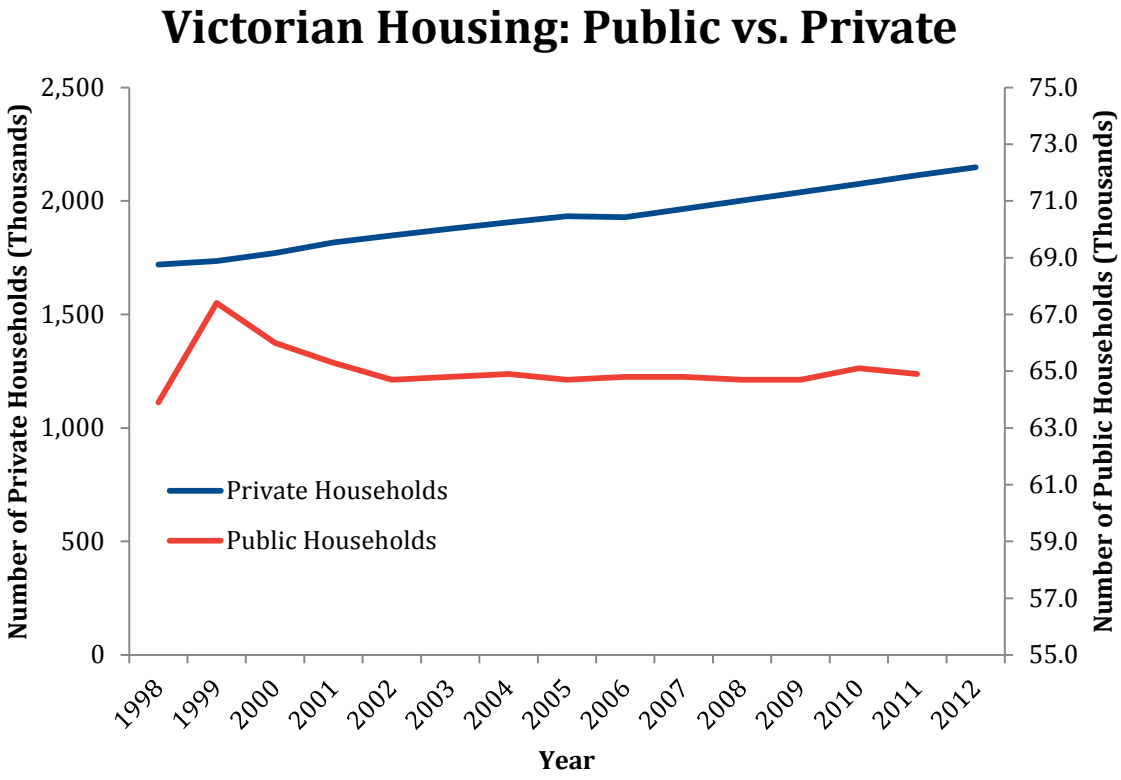

Figure 19 - Victorian Housing: Public vs. Private[101]

The types of residential structures that are predominant in Victoria are detached houses, semi-detached houses, terrace houses, flats, and apartment buildings. Detached houses are free standing houses while both semi-detached houses and terrace houses are attached to others. A semi-detached house is attached to another house on only one side. Terrace houses are often arranged in rows, which is why they are also known as row houses, and are attached to other houses on more than one side. Flats are apartments that are usually single level and are located in buildings no more than two or three stories, whereas apartments are usually located in high rise buildings. Examples of semi-detached houses, terrace houses and flats are shown in Figure 20.

[101] ABS,*4102.0 Australian Social Trends*, 2012

Figure 20 - Semi-detached and Row Houses

The Building Code of Australia (BCA) regulates all residential construction in Australia. Additionally social housing is regulated by the Department of Human Services Fire Risk Management Guidelines (FRMG). The FRMG refer to the BCA while also requiring additional restrictions. Smoke alarms are required in any residence as per the BCA[102]. Within Victoria, the BCA requires an automatic sprinkler system in any residential care building, shared accommodation building, and multiple dwelling buildings higher than 25 meters.[103] Additionally, the FRMG requires an automatic sprinkler system in any medium or high rise structure to be used in social housing[104] and any community based home.[105]

[102] Building Code of Australia, *Volumes I & II,* 2013
[103] Building Code of Australia, *Victoria Appendix,* 2013
[104] DHS, *Fire Risk Management for Multi-storey Residential Buildings*, 2013, Page 9
[105] DHS, *Fire Risk Management for Community-based houses*, 2013, Page 9

Appendix B: Residential Structure Fires with a Focus on the US

This appendix describes common residential structure fires. Hazards, common causes, specific risk scenarios, severity of house fires, prevention techniques, and typical fire department operations will be presented. The hazards that fires pose to the human body will be discussed to illustrate the potential for injury and death incurred by fire. Common causes are shown in order to demonstrate how easily fires can be started in the home. Elevated risk scenarios will be presented to provide a scope to the potential threat of residential structure fires to both the general public as well as specific demographics. Additionally a description of the severity of different residential structure fire scenarios will be presented in an attempt to better characterize fires ranging from minor to extreme. A look at how different agencies, organizations, companies, and fire departments around the world attempt to prevent residential structure fires will also be provided. Finally, this section will explore the actions taken in response to a fire incident, focusing primarily on fire department operations on scene.

Hazard to Human Life

The hazards related to residential structure fires have the potential to severely harm a human being. These hazards will be characterized as potential sources of harm that result from a fire scenario. Three main hazards of residential structure fires are structure damage, release of combustion products, and heat release.

Structural damage can be widespread in scenarios where the fire spreads beyond its object of origin. The worst case scenario of structural damage is the failure of the structure. This can lead to occupants being trapped or killed by the collapsing debris (Cote, 2008).

Occupants of residential structures are also highly susceptible to the products released by the materials that are burning. Combustion products which are detrimental to human health and safety can be classified into three main groups: asphyxiants, sensory/respiratory irritants, and supertoxicants (Cote, 2008). These various products endanger humans by causing a loss of consciousness, interfering with egress attempts, and resulting in other harmful biological reactions to the combustion product.

People who are exposed to fire are also in danger of injury or death due to the heat released by materials during their combustion. The heat produced in a fire is capable of severely harming humans in three main ways: burns to the skin, hyperthermia, and respiratory tract burns (Cote, 2008).

Causes of Residential Structure Fires

Residential structure fires can originate from a variety of different sources. Some of the more common residential structure fires result from: cooking, heating, electrical malfunctions, careless behaviour, and open flames. According to the U.S Fire Administration, from 2009-2011, “Cooking was the leading cause and accounted for 46 per cent of all residential fires” (USFA, May 2013). The other causes of residential structure fires can be seen in Figure 21.

