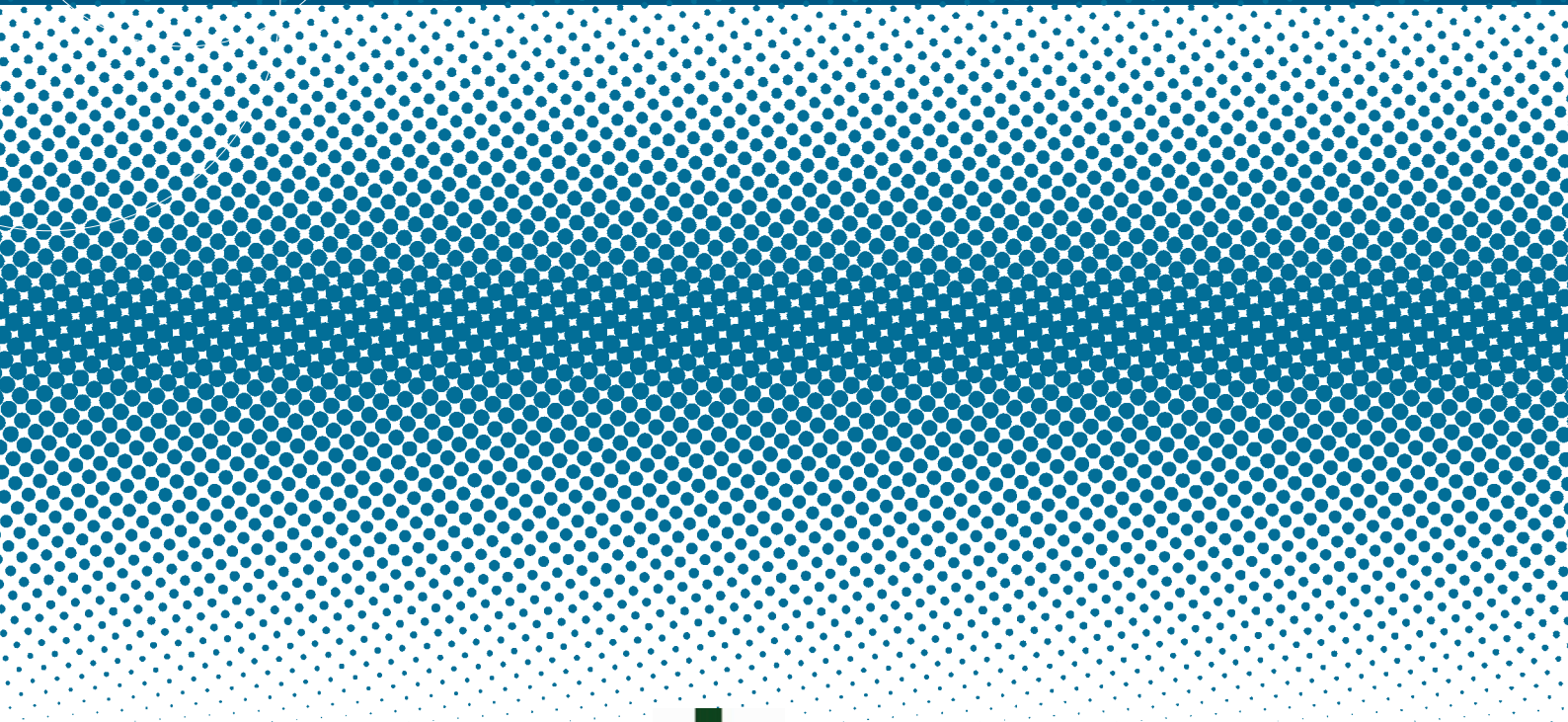


ACCIDENTAL FIRE FATALITIES IN RESIDENTIAL STRUCTURES:
WHO'S AT RISK?

OCTOBER 2005



AUSTRALASIAN FIRE AUTHORITIES COUNCIL

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EXECUTIVE SUMMARY

Introduction

The 'Accidental Fire Fatalities in Residential Structures: Who's at Risk?' project is a research initiative of the Australasian Fire Authorities Council (AFAC). The project was conducted with the cooperation of Australian Fire Services and the New Zealand Fire Service. Data from the Northern Territory was not available at the time this report was produced and, therefore, could not be included in this report.

The 'Accidental Fire Fatalities in Residential Structures: Who's at Risk?' project builds on the 1998 'Fire Fatalities: Who's at Risk?' Research Report and provides further insight into the identification of 'at risk' groups, time periods of elevated risk, and major causes of fatal fires.

Armed with this information, Australasian Fire Services and other associated bodies are placed in the advantageous position of being able to develop enhanced strategies aimed at reducing the total number of fire fatalities in Australia and New Zealand.

Background

Over the past decade, fire services have adopted a proactive approach, as opposed to a reactive approach, to residential fire fatalities. Fire services have developed numerous community education initiatives to educate the community on fire safety. The aim of this proactive approach is to reduce the total number of fire-related deaths in Australia and New Zealand, thereby reducing the economic, social and psychological costs incurred by families and society as a whole.

Project Overview

The major objectives of the *Accidental Fire Fatalities in Residential Structures: Who's at Risk?* project were to:

1. develop a greater understanding of the nature of residential fire fatalities;
2. identify a range of potential risk treatments;
3. provide validated Australasian research to enable assessment and ranking of the identified risk treatments.

In order to achieve the first objective, a comprehensive literature review of national and international research was undertaken. Secondly, all fire fatalities that occurred in residential dwellings, that were deemed to be accidental by nature, were examined. Fatalities that resulted from deliberately lit fires (eg. arson) and from deliberate actions such as murder and suicide were not included in the analysis.

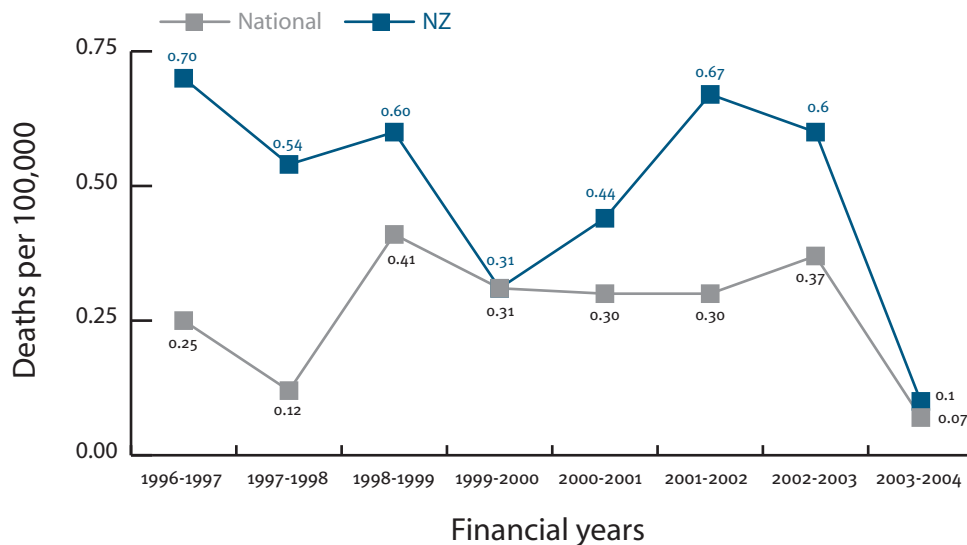
For the purposes of this research, a dwelling was defined as one of the following structures: house, tent, caravan/mobile home, unit/apartment, shed/garage, and other residential area. Where possible, data examined in this report relates to fires that occurred between 1 July 1996 and 30 June 2004. Please note that not all Australian states/territories or New Zealand data covered this period.

Country/State	Time Period
Queensland	July 1996 – June 2003
New South Wales	August 1996 – December 2003
Victoria	November 1997 – September 2003
Tasmania	June 1996 – July 2002
South Australia	July 1998 – May 2001 and July 2003 – June 2004
Western Australia	December 1999 – October 2003
Australian Capital Territory	Data period unknown
Northern Territory	No data available
New Zealand	July 1996 – September 2003

Fire fatality research findings - Australia and New Zealand

In Australia 412 accidental fire fatalities occurred in 366 residential structural fires between 1 July 1996 and 30 June 2004. Data was not available from the Northern Territory, and as such was not included in the total number of accidental residential fire fatalities in Australia. In New Zealand, 155 accidental fire fatalities occurred in 126 residential structure fires between 1 July 1996 and 30 September 2003.

The graph below compares the number of fire deaths per 100,000 in Australia and New Zealand.



Time of Fatal Fires

One focus of the report was the examination of data relating to time of fire fatality. The two categories under investigation were:

- 1) month of year; and
- 2) time of day when the fire death occurred.

As expected, the majority of fire deaths coincided with the cooler winter months. Although the New Zealand data demonstrates a smaller change in autumn and winter. This is most likely due to the fact that in the cooler months, there is an increased use of heating equipment. In terms of time of day, most fires occurred between the sleeping hours of 8.00pm to 8.00am with a peak often occurring between the hours of midnight and 4.00am. Given the fact that most fires occur when people are sleeping, the installation and maintenance of operational smoke alarms needs to be emphasised. Additionally, the installation of sprinkler systems needs to be considered.

Demographic and Socio-economic Characteristics of the Victims

Major demographic details of fire fatality victims were examined in order to determine those people considered most at risk of a residential fire fatality. Across all Australian states and New Zealand, males were more often victims of residential fire fatalities in comparison to females. In Australia, of the 412 fire death victims 60% were male. In New Zealand, of the 155 fire death victims 59% were male. This finding is consistent with worldwide research that males have a higher death rate from residential fires compared to females (Cropp, 1991; Ontario Fire Reporting System, 2004; United States Fire Administration, 2003; Shai & Lupinacci, 2003; Barillo & Goode, 1996; Istre, McCoy, Osborn, Barnard & Bolton, 2001; Hall, 2004).

In Australia, no specific ethnic category dominated the fire fatalities. Of the known ethnic status of victims in New Zealand, the majority of victims (49%) were of Maori decent. This is consistent with research findings by Kool and Ameratunga (2003) who found that in New Zealand, Maoris have higher fire injuries compared to non-Maoris. No occupational type in either Australia or New Zealand data dominated the fire fatalities.

The following groups were identified as having an elevated risk of a fire fatality:

- 1) people aged 65 years and older;
- 2) children aged between 0-4 years; and
- 3) adults affected by alcohol consumption.

Across Australia and New Zealand, and consistent with worldwide research findings, the people aged 65 years and older were one of the dominant age categories of residential fire victims. In Australia, of the victims where age was reported, 22% were aged 65 and older. In New Zealand, of the victims where age was reported, 22% were aged 65 and older. The research shows that as people advance in years, their risk increases in relation to fire.

The National Fire Protection Agency (as cited in Barillo & Goode, 1996) estimates that those people aged 65 years and older have a fire death rate over twice that of the national average. A similar pattern is evidenced in the United Kingdom with one-quarter of fatal dwelling-house fire deaths occurring amongst elderly people (Duncanson, Woodward, Langley, Clements & Harris, 2000).

The other dominant age category was children aged between 0-4 years. In Australia, of the victims where age was reported, 8% were aged between 0-4 years. In New Zealand, of the victims where age was reported, 16% were aged between 0-4 years.

Williamson (1998) maintains that both the very young and the elderly are four times more likely than the general population to suffer a fatal fire injury.

Alcohol

Due to a lack of data, it was not possible to undertake a comprehensive analysis about the contribution of alcohol consumption in relation to residential fire fatalities.