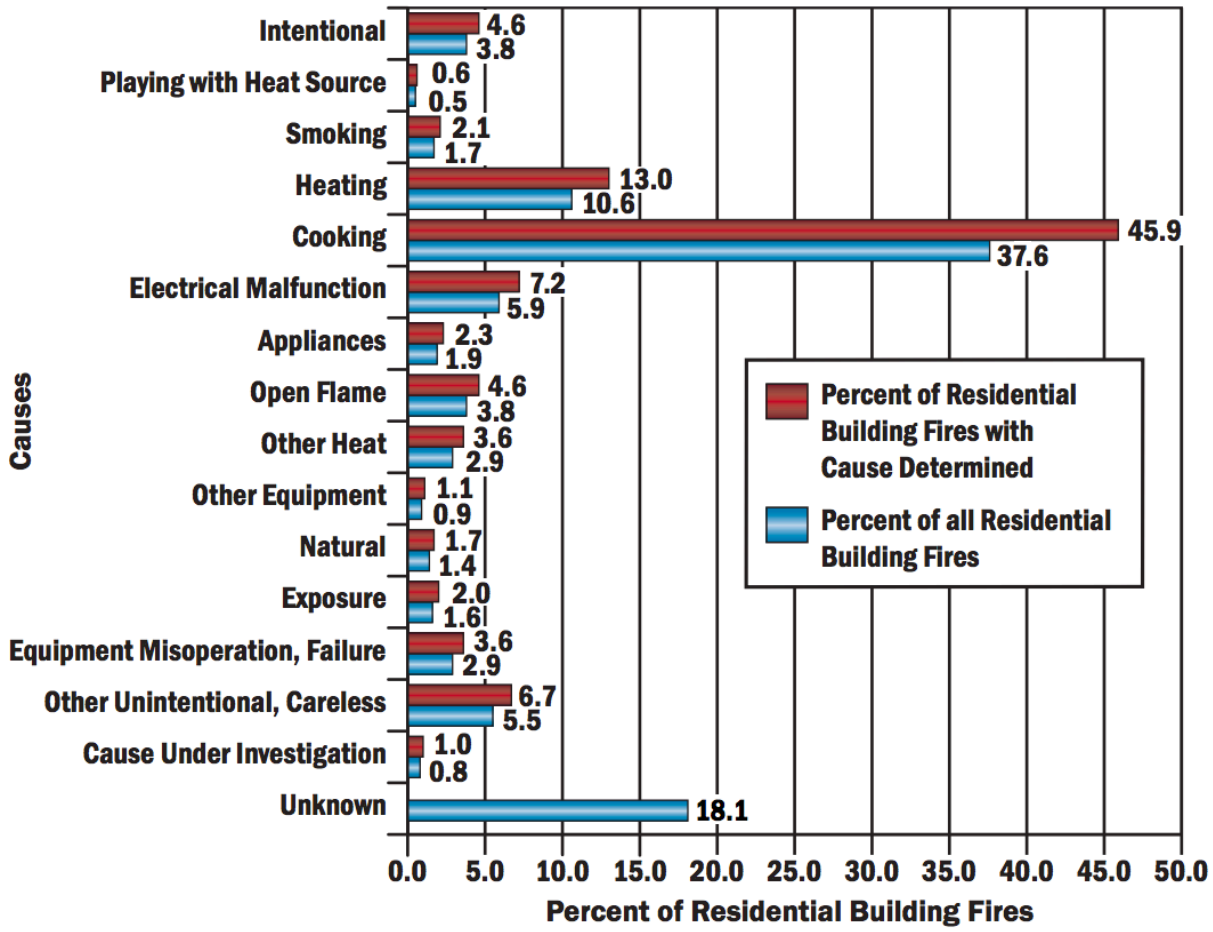

Figure 21 - Causes of US Residential Structure Fires 2009-2011 (USFA, May 2013)

With regards to the specific fires that did not remain contained within their compartment of origin, the U.S Fire Administration reports that structural materials are most often the object ignited (34 per cent) to cause the nonconfined fire. Additional objects of origin for nonconfined fires can be seen in Figure 22.

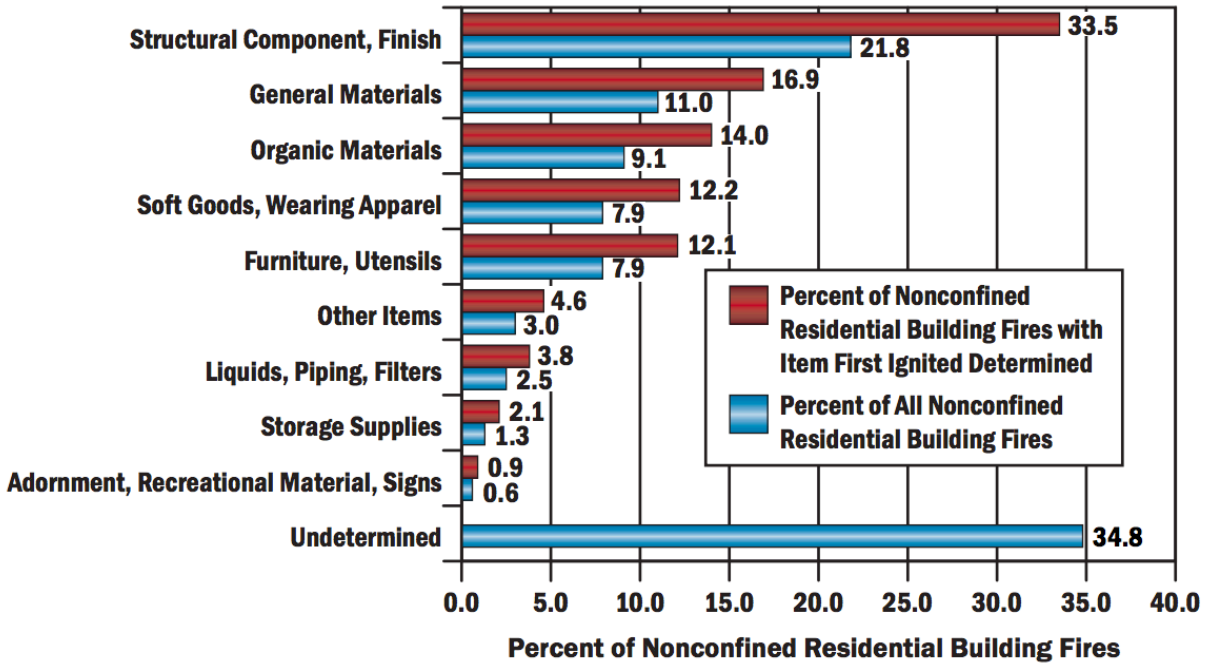

Figure 22 - Item First Ignited in Nonconfined US Residential Structure Fires 2009-2011 (USFA, May 2013)

Elevated Risk Scenarios

Certain demographics have been shown to be more vulnerable to both injury and fatality due to fire. The most vulnerable demographic is those aged 65 or older. People 65 or older were shown to be 2.4 times more likely to perish in a fire within their homes than the general population of the US was in the time between 2007 and 2011. In addition, people in the slightly younger demographic of 50-64 years of age were 1.4 times more likely to die in a fire than the general population (Ahrens, 2013).

Factors other than age can also contribute to an increased vulnerability to the hazards of residential structure fires. Time of year, time of day, and occupant location are important factors in residential structure fire scenarios. According to the NFPA in 2007-2011 (Ahrens, 2013):

- 29% of home structure fires occurred in the winter months.
- 37% of home structure fire deaths occurred in the winter months.
- 20% of residential structure fires occurred between 11:00PM and 7:00AM.
- 51% of all home fire deaths occurred in fires between 11:00PM and 7:00AM.
- 7% of residential structure fires are initiated in the bedroom.
- One of every 41 bedroom fires resulted in occupant fatality and one of every 10 resulted in occupant injury.

Severity of Residential Structure Fires

The dangers associated with residential structure fires have been shown to be substantial to any human being, as well as those in specific population demographics. In the US, from 2007-2011 residential structure fires occurred an average of 366,600 times per year. These fires resulted in a yearly average of 2,570 deaths, 13,210 injuries, and $7.2 billion in damage. Residential structure fires can range from being confined to

their room to fully engulfing the structure and potentially spreading to neighbouring structures. Within the period of 2007-2011, an average of 11,000 fires spread beyond their structure of origin each year. While accounting for only 3% of total fire incidents, these same fires accounted for almost 14% of all fire related deaths and 15% of all property damage from fires (Ahrens, 2013).

Over the past three decades, great progress has been made in reducing the number of residential structure fire deaths. Since 1980, a 52% decrease in total residential structure fire deaths has occurred in the US. While impressive, the number of residential structure fire deaths per 1,000 fires has shown little trend of decreasing (Ahrens, 2013). Further details of these trends can be seen in Figures 23 and 24.

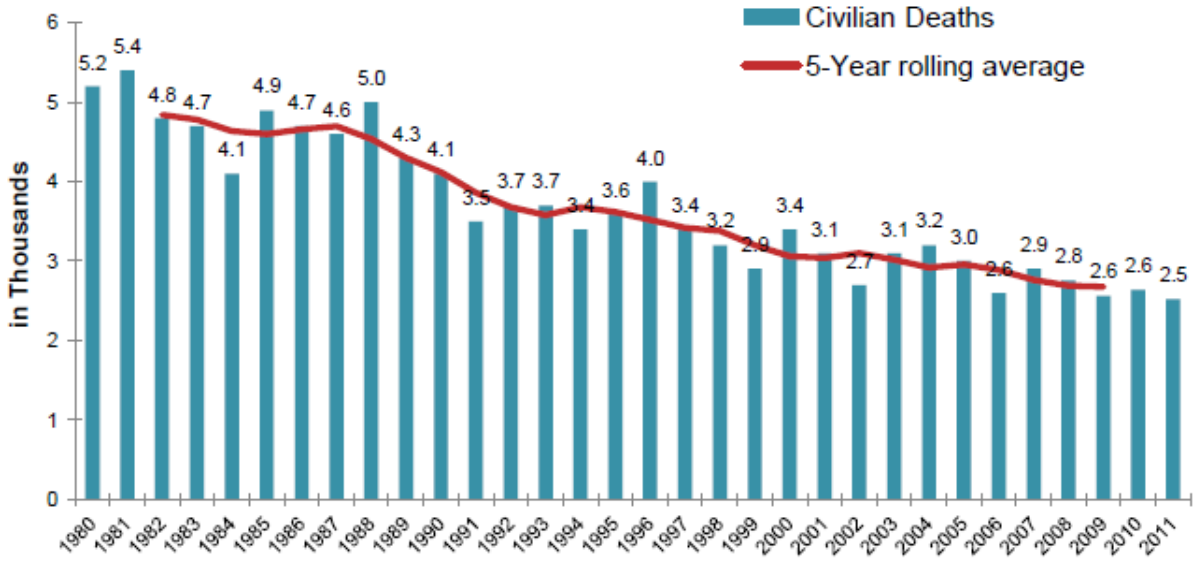

Figure 23 - US Residential Structure Fire Deaths, by Year: 1980-2011 (Aherns, 2013)

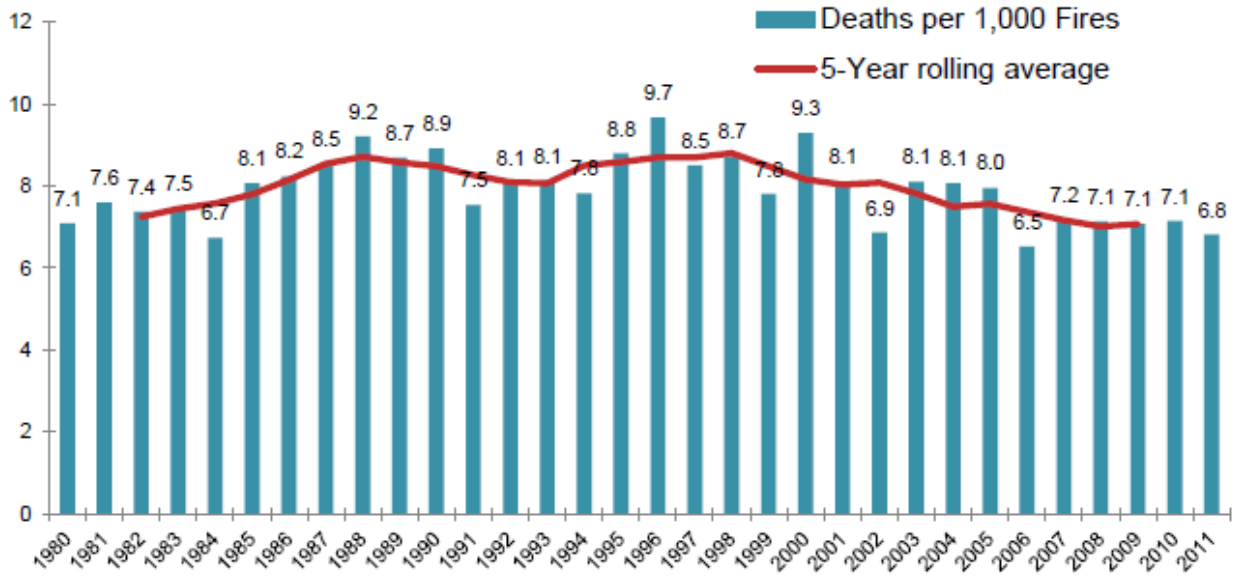

Figure 24 - US Residential Structure Fire Deaths per Thousand Reported Fires, by Year: 1980-2011 (Aherns, 2013)

These trends indicate that while great progress has been made in preventing residential structure fires throughout the past three decades, fires continue to remain just as deadly when they do occur.

Common Fire Prevention Techniques

While most people think of dealing with fire with reactive measures, there exists a multitude of different techniques to confront fire proactively. These measures focus on reducing the likelihood of a fire occurrence. A primary method utilized by the world's governments is through legislative action. Codes, standards and laws all act to illegalize activities that would likely cause a fire to ignite. Product safety regulations are also an important tool in fire prevention. The Underwriter's Laboratory (UL) is a safety science company that works to provide life safety globally. In reference to fire safety measures, UL says "We target prevention and detection by helping develop new technologies, processes and training" (Fire Safety, 2014). In addition to testing, companies, governments, and other organizations seek to reduce the chance of fire incidents through public education. Public education can be defined as "comprehensive community fire and injury prevention programs designed to eliminate or mitigate situations that endanger lives" (NFPA 1035, 2000). A common theme of fire safety education programs is educating the public about residential structure fire causes, demographics subject to elevated risk, and the cost to life and property of a fire. These themes are only some examples of the information that public education campaigns can provide people in order to reduce both the potential and impact of residential structure fires.

Common Operational Response to Fires

When preventative measures fail, fires often spread enough to require the involvement of fire departments. The three main goals of any firefighting operation are in order:

1. to ensure life safety of building occupants, firefighters and bystanders
2. to extinguish the fire
3. to conserve property

The primary method of ensuring life safety to building inhabitants is search and rescue operations. Fire departments perform search and rescue operations by having sufficient personnel to begin search and rescue while simultaneously initiating extinguishment procedures. Fire extinguishment can follow two strategies, offensive and defensive. Offensive fire extinguishment consists of attacking the interior of a structure by applying a sufficient quantity of water to the fuel load to suppress and subsequently extinguish the fire. Defensive extinguishment entails attacking the exterior of a structure in order to contain a fire. Offensive fire extinguishment presents a much greater risk and therefore is typically used when lives are in danger, whereas defensive extinguishment is used when no lives are endangered. The final goal of fire department operations is to conserve property. The primary way to achieve this goal is through a process called overhauling. Overhauling consists of ensuring that the fire is completely extinguished. Overhaul is accomplished by inspecting walls, ceilings, and other structural components for any lingering embers or flames (Cote, 2008).

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Appendix C: MFB Operational Rankings[106]

- Recruit Firefighter, Level 1
- Firefighter, Level 2
- Firefighter, Level 3
- Senior Firefighter
- Qualified Firefighter
- Qualified Firefighter with Leading Firefighter Qualifications
- Leading Firefighter
- Station Officer
- Senior Station Officer
- Commander
- Assistant Chief Fire Officer
- Deputy Chief Fire Officer
- Chief Fire Officer

[106] *About Us*, MFB Website, Accessed 2/05/14, http://mfb.staging.reactive.com/About-Us/Our-People/Ranks.html

Appendix D: Coverage of Other Victorian Fire Services

A map of all of Victoria is located in Figure 25. MFB's coverage area is highlighted in grey. While the coverage area of MFB is smaller than CFA, MFB protects close to four million residents within that area.[107] By comparison, CFA protects approximately 3.3 million residents.[108]

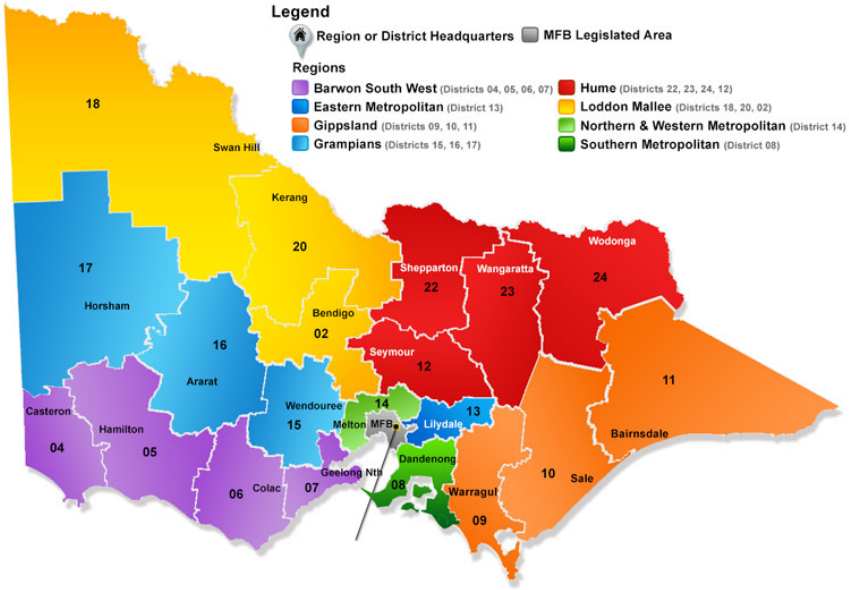

Figure 25 - CFA Coverage Map

As has been mentioned before, DEPI's primary goal is the protection of the environment, and their firefighting services are focused upon protecting public lands in the areas shown in Figure 26.