Property Type and Ownership

Throughout Australia and New Zealand, owner-occupied houses were the most frequently cited property type and ownership. In Australia, of the recorded property type and ownership, 76% were owner-occupied houses. In New Zealand, of the recorded property type and ownership, 53% were owner-occupied houses. However, the proportion of owner occupied and public or rental homes should be taken into consideration when interpreting these findings (data was unavailable at the time of this report).

Cause of Fire

Analysis of cause of fires across Australian states revealed that the three major causes of fire were heater/open fire/lamp (27%), smoking materials/equipment (25%), and electrical fault (23%).

Analysis of cause of fires in New Zealand revealed that the three major causes of fire were heater/open fire/lamp (21%), kitchen fire/cooking materials (21%), and electrical fault (14%).

Cause of Death

Analyses of cause of death across Australian states and territories revealed that the major causes of death were smoke inhalation/poisoning (44%) and burns/incineration (23%). Cause of death was not available for New Zealand residential fire fatalities.

Smoke Alarms

Across Australia, where the presence or absence of smoke alarms was recorded, only 45% of properties had a smoke alarm present in the residential structure. Of those 45% of residences that had a smoke alarm present, 31% were not functioning. No data on the presence or absence of smoke alarms were recorded in the New Zealand database.

Literature Reviews

Smoke alarms

- The absence of smoke alarms can increase the possibility of a fatality in a fire by 60%. Studies show that houses most at risk from fire (ie. low income households) are also the least likely to have smoke alarms installed.

Smoking and/or alcohol consumption

- Smoking has been found to be a leading cause of fire deaths, with smokers tending to also consume more alcohol than non-smokers. The finding that the most common cause of residential fire deaths in Denmark is smoking often combined with alcohol intoxication and handicap supports this. Ballard, Koepsell and Rivara (1992) investigated the importance of alcohol and tobacco use and fire injuries. Households with high alcohol consumption had an increased risk but these households also had high tobacco consumption that was the main underlying risk factor.

Low socio-economic status

- Individuals in low socio-economic positions are more likely to engage in behaviours that increase their risk of mortality.
- Another perspective sees the health behaviours of the low socio-economic groups as reflecting the beliefs, attitudes and values of a separate subculture. It's characteristic traits are said to be a lack of knowledge about, and indifference to health, and a lack of orientation to the future. It is theorized that this leads to higher rates of smoking and alcohol use amongst lower socio-economic groups.
- Stress of low socio-economic status has been attributed to living under conditions of disadvantage, an increased likelihood to suffer from stressful life events, negative social interactions and the experience of discrimination.
- There is evidence that individual's with a low socio-economic status are at a higher risk of developing alcohol related habits that are harmful, with contributing factors being minor psychiatric disorders, including anxiety, depression and higher levels of stress. Excessive alcohol consumption is strongly linked to unintentional injuries and fatalities caused by house fires.

People 65 years and over.

- There is a perception amongst older people that their personal safety is a more important issue than fire safety. Many are reluctant to admit that their often-failing senses and more fragile bodies could hinder them in the event of a fire.
- Education programs aimed at the elderly have been found to be less than effective, as many cannot relate to being 'old'.
- Many older people are also unable to properly maintain fire safety devices and have to rely on the help of others, which may not be as frequent or sufficient as needed.
- Studies also indicate that frequently those in the 65 years and over age group are unaware that help is available from local fire brigades or they have a view that they do not want to be a burden on others.
- It has been concluded that an individual's socio-economic status endures through old age. Older people are less able to buffer the effects of stress using social support because the likelihood of living alone increases with age.
- Socio-economic status of older people also suggests that they may use older appliances, such as portable heaters and heating blankets.
- Other contributing factors are that older people may be hearing impaired and not hear an alarm. They are also more likely to have impaired mobility that slows or prevents escape.

Children

- Child fireplay contributes to a large proportion of fire fatalities in residential properties. Linking to this, maternal characteristics, including the education, age and number of other children to care for have been found to be influencing factors in the increased risk of young children dying in residential fires.
- In terms of explaining why children are considered at risk from fire, factors associated with low socio-economic status, particularly those relevant to psychological functioning, are evident at birth. This is attributed to conditions of the family home environment, which are central to the development of emotional well being for children.
- Other influences that put children in an 'at risk' group include quality of family functioning, emotional support, supervision, stimulation and parental involvement and aspiration.

Risk treatments

- Combining the data from the fire fatalities research with the findings of the literature reviews, six groups that are 'at risk' from dying in a residential fire emerge.
 - Children 0 – 4 years
 - People aged 65 years and over
 - People aged 80 years and over
 - Alcohol-impaired people
 - People from ethnic minorities
 - Lower socio-economic groups.
- In Australia and New Zealand a range of risk treatments are undertaken to educate the community on fire safety. While not all risk treatments are undertaken by all agencies, these risk treatments include:
 - School-based programs for children in pre-school, primary and secondary school. Delivery mechanisms vary and can range from delivery by firefighters, through the Internet or as part of the curriculum. Not only do these programs target school children, there is also a flow on effect of children passing on this information to their parents and families.
 - Fire safety education centres where schools and community groups can visit to learn more about fire safety.
 - Juvenile fire lighting interventions targeting children 4 – 16 years who have an unhealthy interest in fire.
 - Home safety inspections/audits – targeting both owner/occupiers of private residences and also in some instances, particular target groups such as older people, people with special needs and people living in mobile accommodation, such as caravans.
 - Programs for people living in 'at risk' areas such as bushfire community education programs and projects targeting people living in public housing.
 - Programs/projects specific to 'at risk' groups such as active older people in the community (eg. Seniors Fire Ed) and culturally and diverse communities (eg. Multicultural Project).
 - Community workshops, seminars and fire safety expos.
 - Battery replacement programs targeting home owners/investment property owners and also 'at risks' groups such older people and people with special needs.
 - Seasonal campaigns – Winter, Summer, Dry Season. These campaigns target the general population and can also be targeted to specific groups in the community – eg. Summer campaign also target newly arrived migrants, holidaymakers and people living in bushfire prone areas.
 - Smoke alarm legislation targeting the whole of the community.
 - Residential sprinklers targeting people in lower socio-economic groups.
 - Advertising campaigns.

- A summary of treatments that relate to each 'at risk' group are detailed in the table below.

Children 0 – 4 years	People aged 60 +	Lower Socio-economic groups
<ul style="list-style-type: none"> – Fire safety expos (targeting of parents) 	<ul style="list-style-type: none"> – Senior's fire education – Battery replacement programs – Home safety audits – Winter campaign 	<ul style="list-style-type: none"> – Fire safety expos – Residential sprinkler program – Public housing partnership
Alcohol impaired people	People aged 80 +	People from ethnic minorities
<ul style="list-style-type: none"> – 'Don't drink and fry' TV advertisement 	<ul style="list-style-type: none"> – Battery replacement program – Home safety audits – Winter campaign 	<ul style="list-style-type: none"> – Summer campaign – Winter campaign – CALD multicultural project

- While it is recognized that a number of the risk treatments are targeting the whole community and indirectly reach some of the 'at risk' groups, it would appear that there needs to be more specific community education initiatives developed to target the parents of children 0 – 4 years old and alcohol impaired people.

Proposed Actions

- AFAC liaise with relevant parties to discuss strategies for minimising the amount of missing information in relation to fire fatalities. When large amounts of data are missing, this makes interpretation and profiling difficult and less complete.
- Liaison with health associations in an effort to expand the dissemination of information to caretakers to educate their children about fire and fire safety, and also pediatric and geriatric physicians who can stress the dangers of fire in the home and promote home fire safety. Other referral sources may include schools, child-care facilities, police, social services, and other medical centres.
- Development of strategies to educate the elderly on the risk of residential fires in an attempt to alter their possible underestimated perception of risk. A report from the West Midlands Fire Service (as cited in Meldrum, 1997) found that the perception of fire in the elderly is indeed underestimated. Preventative education strategies may be required to educate them into realizing the potential dangers and difficulties that may make it difficult to escape the premises when there is a fire.
- In an effort to increase the number of residences with smoke alarms correctly installed, strategies should be developed to increase the number of homes of 'at risk' groups with operational smoke alarms. Initiatives, such as smoke alarm giveaways, may need to be considered. Give-away smoke alarm programs have demonstrated higher rates of compliance than just providing information on the need for smoke alarms alone and, according to Franklin, Pucci, Arbabi, Brandt, Wahl, and Taheri (2002) have decreased home fire injury rates by up to 80% during a four-year intervention program. However, it is important that strategies also focus on the ongoing need to maintain the operability of smoke alarms.
- The public's perception of the contribution of alcohol consumption in residential fatal fires may be underestimated. Fire safety education and prevention campaigns must continue to promote behavioral change based on a reduction in the consumption of alcohol. It would be timely if such a campaign would coincide with the cooler months when more residential fire fatalities occur.

FIRE FATALITIES DATA

1. QUEENSLAND

1.1 Overview

In Queensland during the period from July 1996 to June 2003 there were 100 residential fires, which resulted in 110 deaths. Of the 100 residential fires during this 7-year period there were 7 fires that resulted in multiple fatalities, refer to Table 1.2. In total these 7 multiple-fatality fires claimed the lives of 17 victims.

Table 1.1 presents the number of fire fatalities that occurred in Queensland in each financial year (two cases missing), and also presents how many deaths in Queensland per 100,000 resulted from fire. As can be seen, there was a peak in the number of fire fatalities in the 2001/02 and 2002/03 financial years. The peak in fire fatalities during the 2002/03 financial year may be partly attributable to an elevated number of deaths which resulted from multiple-fatality fires during these years.

Table 1.1 Fire Deaths in Queensland

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	Year Not known
Number of Victims	11	3	13	20	13	23	25	Not available at time of research	2
Deaths per 100,000	0.31	0.08	0.37	0.56	0.37	0.65	0.70	Not available at time of research	0.06

Figure 1.1 compares the number fire fatalities per 100,000 per financial year in Queensland to the number fire fatalities per 100,000 nationally. As can be seen the Queensland fire fatality rate has been generally higher than the national fire fatality trend across the 7-year recording period.