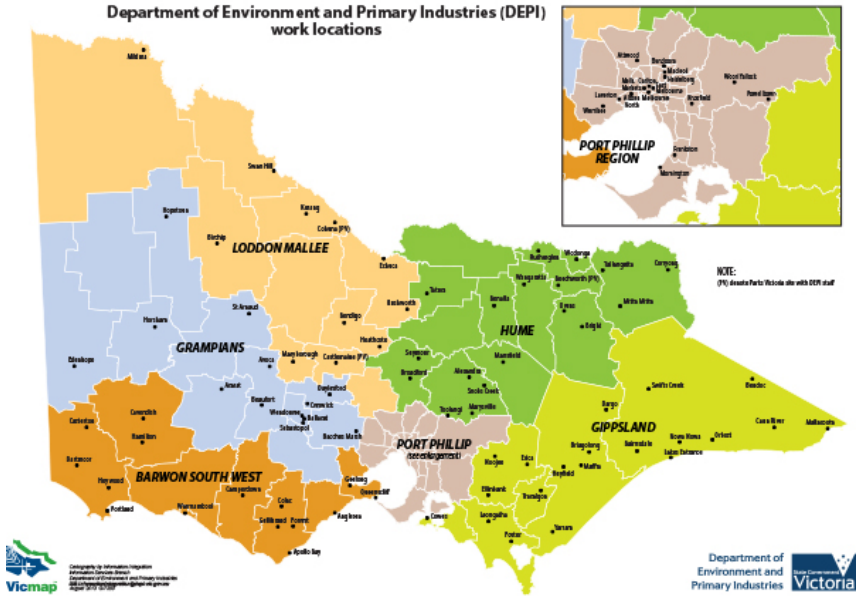

Figure 26 - DEPI Coverage Map

[107] *MFB Annual Report*, 2012-13, Page 6
[108] *CFA Annual Report*, 2011-12, Page 5

Appendix E: Process of Campaign Evaluation

To realize the effectiveness and increase the success of a campaign, an evaluation should take place in which the various aspects and details of the campaign can be analyzed. Barnard and Parker (2012) write that analysis "helps provide the knowledge, understanding and awareness necessary to craft a relevant and compelling narrative and then inform the activities of the campaign" (p. 62). This is however, not easily accomplished. Hornik and Yanovitzky (2003) summarize the difficulty of evaluating fire safety programs well saying,

> Decisions about the standards against which to measure campaign success, strategies for separating campaign effects on outcomes from those of other sources of influence, and expectations for differential campaign effects across subpopulations are only a few examples of the complexity faced by researchers who seek to evaluate communication campaigns (p.1).

According to Cote (2008), "professional program evaluators have developed a staged approach to evaluation" to confront these difficulties. The steps in the approach are as follows (p. 5-120):

1. Formative Evaluation
2. Process Evaluation
3. Impact Evaluation
4. Outcome Evaluation

These four separate processes analyse all aspects of a campaign in order to provide a clear measure of success.

Formative Evaluation

During the beginning stages of a campaign when a plan is being created, a formative evaluation should be conducted to assess of all the aspects that will be utilized throughout the entire process of the program. Becoming familiarized with the audience and other external factors can contribute to a campaign that will be more successful. As mentioned previously, there are several basic elements to a campaign, and these should be given careful thought in the earliest of stages. Analysing these elements is part of the formative evaluation. Cote (2008) defines this as "The process of testing program plans, messages, materials, strategies, and activities for feasibility, appropriateness, acceptability and applicability" (p.5-120).

When beginning with an objective, it must be clear and understandable, as must the message being conveyed ("How to run a campaign," 2013). FEMA suggests particularly for fire safety education programs to analyse risk within the community first, including existing common fire safety problems as well as the demographic features of the situation and those involved ("Public Fire Education Planning: A Five Step Process", 2008). Knowing the current state of the issue gives an idea of what the message should include and how to support it. This allows for an implementation strategy to be created ("Public Fire Education Planning: A Five Step Process", 2008). An informative and evocative title should be chosen keeping in mind the audience and the goals ("How to

run a campaign," 2013). Both selecting and truly understanding the audience are crucial steps. Without the audience, change cannot happen (Barnard & Parker, 2012).

Messages and media types are dependent upon who is on the receiving end of them, and a good understanding of the audience can help organizations recognize how to effectively communicate with them (Barnard & Parker, 2012). Timing of the program and geography are also things to consider. Whether other campaigns are running simultaneously, there is time sensitive information involved, or there is a particular season in which the campaign may be more relevant, timing should be taken into account ("How to run a campaign," 2013). Both geographical reach and demographics of particular areas also lend to an understanding of the audience ("How to run a campaign," 2013). Looking at all of these factors as well as particular factors to specific campaigns or scenarios is a pre-emptive action that can allow a campaign to be more successful from the start. While recommended at the onset of a campaign this evaluation is also possible for existing campaigns. In the case of the evaluation of the HFSC, the formative evaluation examines an existing campaign's materials and strategies for effectiveness, in order to provide an improved future implementation of the campaign.

Process Evaluation

After the above content of a campaign has been optimized, it is useful to examine the actual distribution of this content. The manner by which this occurs is called process evaluation. According to Cote, process evaluation is defined as "The mechanism of testing whether a program is reaching the target population, such as by counting the number of people or households reached" (p. 5-120). This process is completed by surveying those in the target population. The surveys during a process evaluation are strictly for evaluating the means by which content is dispersed. The goal of the process evaluation is only to determine whether or not the methods of distribution are adequate to reach the target population.

An example of process evaluation is one already completed by the MFB through Mitchell, a third party advertising agency. This evaluation broke down the most recent 2013 Home Fire Safety Campaign into radio, outdoor, print media, and digital media advertising. The target population was split into two age demographics, those aged 18+ and those aged 65+. As has been previously mentioned, those aged 65+ have increased vulnerability to harm from home fire incidents and as such were an important group of the target population for the campaign. Each individual media type was analysed by determining the per cent of the population that had either heard or seen the corresponding advertisements. Mitchell's evaluation also included the portion of the budget spent on each individual advertising section.

Impact Evaluation

Once it is determined that the content of the campaign is both appropriate and being efficiently dispersed to the target audience, a campaign has to be evaluated in its capability to change the behaviour of the target population. This process deemed impact evaluation is defined as "The mechanism of measuring changes in the target population's knowledge, attitudes, beliefs, or behaviours associated with the program"

(p. 5-120). This process encounters the difficulty of influencing behaviour change in the evaluation of fire safety, or any other public education campaigns.

A campaign's communication strategy is often designed in a way that will be received well by the audience. If one of the objectives of the campaign is for this information to influence the behaviour of the audience, then simply quantitatively evaluating how many people were reached is not sufficient (McLoughlin, 1982). Behavioural change is a complex subject and with regards to campaigning is often difficult to evaluate due to the multitudinous factors that can affect the behaviour an individual chooses to demonstrate (Hornik & Yanovitzky, 2003).Understanding why people choose to carry out their actions is a difficult task on its own, and determining if a campaign had any substantial contribution to this decision is particularly difficult. Hornik and Yanovitsky (2003) provide a useful graphic to show a general mapping of behavioral results following exposure to a campaigns message that can be seen in Figure 27.

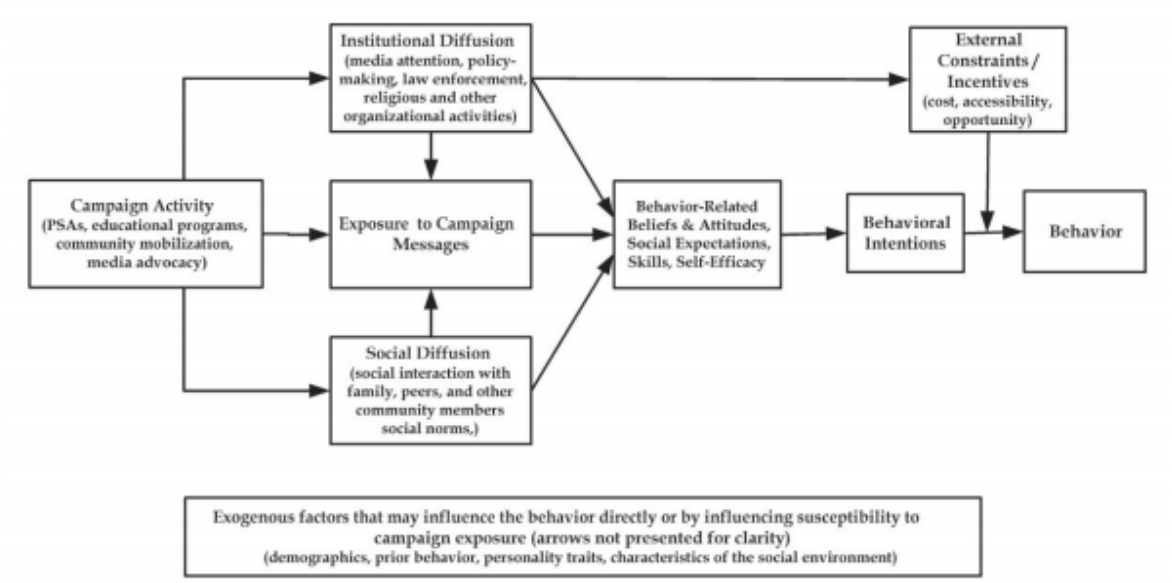

Figure 27 - Behaviorial Change Mapping (Hornik & Yanovitsky, 2003)

Behavioral models are often used to better understand the way in which people behave. According to Cote (2008), there exists three behavioral frameworks for use in community education. The frameworks are summarized in Table 8 (p. 5-122):

Table 8 - Behavioral Frameworks (Cote, 2008)

Framework	Summary
Health Belief Model	Based on the assumptions that an individual will readily alter behavior based on: • Perception of a threat • Perceived severity of threat • Perceived benefit of altered action • Perceived barriers or personal costs of action
Social Learning Theory	Based on assumptions that behavior change is a social process and that it is influenced by active involvement in the learning process and identified consequences of change (or lack thereof)
PRECEDE Model	Predisposing, Reinforcing, and Enabling constructs work together toward inciting a change in behavior

In 2006-2007, the Scottish Executive ran a fire safety campaign entitled “Don’t Give Fire a Home” ("Fire Safety Campaign 2006/07," 2007). To evaluate the behavior of the community resulting from the campaign, the Scottish Executive completed a subsequent impact evaluation of the campaign. Examples of the impact guided questions asked in the evaluation can be seen below in Table 9.

Table 9 - Impact Evaluation Questionnaire (Fire Safety Campaign 2006/07,2007)

	2004 / 2005 %	2005 / 2006 %	2006 / 2007 %
Overloaded plug sockets can cause fire	-	22	33
You should not overload plug sockets	-	30	25
Don’t leave electrical appliances plugged in	23	12	22
Be more careful / think about risks of fire	24	14	16
Potential for fire at home	16	16	15
Danger of fire in your home	22	27	12
‘Make your home safer’	12	17	11
‘Don’t give fire a home’	11	7	11
Make sure your home is safe from things that could cause a fire before you go to bed	-	6	10

In addition to the examples from Table 9, the Scottish Executive also interviewed respondents in terms of their attitudes towards fire safety with the following statements ("Fire Safety Campaign 2006/07," 2007):

- I have never really thought where a fire could happen in my home
- I am concerned about fire in my home, but I could probably take more precautions
- I sometimes overload electrical plug sockets
- I rarely think to switch off electrical appliances at the socket when I go out or to bed
- I am very safety conscious at home and make an effort to minimize the risk of fire
- I probably don’t check the battery in the smoke alarm as often as I should

Outcome Evaluation

Once it has been determined what kind of impact the campaign has had on the target population, it is time to evaluate how successful the campaign was at completing its broad scope goals. This process, called outcome evaluation, is defined by Cote (2008) as "The mechanism of determining how well a program achieves its goal of reducing morbidity and mortality; requires a large study population and analysis of the same data for a similar population that did not receive the program" (p. 5-120). As described in the definition, a proper outcome evaluation requires an in depth look at fire statistics, across a large population.

Outcome evaluation could be considered the most difficult of the four evaluation processes. Cote (2008) summarized the difficulties by saying, "It is often not enough to show that there was a change in knowledge or behavior or in bottom-line measures, such as injuries or dollar loss. One also needs to demonstrate that the observed changes were caused by the education program and not by other factors" (p. 5-133). Table 10 contains examples of factors that are capable of affecting results from the various stages of evaluation (p. 5-134).

Table 10 - Factors Influencing Program Evaluation (Cote, 2008)

Uncontrollable Factor
- Age profile of population - Income distribution of population - Education level of population - Geographical scatter of population - Ethnic groups in population - Weather or climate change - Economic changes - Migration of people in or out of community - Nature of local business and industry - Changes in fire reporting procedures
Semi-controllable Factor
- Condition of housing - Architecture of new homes - Hazards of new technology
Starting Conditions
- Severity of fire problem - Previous exposures of population to fire safety information - Current level of detector usage and condition

These factors must either be addressed or their existence must be acknowledged in order to effectively complete the outcome evaluation of a program. One way to address these factors is to find a control population, which has had little fire safety education, whose characteristics are similar to that of the population under investigation. While this is extremely difficult to complete without the initial intention of isolating a control group, it is still possible to address some of the larger factors such as weather and economic changes.

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Appendix F: Interview Questions

QUESTIONS

- How long have you been involved with the Home Fire Safety Campaign?
- What was your process/strategy for making the campaign?
    - What was the role of the homefiresafety.com website?
- Do you think the HFSC is an effective campaign?
    - What were the goals/metrics for success?
    - What were the specific roles of third-party companies such as Mitchell, Curie, Enhance, Lote, etc.
- What state was the HFSC in when you took it over?
- Is there anything you wanted to see happen in the HFSC that didn't happen?
    - Anything you'd like to see in future HFSCs?
    - Are there any examples of other campaigns that you like?
- What is your take on the fact that the budget for Bush Fire Safety is much more than the budget for the HFSC?
    - How did you try to get the most out of your money?
- Why is the home fire safety campaign focused around winter if home fire safety is a risk all year round? Why is it in the winter?
- Why did the HFSC partner with other organizations such as Energy Safe Victoria (ESV), AIA (Archicentre)
    - Why did the partnership end?
- Have there been any new stakeholders?

MISSING INFO/GAPS:

- Were the 2009 and 2010 HFSCs evaluated?
    - If so, where would the evaluation be?
- Campaign Materials
    - 2009 – 1 Print Ad
    - 2010 – 1 Print Ad
    - 2011 – 1 Poster, 3 Print Ads, 1 Radio Ad
    - Anything we're missing? (Station Kits?)

MISC. IF TIME ALLOWS:

- Did you interact with the local community about the campaigns?
    - What do these interactions involve?
    - What sort of people do you talk to? Where? General demographic?
- Do people seem interested in learning about home fire safety?
- What do you think are the most effective home fire safety measures? i.e. smoke alarms
- Is there anything you think the public is unaware of or does not know about certain aspects of home fire safety?

Appendix G: AIRS Data Fields w/ Sample AIRS Data

Table 11 - Sample AIRS Data

Call Year	2011
Call Id	110300279
Call Date	2/03/2011
Call Time	08:01:48
Final Incident Type	SF
Type of Incident	111
Situation	Fire damaging structure and contents.
Y-Posn	2409824
X-Posn	2489519
LGA	MARIBYRNONG
Suburb	YARRAVILLE
Activity in Ignition Area	11
Form of Heat Ignition	Heat from electrical equipment arcing, overloaded not classified above.
Ignition Factor	Other electrical failure.
Area Of Fire Origin	Laundry room, area.
Type of Material First Ignited	63
Form of Material First Ignited	20
Equipment Involved in Ignition	930
Number of Other Persons Injured	0
Estimated Dollar Loss	$7,000
Extent of Flame Damage	3
Room of Origin	Confined to room of origin.
Presence of Smoke Alarm	2
Power Supply of Smoke Alarm	1
Operation of Smoke Alarm	3
Effectiveness of Smoke Alarm	1
Reason of Failure of Smoke Alarm	N/A
BCA Identifier	21
Type of Property Use	411
Type of Owner	300
Type of Occupant	100
Type of Action Taken	15
Alarm Level	1
Response Time	306
Turnout Time	95
Description	FIRE INVOLVED A POWER LEAD THAT BECAME OVERHEATED CAUSING A FIRE IN A LAUNDRY AREA OF A DWELLING.FIRE WAS CONTAINED BY THE OCCUPIER UNTIL THE BRIGADE ARRIVED.DWELLING IS OWNED BY THE MINISTRY OF HOUSING.

Appendix H: Frequency & Severity Results by Category

Table 12 - Frequency and Relative Severity by Category

Season	Avg. Relative Severity	% of Fires
Spring	0.98	24.2%
Summer	1.10	24.5%
Autumn	0.99	24.9%
Winter	0.94	26.4%

Area of Origin	Avg. Relative Severity	% of Fires
Garage	3.39	1.8%
Bedroom	2.43	8.1%
Living	1.68	8.4%
Structural	1.43	11.4%
Facilities	1.20	4.6%
Outside	1.51	4.2%
Storage	1.59	1.7%
Connecting	0.77	3.5%
Kitchen	0.39	49.7%
Utility	0.34	5.1%
Other	1.60	1.0%
Unknown	7.27	0.5%

Cause	Avg. Relative Severity	% of Fires
Cooking	0.26	36.1%
Impaired	1.11	1.9%
Improper Use	1.48	12.2%
Mechanical Failure	0.98	36.0%
Not Paying Attention	1.56	4.2%
Other	1.92	5.2%
Unknown	4.25	4.4%

Source of Energy	Avg. Relative Severity	% of Fires
Cigarette	1.46	7.0%
Electrical	0.83	52.2%
Gas	0.55	23.9%
Open Flame	1.91	5.6%
Other	2.36	3.6%
Unknown	1.83	7.7%

Appliance	Avg. Relative Severity	% of Fires
Stove	0.34	27.4%
Cigarette	1.46	7.1%
Heater	0.89	6.8%
Oven	0.16	6.0%
Electric Infrastructure	1.11	8.9%
Light	0.89	4.3%
Toaster	0.14	3.0%
Microwave	0.07	2.9%
Candle	2.18	2.2%

Fan	0.95	2.1%
Unknown	2.68	9.4%
Other	1.35	20.0%

Presence of Smoke Detector	Avg. Relative Severity	% of Fires
Not Present/Failed to Operate	1.55	18.8%
Operated	0.80	45.7%
Other (Too Small, Etc)	0.97	35.4%

Time of Day	Avg. Relative Severity	% of Fires
Night (23:00-06:59)	1.66	16.1%
Morning (07:00-14:59)	0.97	33.4%
Evening (15:00-22:59)	0.81	50.4%

Appendix I: Internal Comparison of Severity Criteria

The team compared the three severity criteria amongst one another to ensure that a severe fire in one criterion indicated a severe fire in another criterion.