Figure 1.1 Fire Deaths in Queensland Compared to the National Trend

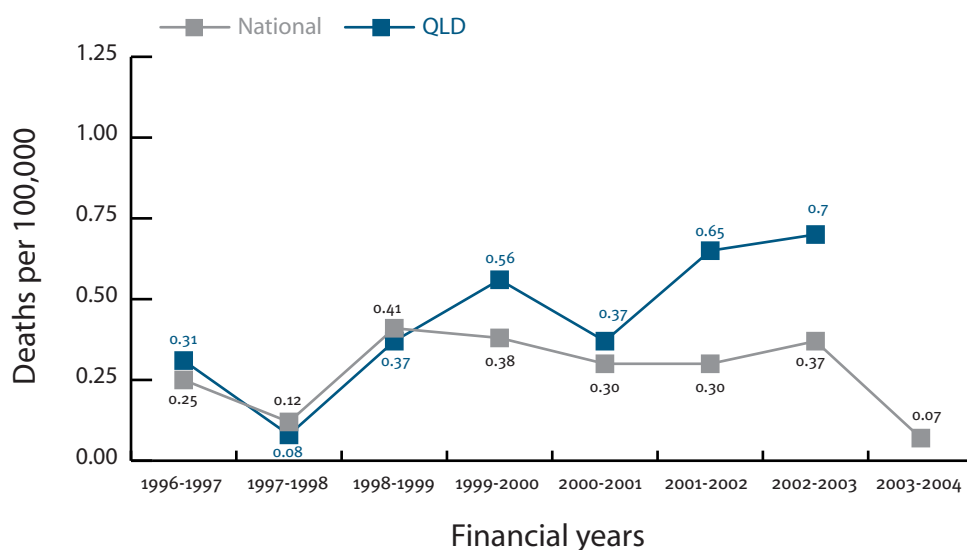


Table 1.2 Queensland Fires that Caused Multiple Deaths

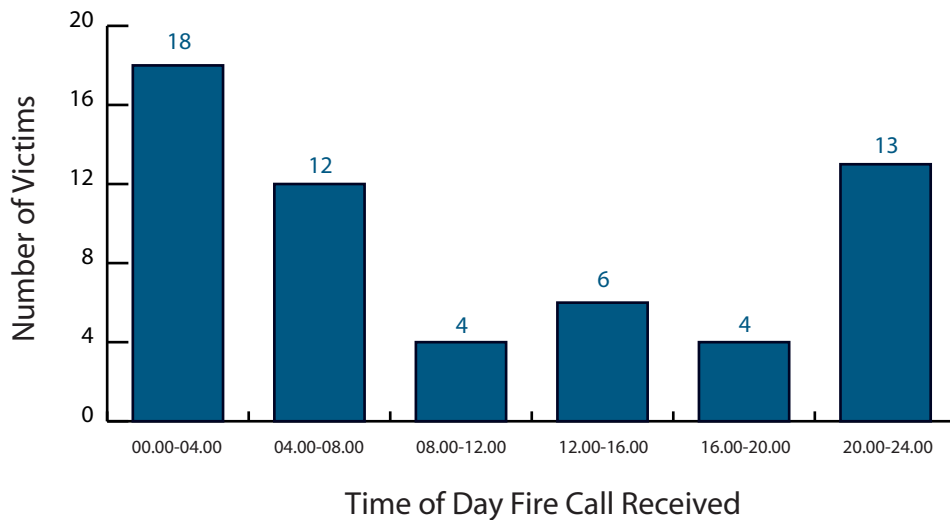
Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	10	11	1	2
1997/1998	3	3	0	0
1998/1999	11	13	2	4
1999/2000	20	20	0	0
2000/2001	13	13	0	0
2001/2002	23	23	0	0
2002/2003	18	25	4	11
2003/2004	0	0	0	0
Year Unknown	2	2	0	0

1.2 Time of Fatal Fires

Time of Day

Figure 1.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. Of the 110 recorded deaths a time of day was not recorded for 53 (48%). Of the remaining 57 cases, 43 (75%) occurred during the sleeping times of 8pm-8am, with a more pronounced peak occurring during midnight and 4am (18 victims, 32%).

Figure 1.2 Deaths Time of Day



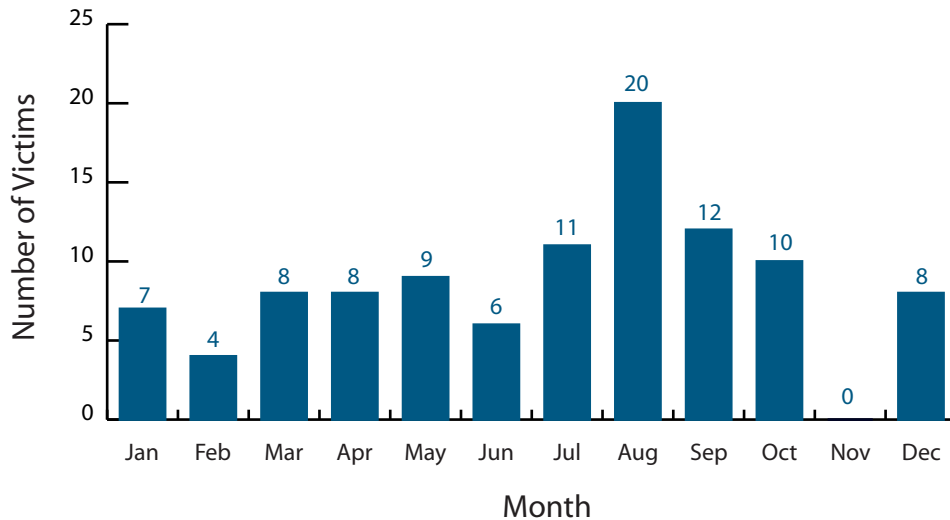
FINDING

- The time period when most fire fatalities occurred was between the general sleeping times of 8pm – 8am (75%).

Month of the Year

Figure 1.3 displays the frequency of fire fatalities collapsed across years for each calendar month. It was not possible to determine the month of death for 7 victims. Analysis is based on the 103 remaining victims. Fatality rates peaked during the winter months from June to August (37 victims, 36%). Of the 37 fire fatalities that occurred during winter, the cause was either unknown or not recorded for 27 (73%) of the victims. Where a cause was recorded, the main causes were electrical fault (3 victims, 30%), candle (3 victims, 30%), and smoking material/equipment (2 victims, 20%). Elevated fatality rates also occurred during the cooler months from September-October (22 victims, 21%).

Figure 1.3 Deaths per Month (period 1996/97 to 2002/03)



FINDING

- The majority of fire deaths occurred during the winter months of June to August (36%).

1.3 Demographics and Socio-economic Characteristics of the Victims

Gender and Age of the Victims

Figure 1.4 depicts the gender breakdown of fire fatality victims. Of the 110 Queensland fire fatalities that could be analysed, the gender for 16 (15%) was not recorded. The majority of the remaining 94 fatalities were male (59 victims, 63%).

Figure 1.4 Gender of Fire Victims

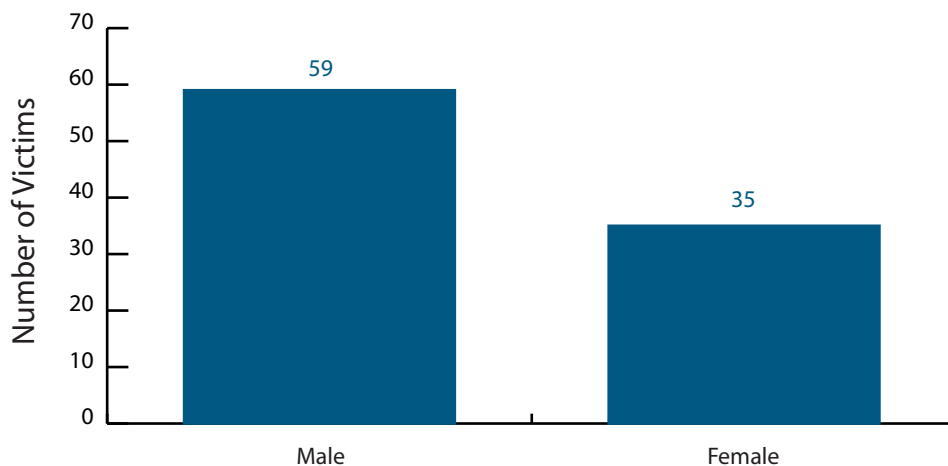


Table 1.3 presents the age breakdown of fire fatality victims. Persons aged 60 and over accounted for 29 deaths or 26%, compared to 15% of the Queensland population who make up this age category.

Table 1.3 Age of Queensland Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of QLD population
0 – 4 years	6	4.84%	7%
5 – 9 years	3	2.42%	7%
10 – 14 years		0.00%	7%
15 – 19 years	4	4.03%	7%
20 – 24 years	4	4.03%	7%
25 – 29 years	10	8.06%	7%
30 – 34 years	5	4.03%	7%
35 – 39 years	6	4.84%	8%
40 – 44 years	7	5.65%	8%
45 – 49 years	10	8.06%	7%
50 – 54 years	7	5.65%	6%
55 – 59 years	2	1.61%	5%
60 – 64 years	7	5.65%	4%
65 – 69 years	6	4.84%	3%
70 – 74 years	4	3.23%	3%
75 – 79 years	4	3.23%	2%
80 – 84 years	5	4.03%	2%
85 +	3	2.42%	1%
Unknown age	17	13.71%	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

FINDINGS

- **The majority of fire fatality victims were male (63%).**
- **The majority of victims were persons aged 60 and over (26%).**

Ethnicity of the Victims

Caution needs to be taken in relation to any findings on ethnicity of the victims, due to the small amount of data available. In most cases (99 victims, 90%), the ethnicity of the victim was not recorded. Where information was available, most fatalities occurred among Caucasians (6 victims, 55%).

FINDING

- **Most fatalities occurred among Caucasians (55%), although over-interpretation of these findings should be cautioned due to the large number of missing cases.**

Occupations of the Victims

Of the 110 Queensland fire fatality victims, the occupation of 69 (63%) were undetermined or not recorded. Of the remaining 41 victims, 8 (20%) were classified as children, and the majority were pensioners/retired (12 victims, 29%). This latter finding is consistent with the previously mentioned trend showing that the majority of fire victims were aged 60 years or older.

FINDING

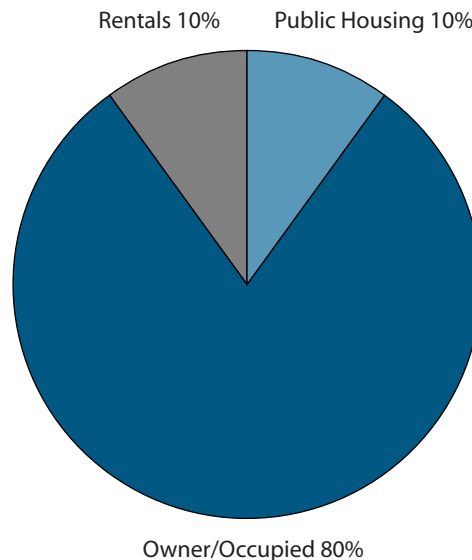
- **The majority of fire death victims were recorded as being pensioners/retired (22%).**

1.4 Property Type and Ownership

A classification of the property types where fire fatalities occurred was performed. Of the 110 fatalities, the property type was not recorded in 65 (59%) of the incidents. Of the remaining 45 incidents, the most common property types were as follows: houses (32 victims, 71%) and units/apartments (6 victims, 13%).

Figure 1.5 below provides a breakdown of the property ownership status where fire fatalities occurred. Please note that 79 (72%) of cases were either not determined or unrecorded.

Figure 1.5 Property Status Where Fire Fatality Occurred



FINDING

- **Fire fatalities were most likely to occur in premises that were classified as owner occupied (25 victims, 80%).**

1.5 Major Cause of Fatal Fires

In 93 (85%) fatality cases, the cause of the fire was either undetermined or not recorded. Of the remaining 17 cases, 8 (47%) victims died in fires caused by electrical faults, 5 (29%) in fires due to smoking materials/equipment and 3 (18%) died in fires started by candles.

FINDING

- **Where information was available, fires that occurred as a result of electrical faults were the most frequently cited cause also smoking materials/equipment**

1.6 Cause of Death

The cause of death was undetermined/not recorded for 74 (67%) cases. Of the remaining 36 cases, the 4 most common causes were as follows: 11 (31%) were due to a combination of causes, 10 (28%) were the result of smoke inhalation/poisoning, 9 (25%) due to burns/incineration and 5 (14%) arose from medical complications.