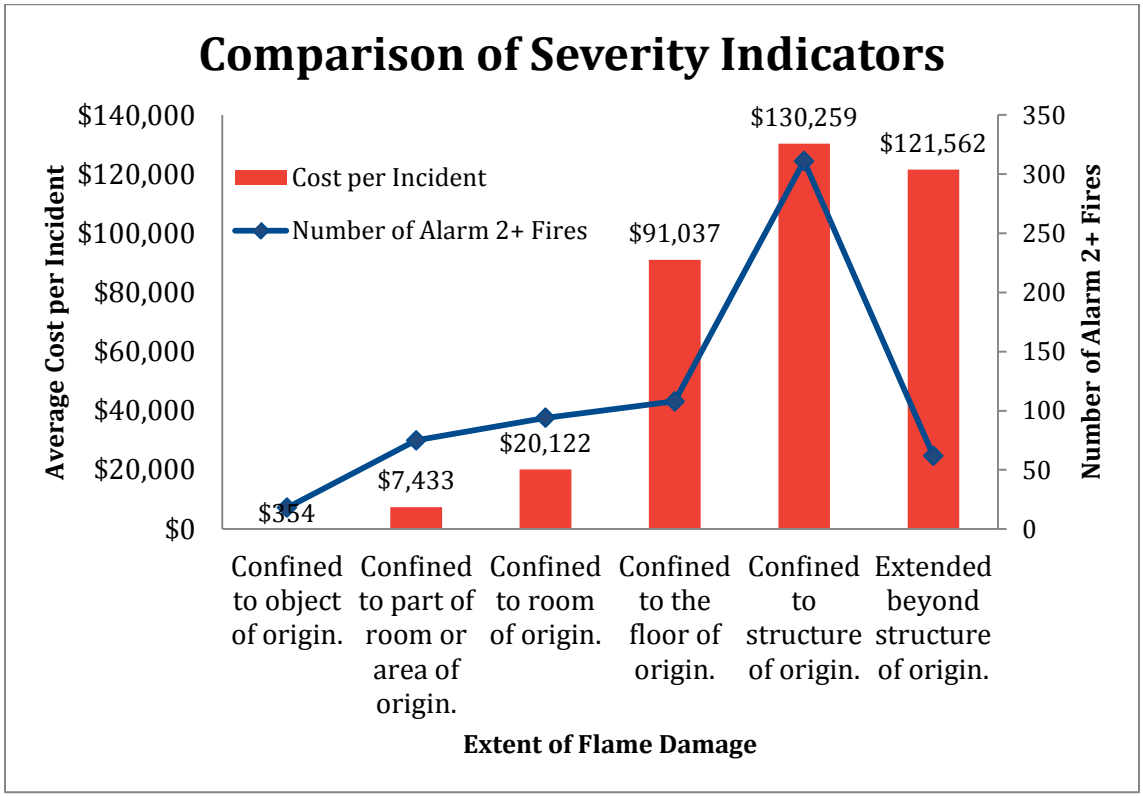

Figure 28 – Comparison of Severity Indicators

Figure 28 shows that there was a high level of internal consistency between each of the three measures of severity. Fires of more than one alarm are more common the further they spread from their object of origin. Additionally, the greater the extent of flame damage, the higher the average estimated dollar loss per incident. Finally as fires increase in average dollar loss, the likelihood of it being greater than a one alarm fire increases.

One outlier to this trend are fires extending beyond the structure of origin with an average cost being less than fires contained to the structure of origin. One explanation for this could be that a fire that extends past the structure of origin does not necessarily indicate a more severe fire. For example, a fire started in a kitchen that spreads through a window and impinges on a neighbouring fence has extended beyond the structure of origin. This would be the case regardless of whether or not the fire was otherwise contained to the kitchen. The same fire, had it not impinged upon the fence, would be classified as confined to room of origin.

The average cost per incident shown in Figure 28 excludes the lowest and highest five per cent of estimated dollar loss figures. This was done to remove outliers, particularly in the very high dollar loss figures, as some of these appeared to be errors in the AIRS data where fires had extremely high estimated losses relative to other indicators of severity. The median values for estimated dollar loss were also calculated, and followed the same trend as the average. These values as well as a comparison between the average and 90 per cent average can be seen in Table 13.

Table 13 - Average Cost per Incident vs. 90% Cost per Incident

Extent of Flame Damage	Average	Middle 90%	% Diff	Median
Confined to object of origin.	$1,572	$354	77%	$100
Confined to part of room or area of origin.	$10,624	$7,433	30%	$2,200
Confined to room of origin.	$26,003	$20,122	23%	$10,000
Confined to the floor of origin.	$107,837	$91,037	16%	$65,000
Confined to structure of origin.	$155,404	$130,259	16%	$80,000
Extended beyond structure of origin.	$153,023	$121,562	21%	$60,000

Over 90% of all fires estimated to cause less than $10,000 of damage were fires which were contained to the room of origin, while over 78% of all fires causing greater than $100,000 in damage spread past the room of origin. Fires causing damage between $50,000 and $100,000 were relatively evenly distributed between containment to room of origin and spreading beyond room of origin with 46.9% and 53.1% respectively. This indicates that the further fires spread from their object of origin, the more monetary damage they caused. This trend is displayed in more detail in Figure 29.

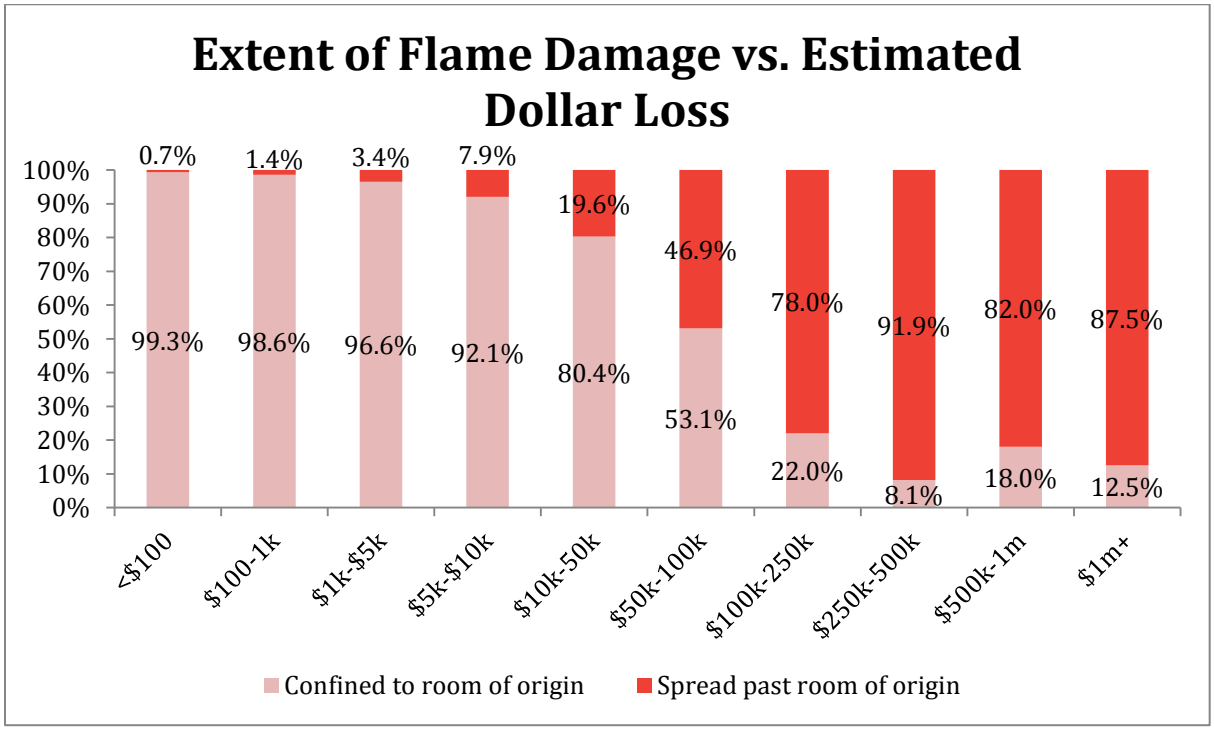

Figure 29 - Extent of Flame Damage vs. Estimated Dollar Loss

Approximately 85.2% of one alarm fires were estimated to have caused less than $5,000 of damage. More than 90% of all two, three, and four alarm fires caused damages estimated above $5,000. Therefore an increasing alarm level was also found to indicate a more severe fire in terms of estimated dollar loss. Further information is located in Figure 30.