FINDING

- **The majority of victims died from a combination of causes (31%), followed by smoke inhalation/poisoning (28%). Again, caution should be taken in interpreting this data, given the large number of undetermined/unrecorded cases.**

1.7 Smoke Alarms

Of the 110 cases, data on whether or not a smoke alarm was present was not recorded/undetermined in 87 (79%) of the incidents. In the remaining 23 cases, 14 (61%) did not have smoke alarms. Of the 9 cases where a smoke alarm was present, 5 (56%) were not functioning at the time of the fire.

FINDINGS

- **The majority of homes did not have a smoke alarm installed (60%).**
- **Of the homes that did have an alarm present, 56% of the alarms were not working at the time of the fire.**

2. NEW SOUTH WALES

2.1 Overview

In New South Wales during the period from August 1996 to December 2003 there were 103 residential fires that resulted in 124 deaths. Of the 103 residential fires during this 7-year period there were 14 fires that resulted in multiple fatalities, refer to Table 2.2. In total these 14 multiple-fatality fires claimed the lives of 35 victims.

Table 2.1 presents the number of fire fatalities that occurred in New South Wales in each financial year, and also presents how many deaths in New South Wales per 100,000 that resulted from fire. As can be seen, there was a peak in the number of fire fatalities in the 1996/97, 1998/99 and 2002/03 financial years.

The increase in fire fatalities during the 1996/97 and 1998/99 financial years may be partly attributable to higher numbers of fires resulting in multiple deaths, thus inflating the total number of recorded victims (refer to 2.2). Overall, there were fewer fires in the last 4 financial years (2000/01-2003/04) as compared to the earlier 4 financial years (1996/97-1999/00).

Table 2.1 Fire Deaths in New South Wales

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Number of Victims	28	11	27	12	12	13	20	1*
Deaths per 100,000	0.43	0.17	0.42	0.19	0.19	0.20	0.31	0.02*

* Data only available up to mid-December, 2003 – please view this result with caution.

Figure 2.1 compares the number fire fatalities per 100,000 per financial year in New South Wales to the number fire fatalities per 100,000 nationally. As can be seen the New South Wales, except for 1996/97 and 1998/99, fire fatality rate has been lower than the national fire fatality trend across the 7-year recording period.

Figure 2.1 Fire Deaths in New South Wales Compared to the National Trend

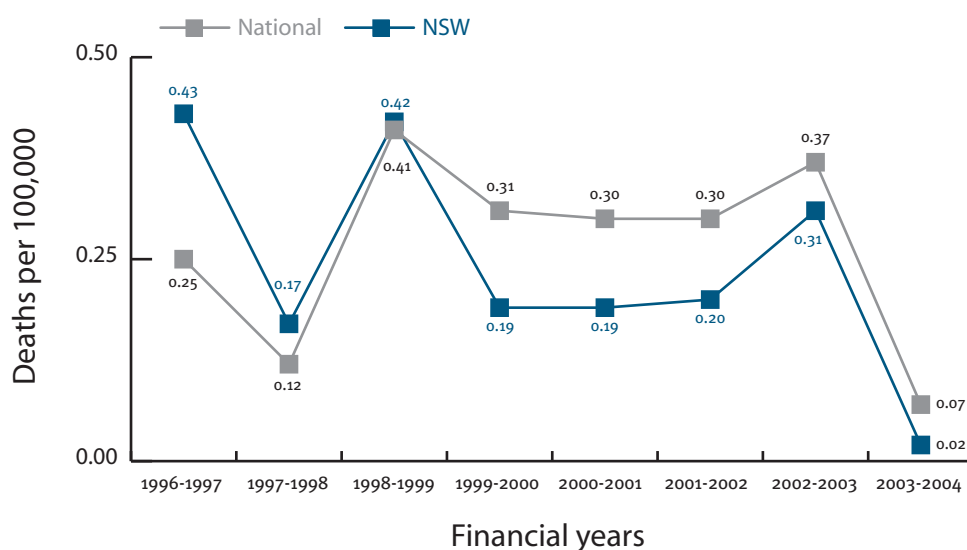


Table 2.2 New South Wales Fires that Caused Multiple Deaths

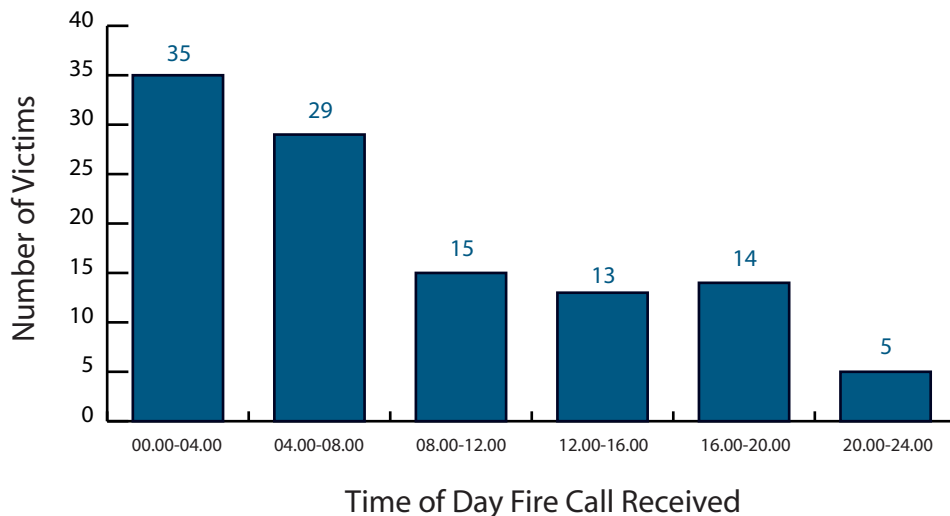
Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	20	28	6	14
1997/1998	8	11	2	5
1998/1999	19	27	5	13
1999/2000	12	12	0	0
2000/2001	12	12	0	0
2001/2002	13	13	0	0
2002/2003	18	20	1	3
2003/2004	1	1	0	0

2.2 Time of Fatal Fires

Time of Day

Figure 2.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. Of the 124 recorded deaths due to fire, a time of day was not recorded for 13 (11%). Of the remaining 111 fatalities, 69 (62%) occurred during the sleeping times of 8pm-8am, with a particularly high number occurring between midnight-8am (64 victims, 57%).

Figure 2.2 Deaths Time of Day



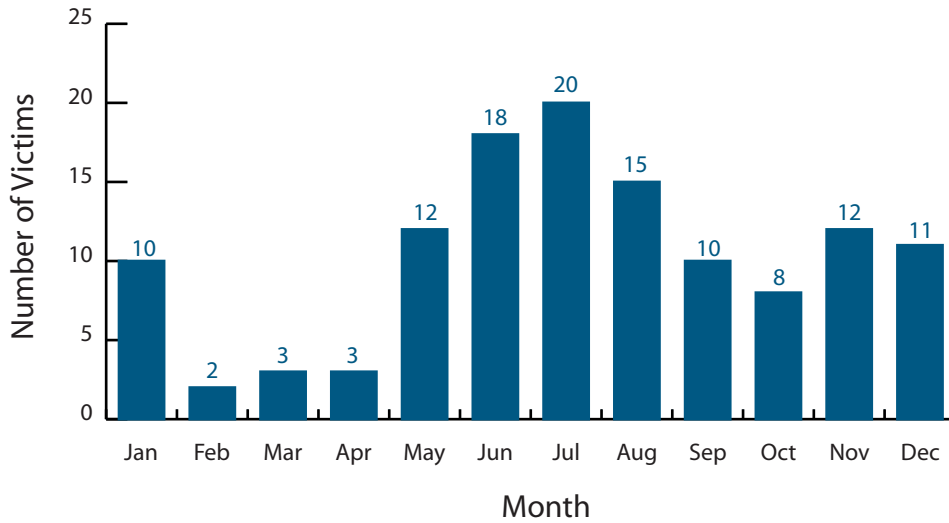
FINDING

- **62% of fire fatalities occurred between the general sleeping times of 8pm – 8am.**

Month of the Year

Figure 2.3 displays the frequency of fire fatalities collapsed across years for each calendar month. Overall, there appears to be a tendency toward a higher number of fire fatalities in the second half of the calendar year from July-December (76 victims, 61%). Furthermore, a high number of fatalities (65 victims, 52%) occurred during the cooler months of the year, from May to August. Of the 65 fire fatalities that occurred during these cooler months the cause of 34 (52%) was not recorded. Of the remaining 31 cases the three main causes were, 12 (39%) attributed to heater/ open fire/ lamp and a further 8 (26%) and 6 (19%) were caused by electrical and smoking materials/ equipment respectively.

Figure 2.3 Deaths per Month (period 1996/97 to 2003/04)



FINDING

- The majority of fire deaths occurred during the second half of the calendar year (61%), with 52% of all deaths occurring during the cooler months of May to August.

2.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Figure 2.4 depicts the gender breakdown of fire fatality victims. Of the 124 New South Wales fire fatalities, the gender of 8 (6%) was not recorded. Of the remaining 116, the majority (61 victims, 53%) were male.

Figure 2.4 Gender of Fire Victims

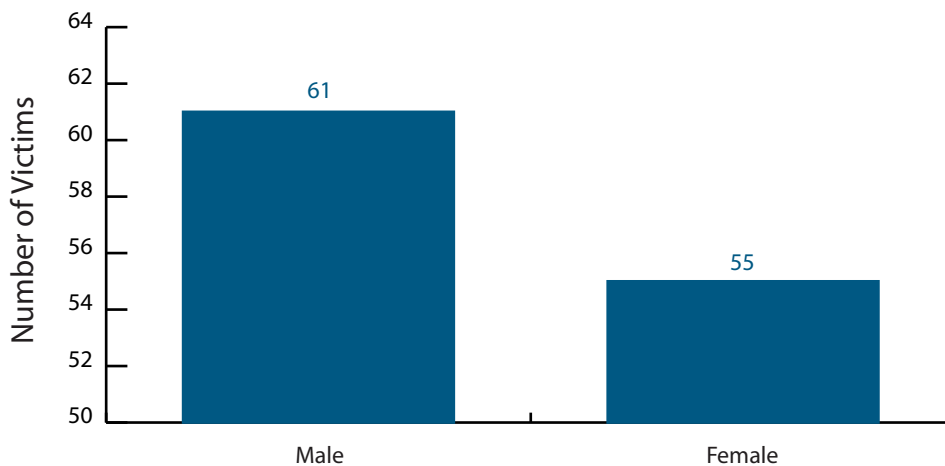


Table 2.3 presents the age breakdown of fire fatality victims. There appears to be an overrepresentation of fire fatalities among persons aged 70 years and over, with 21 deaths occurring in this age group. This number represents 17% of the New South Wales fire fatality victims, however, this age group only makes up 9% of the New South Wales population. Most of these fatal fires in the 70+ age group occurred in a house (17 victims, 81%), with 6 (29%) incidents being caused by electrical faults.

Another two peaks in the number of fire deaths were recorded amongst small children aged between 0 and 4 years (9 victims, 7%), and 50-64 years old (16 victims, 13%), although these two age groups were not over-representative when compared to the proportion of the New South Wales population they represented.

Table 2.3 Age of NSW Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of NSW population
0 – 4 years	9	7.26%	7%
5 – 9 years	2	1.61%	7%
10 – 14 years	5	4.03%	7%
15 – 19 years	5	4.03%	7%
20 – 24 years	4	3.23%	7%
25 – 29 years	2	1.61%	7%
30 – 34 years	2	1.61%	8%
35 – 39 years	6	4.84%	8%
40 – 44 years	3	2.42%	8%
45 – 49 years	2	1.61%	7%
50 – 54 years	7	5.65%	6%
55 – 59 years	4	3.23%	5%
60 – 64 years	5	4.03%	4%
65 – 69 years	3	2.42%	4%
70 – 74 years	6	4.84%	3%
75 – 79 years	2	1.61%	3%
80 – 84 years	5	4.03%	2%
85 +	8	6.45%	1%
Unknown age	44	35.48%	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

FINDINGS

- **The majority of fire fatality victims were male (53%).**
- **The majority of victims were elderly persons aged 70 years and over (17%), persons aged 50-64 years (13%), and young children aged between 0-4 years (7%).**

Occupations of the Victims

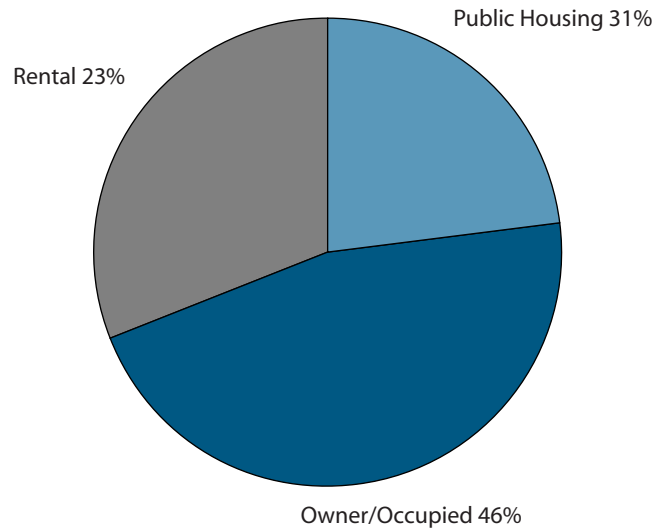
Of the 124 cases, occupational data was not recorded for 122 (98%) of incidents. Therefore, an analysis of the occupational breakdown of the fire fatality victims was not performed.

2.4 Property Type and Ownership

The property type for 5 (4%) cases was undetermined/not recorded. Of the remaining 119 cases, 108 (91%) occurred in houses, 5 (4%) in units/apartments, 4 (4%) in sheds/ garages, 1 in a tent and 1 in “other residential area”.

Figure 2.5 below provides the complete breakdown of the property status where fire fatalities occurred. In 111 (90%) of incidents the property status was undetermined/ not recorded. Of the 13 incidents that had recorded data, half (6 victims, 46%) of the fatal fires occurred in houses that were classified as owner/ occupied.

Figure 2.5 Property Status Where Fire Fatality Occurred



FINDING

- Fire fatalities were most likely to occur in premises that were classified as owner occupied (6 victims, 46%).

2.5 Major Cause of Fatal Fires

The cause of fire was either undetermined or not recorded in 65 (52%) of the fatality cases. Of the remaining 59 cases, the most common causes were smoking materials/ equipment (22 victims, 37%); electrical faults (18 victims, 31%); and heater/ open fire/ lamp (13 victims, 22%).

FINDING

- 90% of fatalities were caused by fires arising from either smoking materials/ equipment, open fires/ heaters, or electrical faults.

2.6 Cause of Death

A cause of death was not recorded for 108 (87%) fire fatality victims. Of the remaining 16 victims, the most common causes of death were smoke inhalation/ poisoning (7 victims, 44%), and burns/ incineration (6 victims, 38%).

FINDINGS

- A cause of death was not recorded in the majority of incidents (87%).
- Where a cause was recorded, 81% of victims died from smoke inhalation/poisoning (44%) or from burns/incineration (38%).

2.7 Smoke Alarms

The presence of a smoke alarm was either unknown or not recorded for 113 (91.1%) cases. Of the remaining 11 cases, a smoke alarm was present in 6 (55%) of the fatal incidents. When a smoke alarm was present, 4 (67%) were determined to be functioning at the time of the fire.

FINDINGS

- In 55% of fatalities a smoke alarm was present.
- When a smoke alarm was present, it was determined to be functioning in 67% of incidents.

3. VICTORIA

3.1 Overview

In Victoria during the period from November 1997 to September 2003 there were 95 residential fires that resulted in 99 deaths. Of the 99 residential fires during this 7-year period there were 3 fires that resulted in multiple fatalities, refer to Table 3.2. In total these 3 fires claimed the lives of 7 victims.

Table 3.1 presents number of fire fatalities that occurred in Victoria in each financial year and also presents how many deaths in Victoria per 100,000 that resulted from fire. As can be seen, from 1998/99 – 2002/03 there has been a consistent number of fire fatalities across the 5-year period.

Table 3.1 Fire Deaths in Victoria

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Number of Victims	Not available at time of research	4	21	20	17	15	19	3*
Deaths per 100,000	Not available at time of research	0.08	0.44	0.42	0.36	0.32	0.40	0.06*

* Data only available up to early September 2003 – please view this result with caution.

Figure 3.1 compares the number of fire fatalities per 100,000 per financial year in Victoria to the number fire fatalities per 100,000 nationally. As can be seen the Victorian fire fatality rate has generally been higher than the national fire fatality trend across the 7-year recording period, with the exception of 1997/98 and 2003/04 where it was slightly lower than the national trend.

Figure 3.1 Fire Deaths in Victoria Compared to the National Trend

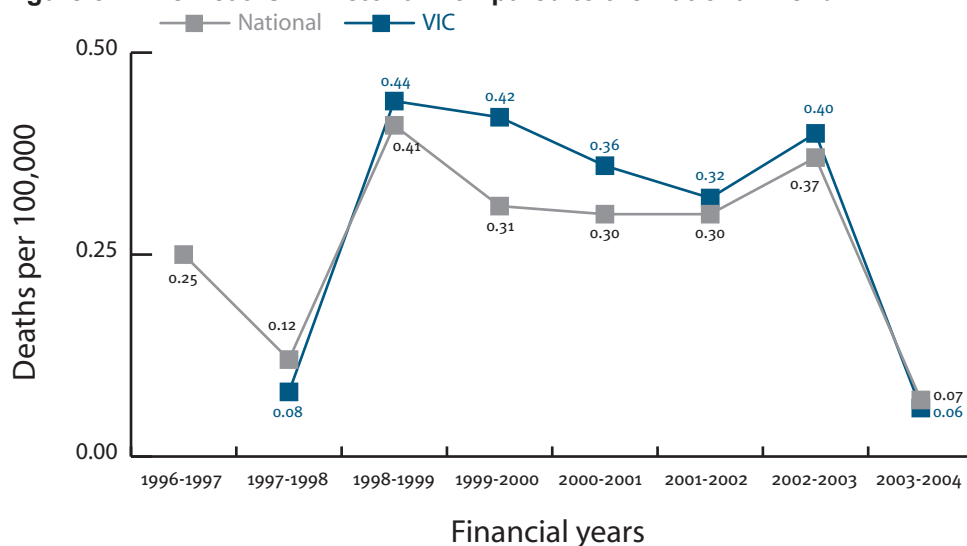


Table 3.2 Victoria Fires that Caused Multiple Deaths

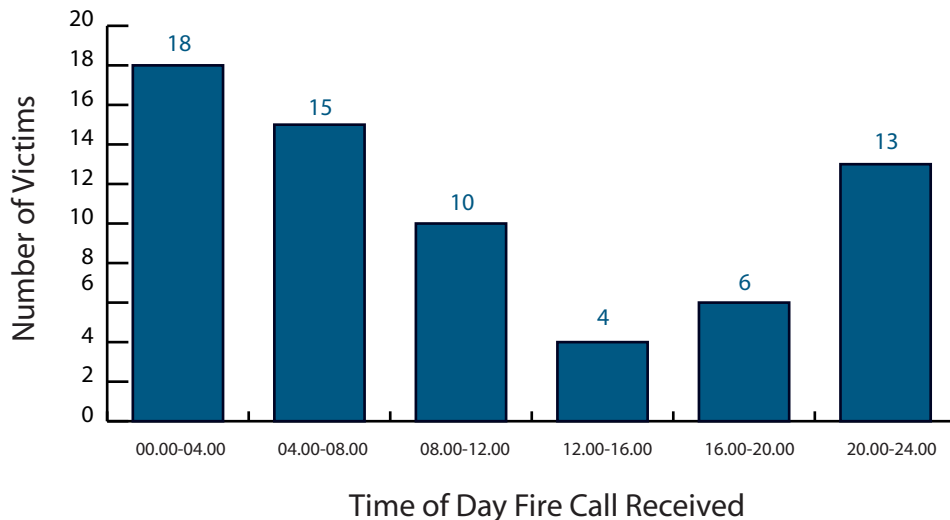
Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	0	0	0	0
1997/1998	4	4	0	0
1998/1999	18	21	2	5
1999/2000	19	20	1	2
2000/2001	17	17	0	0
2001/2002	15	15	0	0
2002/2003	19	19	0	0
2003/2004	3	3	0	0

3.2 Time of Fatal Fires

Time of Day

Figure 3.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. Of the 99 recorded deaths due to fire, a time of day was not recorded for 33 (33%). As can be seen from the figure below the majority of fire fatalities occurred between the sleeping hours of 8pm-8am, in which 46 (70%) of incidents occurred.

Figure 3.2 Deaths Time of Day



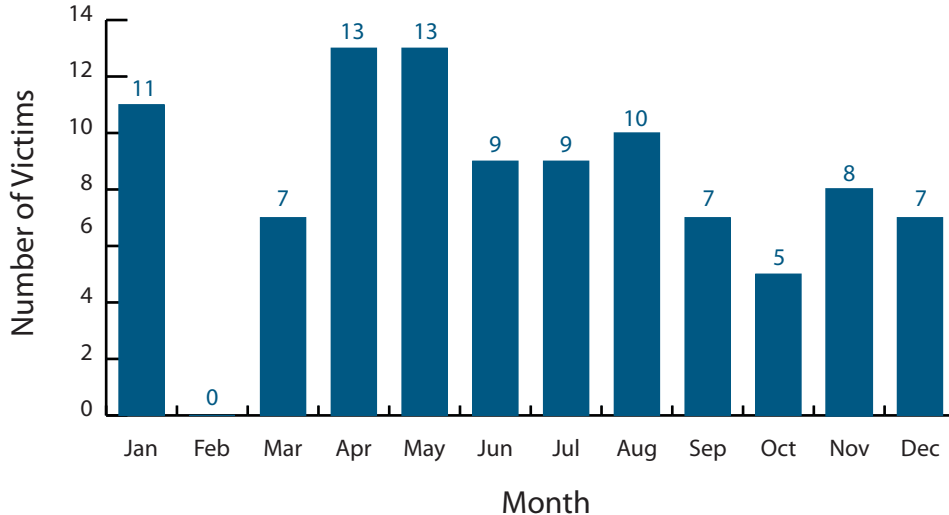
FINDING

- The time period when most fire fatalities occurred (70%) was during the sleeping hours between 8pm- 8am.

Month of the Year

Figure 3.3 displays the frequency of fire fatalities collapsed across years for each calendar month. As can be seen from the figure below there is a notable trough in February, with zero fire fatalities being recorded for this month. Further to this however, there does not appear to be any notable peak times when fire fatalities are high. Rather, there is quite a consistent pattern of incidents across the remaining months of the year.

Figure 3.3 Deaths per Month (period 1996/97 to 2003/04)



FINDING

- There were no fire fatality incidents recorded for the month of February. All other months have a fairly consistent pattern of fire fatality rates.