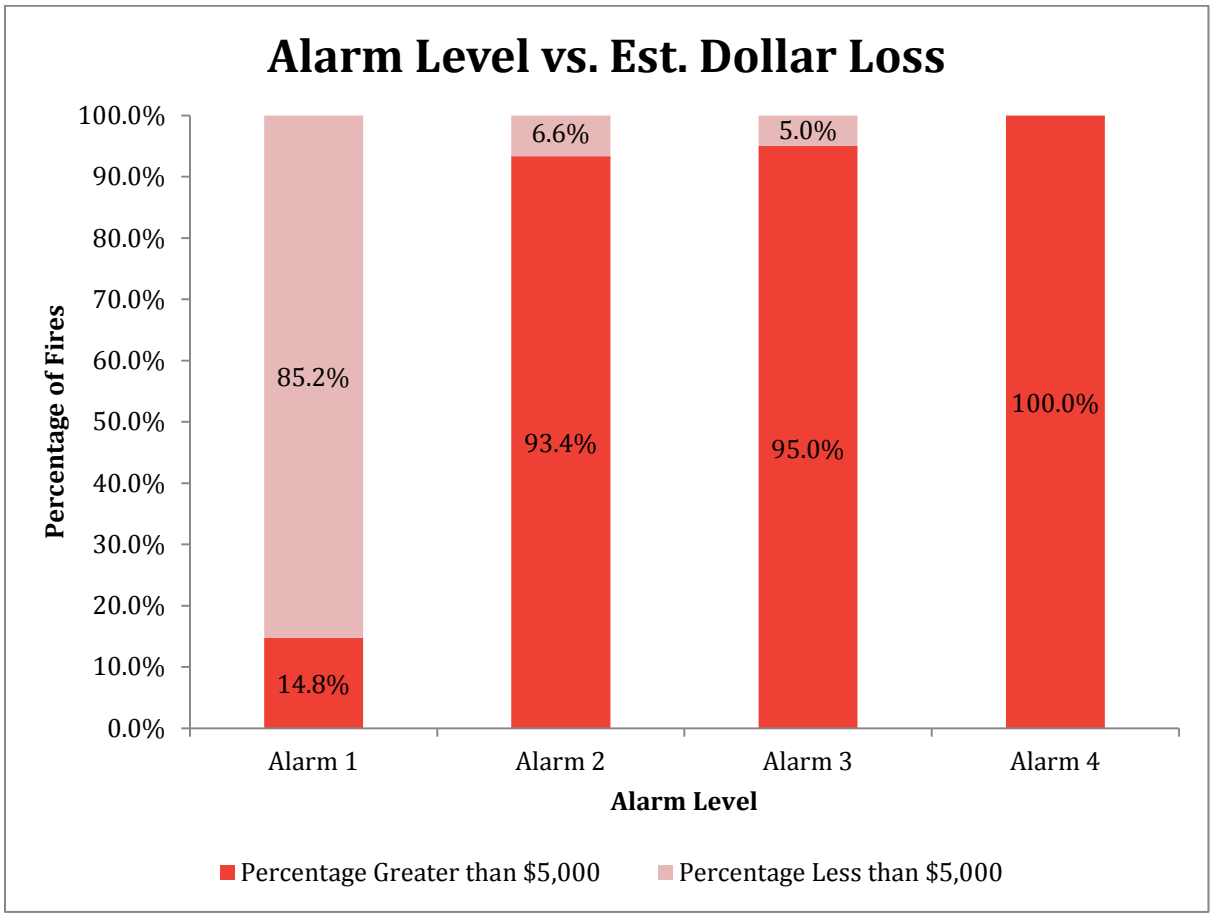

Figure 30- Alarm Level vs. Estimated Dollar Loss

Over 96% of all one alarm fires were contained to the room of origin. Fires that spread beyond the room of origin comprised 71% of all two alarm fires, 75% of all three alarm fires and 100% of all four alarm fires. This indicates that a fire deemed severe with regards to alarm level can also be deemed severe with regards to extent of flame damage. This distribution is displayed in more depth in Figure 31.

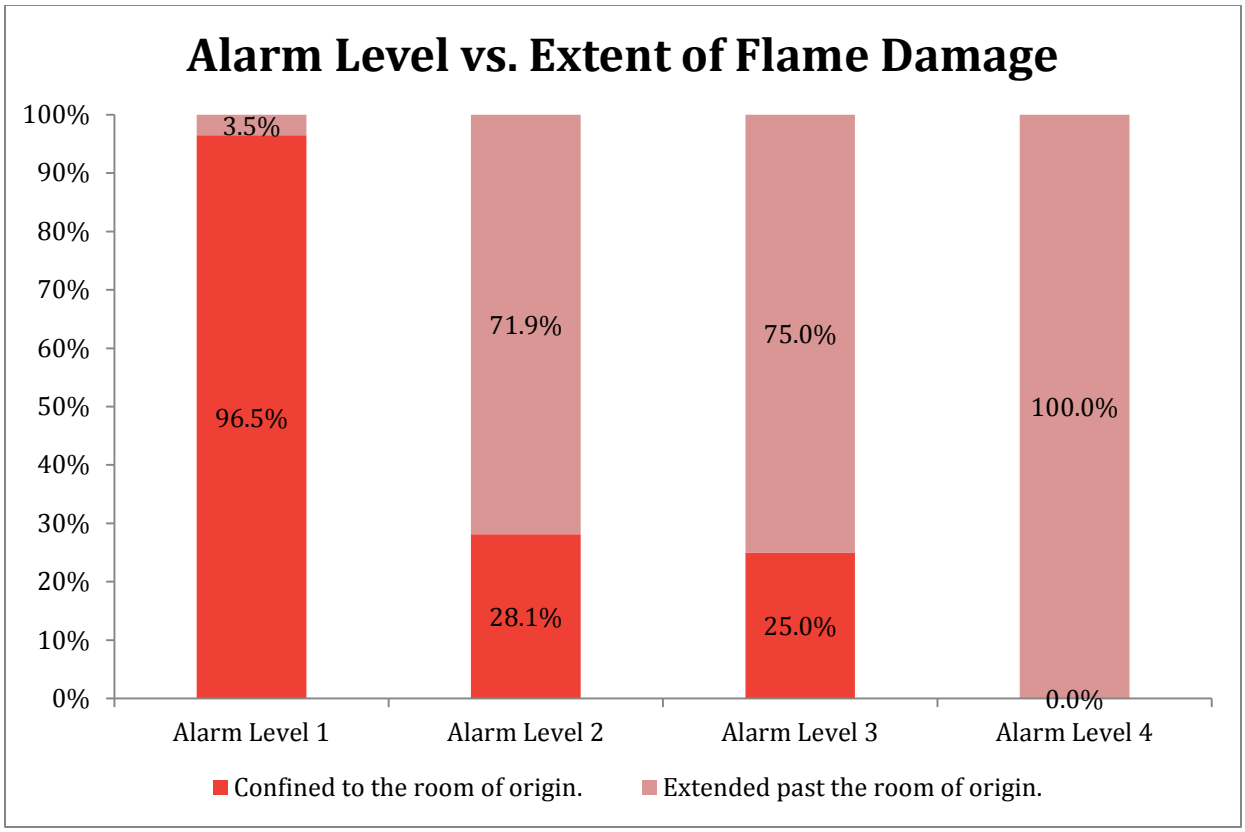

Figure 31 - Alarm Level vs. Extent of Flame Damage

Appendix J: 2009-2013 HFSC Analysis

Table 14 - Preliminary HFSC Analysis

Campaign	*2009*	*2010*	*2011*	*2012*	*2013*
Budget	$173,802.80	$183,000.00	$156,620.31	$254,495.20	$187,727.49
Duration	31/05 - 26/07	23/05 - 31/08	01/06 - 31/08	27/05 -1/09	31/05 - 31/08
Target Demo's	Families Elderly CALD Lower Economic	Families Elderly CALD	Familes Elderly (55+) Firefighters	Families 25-54 Aged (65+) Males 18-34	People who cook Aged (65+) Males 18-45
Partners	CFA/ESV Mitchell	CFA/ESV/AIA Mitchell	CFA/ESV/AIA Mitchell	CFA Mitchell	CFA Mitchell
3rd Party Involvement	HB Advertising		Currie LOTE	Currie LOTE	Haystac LOTE
Main Theme(s)	Fire Safety	Cooking Danger	Be Vigilant (Fire Warden)	Personal Responsibility	Personal Responsibility
Evalulation?	No	Yes (Enhance)	Yes (Enhance)	Yes (Wallis)	Yes (Wallis)