3.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Figure 3.4 depicts the gender breakdown of fire fatality victims. Of the 99 Victorian fire fatality victims the majority were male (65 victims, 66%).

Figure 3.4 Gender of Fire Victims

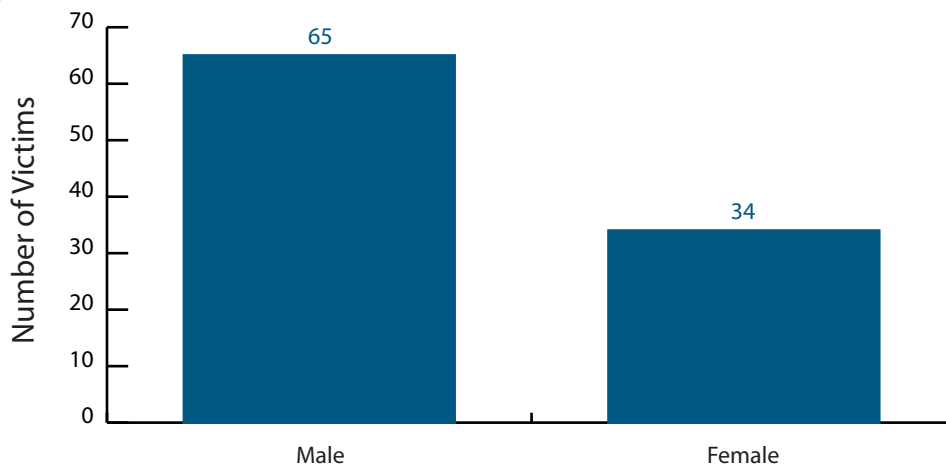


Table 3.3 presents a tally of the age breakdown of fire fatality victims. Persons aged 70 and over accounted for 23 deaths (25%). This age group is thus over-represented in fire fatalities when compared to the percentage of persons in this age group for Victoria (25% fire fatalities versus 9% in the Victorian population). An overrepresentation of fatalities occurred also among persons aged between 0-4, with 8 deaths (9%) in this age group. This age group represented 9% of the Victorian fire fatality victims, and yet this age group only comprises 7% of the Victorian population.

Table 3.3 Age of Victorian Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of VIC population
0 – 4 years	8	8.08%	7%
5 – 9 years	1	1.01%	7%
10 – 14 years	3	3.03%	7%
15 – 19 years	1	1.01%	7%
20 – 24 years	5	5.05%	7%
25 – 29 years	2	2.02%	8%
30 – 34 years	6	6.06%	8%
35 – 39 years	5	5.05%	8%
40 – 44 years	8	8.08%	8%
45 – 49 years	6	6.06%	7%
50 – 54 years	7	7.07%	6%
55 – 59 years	8	8.08%	5%
60 – 64 years	4	4.04%	4%
65 – 69 years	4	4.04%	4%
70 – 74 years	7	7.07%	3%
75 – 79 years	4	4.04%	3%
80 – 84 years	5	5.05%	2%
85 +	7	7.07%	1%
Unknown age	8	8.08%	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

FINDINGS

- **The majority of fire fatality victims were male (66%).**
- **Fire fatality victims were over represented in both the 0-4 and 70 and older age groups.**

Ethnicity and Occupations of the Victims

In 96% of cases the victims' ethnicity and occupation was not recorded. Therefore, these analyses were not performed.

3.4 Property Type and Ownership

A classification of the property types where fire fatalities occurred was performed. Note that 29 (29%) of cases were not determined or unrecorded. Of the remaining 70 cases, the most common property type was as follows: 56 (80%) were in houses, 7 (10%) were in units/apartments, 3 (4%) were in sheds/garages and 3 (4%) were in other residential areas. The property status was not recorded for any fire fatality cases.

FINDING

- **Fire fatalities were most likely to occur in houses (56 victims, 80%).**

3.5 Major Cause of Fatal Fires

In 50 (51%) fatalities, the cause of the fire was either undetermined or not recorded. Of the remaining 49 cases, the majority of fires were caused by: heater/open fire/lamp (11 victims, 22%), smoking materials/equipment (9 victims, 18%), smoking in bed (6 victims, 12%), electrical fault (6 victims, 12%) and accident/explosion (5 victims, 10%).

FINDING

- **The majority of fatalities occurred in fires caused by smoking materials/equipment (22.4%).**

3.6 Cause of Death

The cause of death was undetermined/unrecorded for 72 (73%) cases. Of the remaining 27 cases, the most common causes were smoke inhalation/poisoning (14 victims, 51.8%), not as a direct cause of fire (5 victims, 19%), burns/incineration (4 victims, 15%), and smoke inhalation/burns (3 victims, 11%).

FINDING

- **The majority of fatality victims died as a result of smoke inhalation/poisoning.**

3.7 Smoke Alarms

Of the 99 cases, data on whether or not a smoke alarm was present at the time of the fire was not recorded in 27 (27%) incidents. Of the remaining 72 cases, in the majority of incidents (38, 53%) of a smoke alarm was recorded as being present. However, in 34 (47%) of the fatal fires a smoke alarm was recorded as not being present. Of the 38 incidents where a smoke alarm was present, 31 (82%) were recorded as functioning at the time of the fire.

FINDINGS

- **The majority of homes (53%) were recorded as having a smoke alarm present at the time of the fatal fire.**
- **Of the homes that did have an alarm present, 82% of them were recorded as functioning at the time of the fire.**

4. WESTERN AUSTRALIA

4.1 Overview

In Western Australia during the period from December 1999 to October 2003 there were 25 residential fires that resulted in 27 deaths. Of the 25 residential fires during this 5-year period there were 2 fires that resulted in multiple fatalities, refer to Table 4.2. In total these 2 fires claimed the lives of 4 victims.

Table 4.1 presents the number of fire fatalities that occurred in Western Australia in each financial year, and also presents how many deaths in Western Australia per 100,000 resulted from fire. As can be seen, there was a peak in the number of fire fatalities in the 2002/03 financial years.

Table 4.1 Fire Deaths in Western Australia

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Number of Victims	Not available at time of research	Not available at time of research	Not available at time of research	1	7	5	10	4*
Deaths per 100,000	Not available at time of research	Not available at time of research	Not available at time of research	0.05	0.38	0.27	0.54	0.21

* Data only available up to mid-October 2003 – please view this result with caution.

Figure 4.1 compares the number of fire fatalities per 100,000 per financial year in Western Australia to the number of fire fatalities per 100,000 nationally. As can be seen the Western Australia fire fatality rate has been generally higher than the national fire fatality trend across the 5 year recording period, with a peak occurring in 2002/03.

Figure 4.1 Fire Deaths in Western Australia Compared to the National Trend

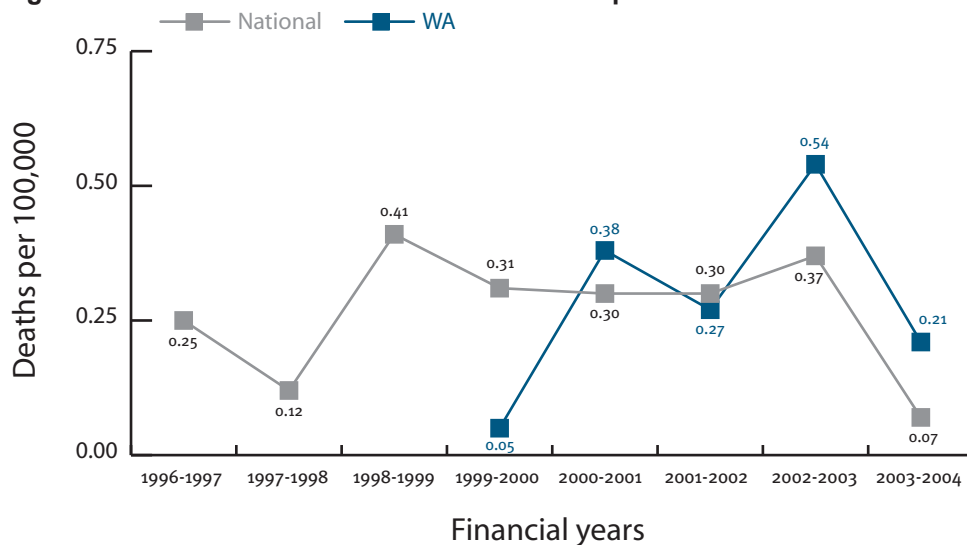


Table 4.2 Western Australia Fires that Caused Multiple Deaths

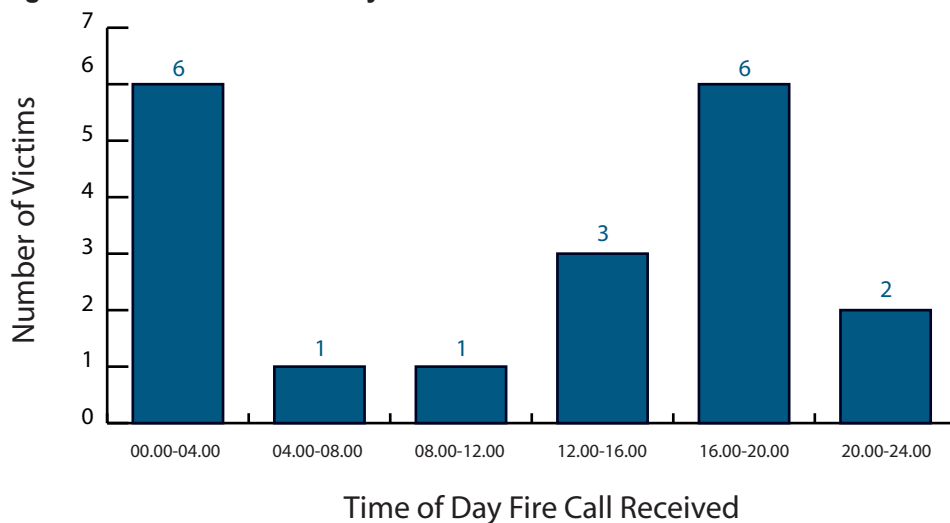
Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	-	-	-	-
1997/1998	-	-	-	-
1998/1999	-	-	-	-
1999/2000	1	1	0	0
2000/2001	6	7	1	2
2001/2002	5	5	0	0
2002/2003	9	10	1	2
2003/2004	4	4	0	0

4.2 Time of Fatal Fires

Time of Day

Figure 4.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. Of the 27 recorded deaths due to fire, a time of day was not recorded for 8 (30%) cases. As can be seen from the figure two peak times for fire fatalities are evidenced. The first peak was between the dinner hours of 16.00-20.00, in which 6 (32%) fire fatalities occurred. Another peak time for fire fatalities was during the sleeping times of midnight – 4am also in which 6 (32%) fire fatalities occurred.