Table 15 - Evaluation of the 2010 and 2011 HFSC by Enhance Research

Prompted Awareness of Campaign			
2010		**2011**	
Radio (1 ad)	28%	TV	51%
Editorials	24%	Radio (2 ads)	24%/25%
Poster	9%	Print	20%
Spontaneous Message Take-out			
2010		**2011**	
Being aware of fire hazards/practising fire safety	42%	Dangers of distractions when using appliances	58%
Ensure house is fire ready/safety plans for households	21%	Being aware of fire hazards/practising fire safety	36%
Smoke alarms in working order	17%	Care when dealing with fires/flammables	15%
Actions Taken			
2010		**2011**	
Tested Smoke Alarms	56%	Tested Smoke Alarms	46%
Extra care to minimise distractions	45%	Extra care to minimise distractions	47%
Talked to family and friends	29%	Talked to family and friends	20%
Visited Fire Safety Website	11%	Visited Fire Safety Website	9%

Table 16 - Evaluation of the 2012 and 2013 HFSC by Wallis

Result	*Did it because they saw/heard a message*		*Did it, not because they saw/heard a message*		*Did activity, did not see/hear any message*	
Action	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Tested smoke alarm	8%	11%	6%	13%	30%	34%
Checked electrical appliance	6%	3%	4%	4%	21%	10%
Planned escape	6%	2%	3%	4%	17%	5%
Talked with friends/family	6%	2%	4%	2%	13%	3%
Had heating serviced	4%	3%	4%	3%	12%	9%
Started using fire screen	3%	n/a	2%	n/a	2%	n/a
Practised Escape	3%	2%	3%	0%	8%	1%
Improve cooking safety	3%	4%	3%	4%	3%	6%
Completed Checklist	3%	2%	1%	1%	9%	3%
Bought a fire blanket	2%	1%	2%	0%	6%	3%
Visited website	1%	1%	1%	0%	3%	1%

Appendix K: 2009-2013 Home Fire Safety Campaign Media

Figure 32 –A 2009 HFSC Advertisement in the Herald Sun Newspaper

Figure 33 - A 2011 HFSC Poster

Figure 34 - Two 2011 HFSC Advertisements in the Melbourne Senior Services Newspaper

Figure 35 - A 2012 HFSC Advertisement in Regional Newspapers

Figure 36 - A 2013 HFSC Advertisement in Regional Newspapers

Figure 37 - A 2013 HFSC Online Advertisement

Appendix L: Statistical Significance Calculations

To determine the statistical significance of the variation between the seasons, the p-value was found using the chi-squared value. The chi squared value was found using the following formula:

$$X^2 = \sum \frac{(Expected\ Value\ -\ Observed\ Value)^2}{Expected\ Value}$$

The expected value was chosen to be an exactly 25 per cent split between the seasons. The exact values can be seen in Table 17 and Table 18.

Table 17 - Values Used in Chi-Squared Test for 2008-2013

Season	Expected	Observed	Month	Expected	Observed	Month	Expected	Observed
Spring	2528	2451	January	842.7	851	July	842.7	871
Summer	2528	2474	February	842.7	763	August	842.7	885
Autumn	2528	2520	March	842.7	835	September	842.7	841
Winter	2528	2667	April	842.7	783	October	842.7	813
			May	842.7	902	November	842.7	797
			June	842.7	911	December	842.7	860

2008-2013

The chi squared value was calculated to be 11.167 for seasonal variance and 28.586 for monthly variance. This resulted in an associated p-value of .01086 and .00263 respectively. In other words, it can be said with 98-99 per cent confidence that the observed differences in the seasons were insignificant and above 99 per cent confidence that the monthly variations were as well.

Table 18 - Values Used in Chi-Squared Test for 2001-2013

Season	Expected	Observed	Month	Expected	Observed	Month	Expected	Observed
Spring	4814.5	4773	January	1604.8		July	1604.8	
Summer	4814.5	4669	February	1604.8		August	1604.8	
Autumn	4814.5	4755	March	1604.8		September	1604.8	
Winter	4814.5	5061	April	1604.8		October	1604.8	
			May	1604.8		November	1604.8	
			June	1604.8		December	1604.8	

2001-2013

The chi squared value was calculated to be 18.111 for seasonal variance and 40.880 for monthly variance. This resulted in an associated p-value of .0004 and .000003 respectively. In other words, it can be said with over 99 per cent confidence that the observed variation is insignificant for both months and seasons.

Appendix M: Authorship Page

Section	Primary Author	Primary Editor
Abstract	Fagan	Knight
Acknowledgements	Knight	Fagan
Executive Summary	Fagan	Knight
1. Introduction	Team	Team
2. Background		
2.1 Population and Demographics of Victoria	Royds	Fagan
2.2 Residential Structure Fires of Australia	Fagan	Royds
2.3 Fire Services in Victoria	Royds	Knight
2.4 The Role of Community Resilience in MFB	Royds	Greene
2.5 Literature Review		
2.5.1 Perception of Risk from Fire	Greene	Knight
2.5.2 Theory, Complexity, and Models of Behaviour Change	Knight	Greene
2.5.3 Holistic Approach to Public Safety Communication	Royds	Knight
2.5.4 Simplification of Messaging	Royds	Greene
2.5.5 Outlets of Communication	Royds	Greene
2.5.6 Difficulties of Measuring Success in Public Education	Royds	Greene
2.5.7 Risk Reduction Through Harm Avoidance	Knight	Royds
3. Methodology		
3.1 Analysis of Home Fire Safety Campaigns	Fagan	Knight
3.2 Examination of Fire Incident Data		
3.2.1 Time of Year	Fagan	Knight
3.2.2 Area of Origin	Royds	Fagan
3.2.3 Grounded Theory Analysis of AIRS Data	Knight	Fagan
3.2.4 Casualties from Residential Structure Fires	Knight	Fagan
3.2.5 Severity	Knight	Fagan
3.2.6 Establishment of Relative Severity	Knight	Royds
3.3 Comparing Data to the Home Fire Safety Campaigns		
3.3.1 Creation of Timeline to Compare Messaging of HFSC	Fagan	Knight
3.3.2 Analysis of Media Release Messaging	Fagan	Royds
3.4 Examination of Other Safety Organisations	Royds	Greene
3.5 Isolation of Potential Home Fire Safety Issues	Knight	Greene
3.6 Limitations of this Study	Knight	Royds
3.7 Conclusion	Fagan	Greene
4. Results and Analysis		
4.1 The 2009-2013 Home Fire Safety Campaigns	Fagan	Knight
4.2 Effect of the 2009-2013 Home Fire Safety Campaigns		
4.2.1 Campaign Evaluations	Fagan	Royds
4.2.2 Winter as a Campaign Time Period	Knight	Greene
4.2.3 Kitchen and Unattended Cooking Fires	Royds	Greene
4.2.4 Heater Fires	Fagan	Knight

4.2.5 Smoking in Bed	Knight	Fagan
4.3 Definition of the Home Fire Safety Problem		
4.3.1 Area of Origin	Knight	Fagan
4.3.2 Cause	Fagan	Royds
4.3.3 Source of Energy	Knight	Greene
4.3.4 Appliances	Knight	Greene
4.3.5 Time of Day	Fagan	Knight
4.3.6 Presence of a Working Smoke Alarm	Fagan	Knight
4.4 Three Prominent Home Fire Safety Issues	Knight	Fagan
4.5 A Holistic Approach to Public Safety Concerns	Royds	Knight
4.6 Methods to Establish an Effective Campaign		
4.6.1 Advertising a Simple Message with the Fire Department of Austin, Texas	Greene	Royds
4.6.2 Addressing an Emerging Risk with New Zealand Fire Service's Don't Drink and Fry Campaign	Royds	Knight
4.6.3 Advertising without Advertising with Melbourne Metro's Dumb Ways to Die	Royds	Fagan
5. Conclusions and Recommendations	Greene	Royds
6. Bibliography	Fagan	Team
Appendix A: Residential Structure Fires with a Focus on the US	Knight	Team
Appendix B: MFB Operational Rankings	Knight	Greene
Appendix C: Coverage of Other Victorian Fire Services	Royds	Knight
Appendix D: Residences of Victoria and the Regulations Protecting them from Fire	Royds	Greene
Appendix E: Process of Campaign Evaluation	Royds	Team
Appendix F: 2009-2013 Home Fire Safety Campaign Media	Fagan	Greene
Appendix G: Interview Questions	Team	Team
Appendix H: 2009-2013 HFSC Analysis	Fagan	Knight
Appendix I: AIRS Data Fields w/ Sample AIRS Data	Knight	Greene
Appendix J: Statistical Significance Calculations	Knight	Royds
Appendix K: Frequency & Severity Results by Category	Knight	Greene
Appendix L: Internal Comparison of Severity Criteria	Knight	Fagan