Figure 4.2 Deaths Time of Day



FINDING

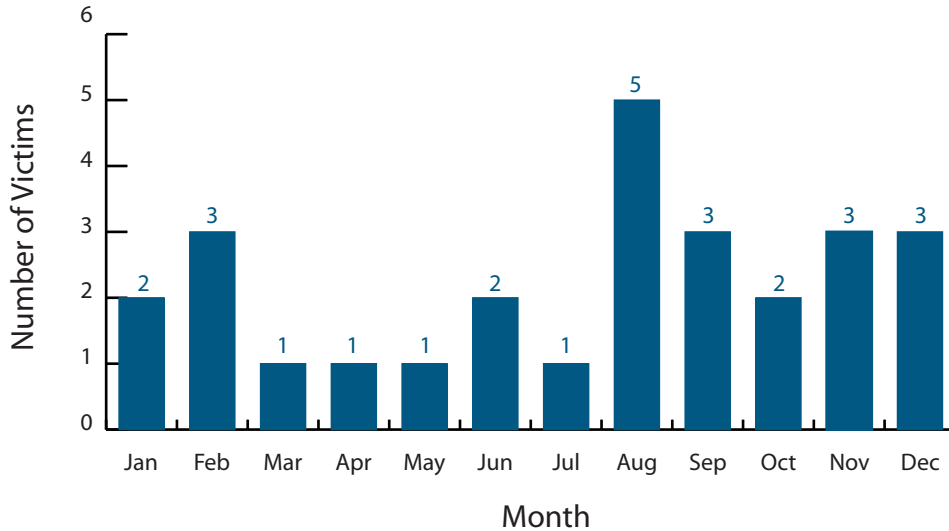
- **The time period when most fire fatalities occurred was between the dinner hours of 4pm – 8pm and between the sleeping hours of midnight- 4am. A total of 63% of fire fatalities occurred during these two peak times.**

Month of the Year

Figure 4.3 displays the frequency of fire fatalities collapsed across years for each calendar month. Fatality rates peaked during the second half of the year, with 17 (63%) of the 27 fire fatalities occurring between the months of July-December. Furthermore, a peak was evidenced during the cooler months of August and September. During these two months 8 (30%) fire fatalities occurred. Of these 8 fire fatalities the main fire causes were smoking materials/equipment (3 victims, 38%), and electrical faults (3 victims, 38%).

There was also another peak in fire fatalities over the warm months from November–February, with 11 (41%) fire fatalities occurring in these four months. Of the 11 cases the cause of 3 (27%) was not recorded. Of the remaining 8 fatalities the major cause of fires were: electrical distribution/lighting (3 victims, 27%), and lighter/matches (2 victims, 18%).

Figure 4.3 Deaths per Month (period 1996/97 to 2003/04)



FINDING

- The majority of fire deaths occurred during the cooler months of August-September (29.6%) and the warmer months of November-February (41%).

4.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Figure 4.4 depicts the gender breakdown of fire fatality victims. Of the 27 Western Australia fire fatality victims, the majority were male (18 victims, 67%).

Figure 4.4 Gender of Fire Victims

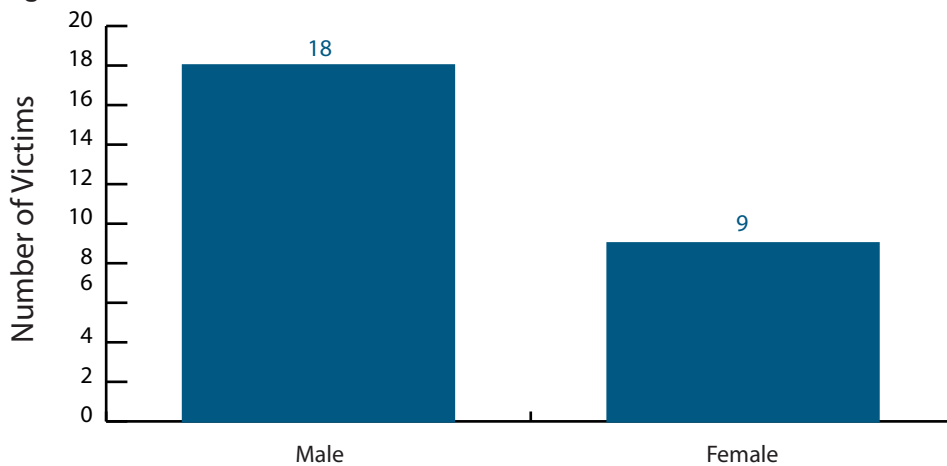


Table 4.3 presents a tally of the age breakdown of fire fatality victims. Persons aged 75 and over accounted for 7 deaths (26%). This age group is thus over-represented in fire fatalities when compared to the percentage of persons in this age group that comprise the Western Australian population 26% fire fatalities versus 4% in the Western Australian population. An over-representation of fatalities occurred also among persons aged between 0-4, with 5 deaths in this age group. This age group represented 19% of the Western Australian Fire fatality victims, and yet this age group only comprises 7% of the Western Australian population.

Table 4.3 Age of Western Australia Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of WA population
0 – 4 years	5	19%	7%
5 – 9 years	1	4%	7%
10 – 14 years	0	0%	7%
15 – 19 years	1	4%	7%
20 – 24 years	0	0%	7%
25 – 29 years	2	7%	7%
30 – 34 years	3	11%	8%
35 – 39 years	1	4%	8%
40 – 44 years	2	7%	8%
45 – 49 years	0	0%	7%
50 – 54 years	0	0%	6%
55 – 59 years	1	4%	5%
60 – 64 years	0	0%	4%
65 – 69 years	1	4%	3%
70 – 74 years	0	0%	3%
75 – 79 years	3	11%	2%
80 – 84 years	1	4%	1%
85 +	3	11%	1%
Unknown age	3	11%	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

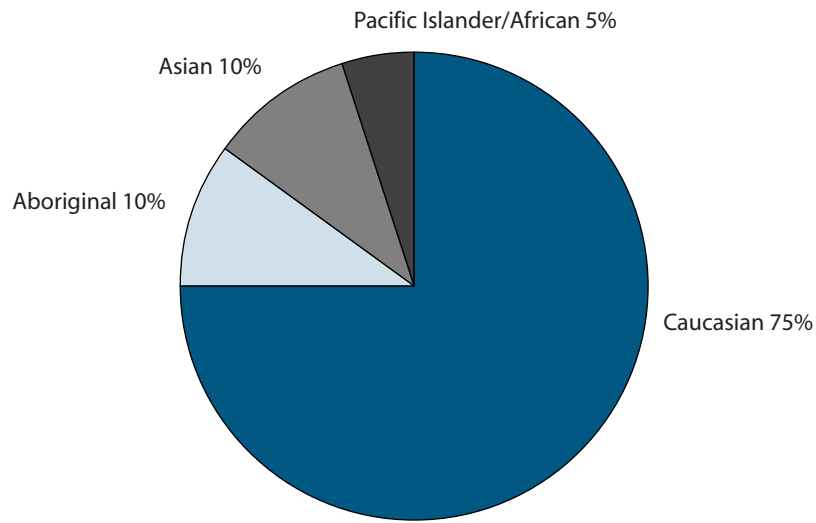
FINDINGS

- **The majority of fire fatality victims were male (67%)**
- **Fire fatality victims were over-represented in both the 0-4 years and 75+ age groups.**

Ethnicity of the Victims

Figure 4.5 represents the ethnicity of fire victims. Of the 27 victims the ethnicity of 7 (26%) was unknown/not recorded. The ethnic breakdown of the remaining victims is presented in figure 4.5 below, as can be seen the majority of victims were Caucasian (75%).

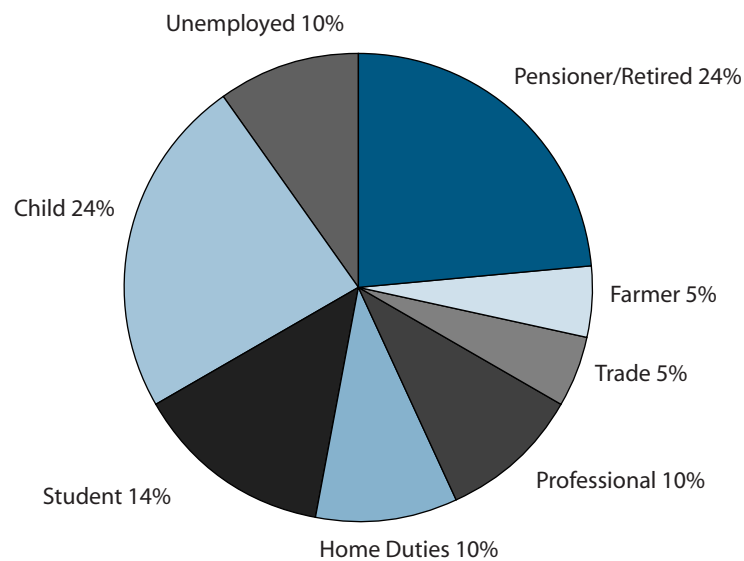
Figure 4.5 Ethnicity of Fire Fatality Victims



Occupations of the Victims

Figure 4.6 presents a detailed breakdown of the victims' occupations. Of the 27 Western Australian fire fatality victims, the occupation of 6 (22%) was undetermined or not recorded. Of the remaining, the majority were pensioners/retired (5 victims, 24%), 5 (24%) were children and students (3 victims, 14%).

Figure 4.6 Occupational Breakdown of Victims



FINDING

- The majority of fire death victims were recorded as being pensioners/retired (24%).

4.4 Property Type and Ownership

A classification of the property type where fire fatalities occurred could not be performed as no data on property type and status was recorded.

4.5 Major Cause of Fatal Fires

In 5 (19%) fatality cases, the cause of the fire was either undetermined or not recorded. Of the remaining 22 cases, the majority of fires were caused by smoking materials/equipment (8 victims, 36%), heater/ open fire/ lamp (8 victims, 36%), and electrical faults (5 victims, 23%).

FINDING

- **The majority of fires were caused either by smoking materials/equipment (36%) or heater/open fire/lamp (36%).**

4.6 Cause of Death

The cause of death was undetermined/unrecorded for 5 (19%) cases. Of the remaining cases, the 2 most common causes were smoke inhalation/poisoning (15 victims, 68%) and burns/incineration (7, 32%).

FINDING

- **The majority of fatality victims died as a result of smoke inhalation/poisoning or burns/incineration.**

4.7 Smoke Alarms

Of the 27 cases, 21 (78%) did not have smoke alarms and 6 (22%) had an alarm. Of the 6 cases where a smoke alarm was present in the home, 3 (50%) were not functioning at the time of the fire.

FINDINGS

- **The majority of homes did not have a smoke alarm installed (78%).**
- **Of the homes that did have an alarm present, 50% of the alarms were not working at the time of the fire.**

5. SOUTH AUSTRALIA

5.1 Overview

In South Australia during the period from July 1998 to June 2004 there were 14 residential fires that resulted in 17 deaths. Please note there was no data available for the financial years 2001/02 and 2002/2003. Of the 14 residential fires during this 4-year period there were 2 fires that resulted in multiple fatalities, refer to Table 5.2. In total these 2 fires claimed the lives of 5 victims.

Table 5.1 presents the number of fire fatalities that occurred in South Australia in each financial year, and also presents how many deaths in South Australia per 100,000 that resulted from fire. As can be seen, there was a peak in fire fatalities in the following three financial years: 1998/1999 and 2003/2004. There were no fire fatalities recorded in the database for each of the remaining financial years.

Table 5.1 Fire Deaths in South Australia

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Number of Victims	Not available at time of research	Not available at time of research	6	3	1	Not available at time of research	Not available at time of research	7
Deaths per 100,000	Not available at time of research	Not available at time of research	0.40	0.20	0.07	Not available at time of research	Not available at time of research	0.05

Figure 5.1 compares the number fire fatalities per 100,000 per financial year in South Australia with the number fire fatalities per 100,000 nationally. As can be seen the South Australian fire fatality rate has been generally lower than the national fire fatality trend across the 4-year recording period.

Figure 5.1 Fire Deaths in South Australia Compared to the National Trend

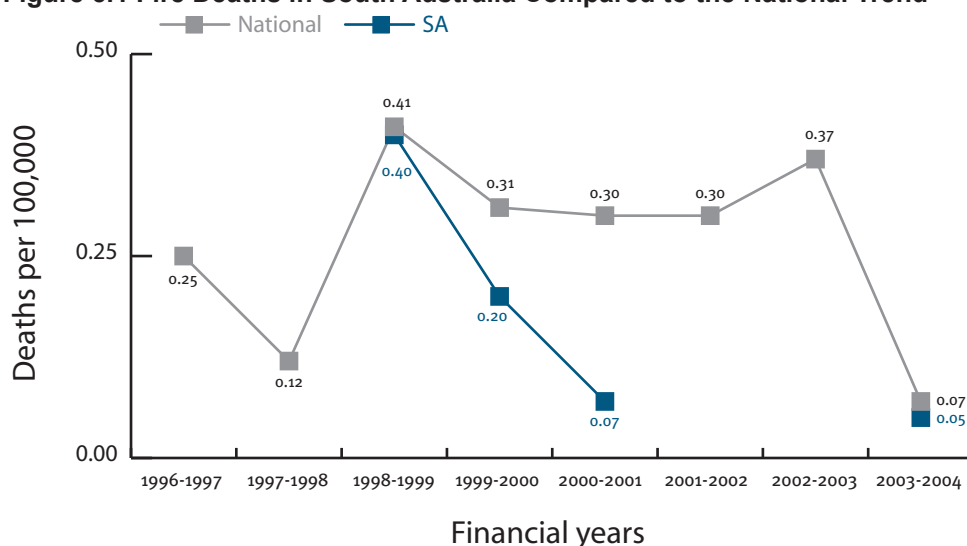


Table 5.2 South Australian Fires that Caused Multiple Deaths

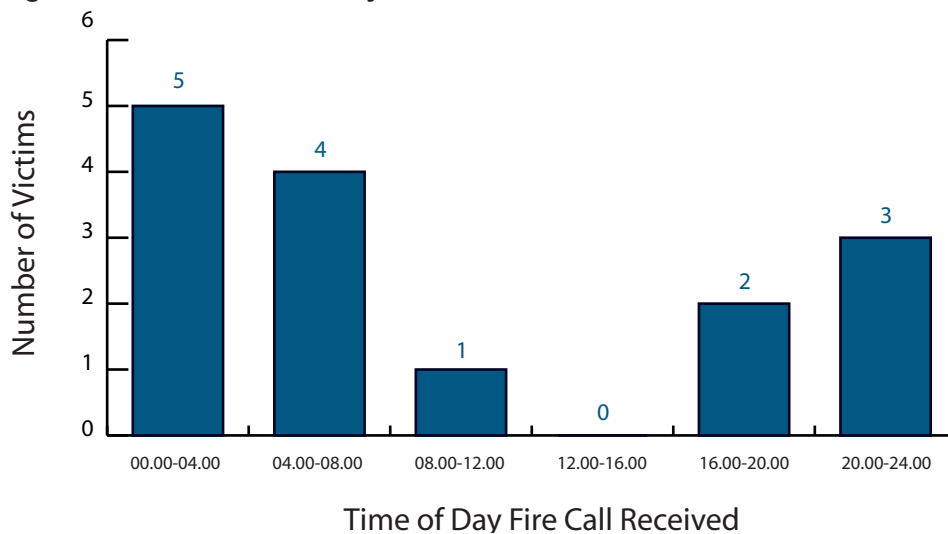
Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	-	-	-	-
1997/1998	-	-	-	-
1998/1999	5	6	1	2
1999/2000	1	3	1	3
2000/2001	1	1	0	0
2001/2002	-	-	-	-
2002/2003	-	-	-	-
2003/2004	7	7	0	0

5.2 Time of Fatal Fires

Time of Day

Figure 5.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. Of the 17 recorded fires, a time of day was not recorded for 2 cases. As can be seen from the figure below, 12 (71%) occurred during the sleeping times of 8pm- 8am, a further 2 (12%) occurred during the dinner hours of 4pm- 8pm.

Figure 5.2 Deaths Time of Day



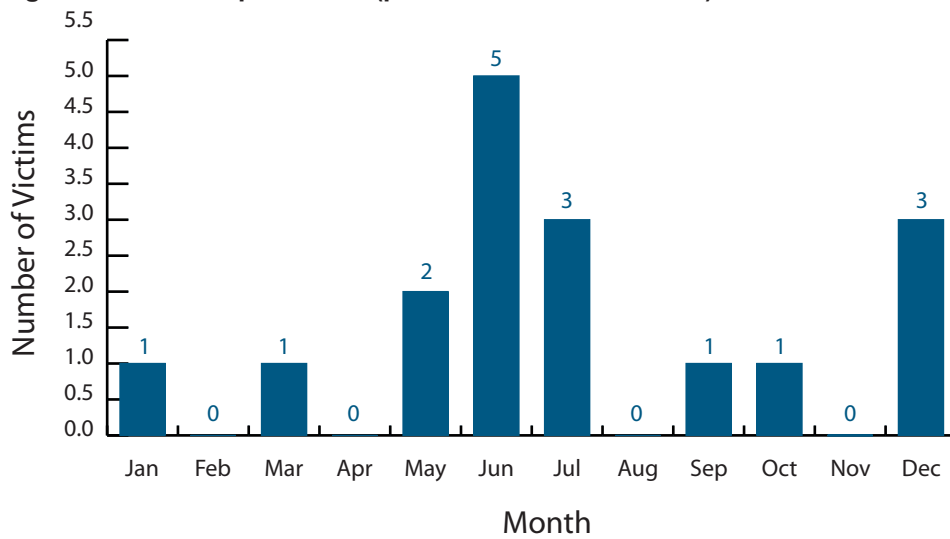
FINDING

- The time period when most fire fatalities occurred was between the general sleeping times of 8pm – 8am (71%).

Month of the Year

Figure 5.3 displays the frequency of fire fatalities collapsed across years for each calendar month. The majority of fires (10 victims, 71%) occurred during the cooler months of the year, from May to July. Of the 10 fire fatalities that occurred during these cooler months the cause of 3 (30%) was not recorded. Of the remaining fires 4 (40%) were caused by heater/open fire/ lamp, 2 (20%) were caused by kitchen fire/cooking materials and 1 (10%) by smoking in bed.

Figure 5.3 Deaths per Month (period 1996/97 to 2003/04)



FINDINGS

- The majority of fire deaths (71%) occurred during the cooler months of the year from May to July.
- The major cause of fires during these cooler months was heater/open fire/ lamp (40%).

5.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Of the 17 South Australian fire fatalities, the gender of 1 case was not recorded, however there was an equal number of male (8 victims, 50%) and female victims (8, victims 50%). Figure 5.4 depicts the gender breakdown of fire fatality victims.

Figure 5.4 Gender of Fire Victims

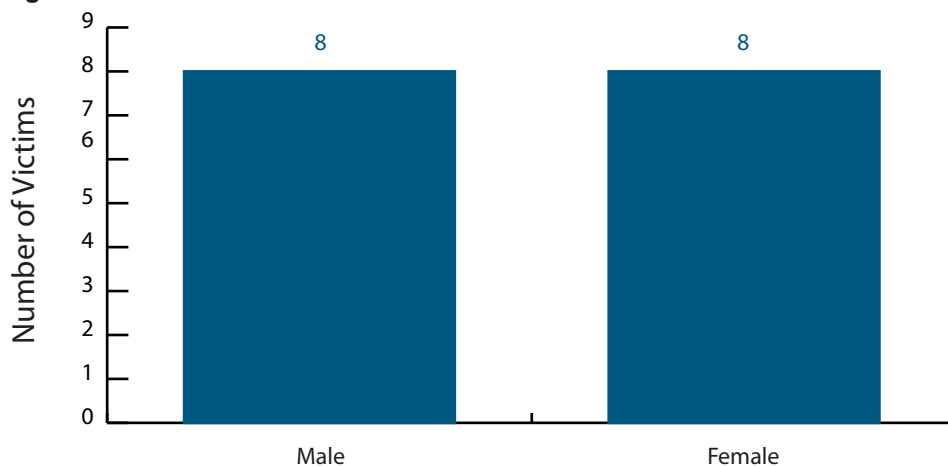


Table 5.3 presents a tally of the age breakdown of fire fatality victims. An age was not recorded for 11 (65%) of fire fatality victims. Therefore, no conclusions about the age pattern of fire victims can be drawn from the data.

Table 5.3 Age of South Australian Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of SA population
0 – 4 years	0	0	6%
5 – 9 years	0	0	7%
10 – 14 years	0	0	7%
15 – 19 years	0	0	7%
20 – 24 years	0	0	7%
25 – 29 years	0	0	7%
30 – 34 years	0	0	7%
35 – 39 years	1	6%	8%
40 – 44 years	1	6%	8%
45 – 49 years	0	0	7%
50 – 54 years	0	0	7%
55 – 59 years	0	0	5%
60 – 64 years	0	0	4%
65 – 69 years	0	0	4%
70 – 74 years	0	0	4%
75 – 79 years	0	0	3%
80 – 84 years	3	18%	2%
85 +	1	6%	2%
Unknown age	11	65%	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

FINDINGS

- **There was an equal number of male and female fire fatality victims.**
- **18% of the known fire fatality victims were over 80.**

Occupations of the Victims

No data on the occupational status of South Australian fire fatality victims was recorded.

5.4 Property Type and Ownership

A classification of the property types where fire fatalities occurred was performed. Of the 17 cases, 2 (12%) did not have this data recorded. Of the remaining cases 12 (80%) occurred in a house, 1 (7%) occurred in a unit/apartment, 1 (7%) occurred in a caravan/mobile home and 1 (7%) occurred in a shed/garage. In terms of property ownership, 9 cases were not recorded. Of the remaining 8 cases all (100%) residential properties were classified as owner occupied.

5.5 Major Cause of Fatal Fires

In 6 (35%) of the fires, the cause of the fire was either undeterminable or not recorded. Of the remaining 11 fires there were three main causes; open fires/heaters/lamp (4 victims, 36.5%); electrical faults/candle (4 victims, 36.5%) and kitchen fire/cooking materials (2 victims, 18%).

5.6 Cause of Death

A cause of death was not recorded for 10 (59%) of the 17 South Australian fire fatality victims. Of the remaining victims, 5 died of burns/incineration and 2 of natural causes.

5.7 Smoke Alarms

For 8 fires no data on whether or not a smoke alarm was present was recorded. Of the remaining 9, 8 were recorded as having an alarm present, of which 4 (50%) was determined to be not working at the time of the fire.

6. TASMANIA

6.1 Overview

In Tasmania during the period from August 1996 to July 2002 there were 27 structural fires that resulted in 33 deaths. Of the 27 structural fires during this 6-year period there were 4 fires that resulted in multiple fatalities, refer to Table 6.2. In total these 4 fires claimed the lives of 10 victims.

Table 6.1 presents the number of fire fatalities that occurred in Tasmania in each financial year, and also presents how many deaths in Tasmania per 100,000 that resulted from fire.

As can be seen, there was a peak in the number of fire fatalities in the 1996/97, 1998/99 and 2000/01 financial years.

The increase in fire fatalities during the 1996/97 and 1998/99 financial years may be partly attributable to the fact that in both financial years fires resulting in multiple deaths were recorded, thus inflating the total number of recorded victims (refer to table 6.2).

Table 6.1 Fire Deaths in Tasmania

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Number of Victims	8	3	11	3	7	1	Not available at time of research	Not available at time of research
Deaths per 100,000	1.69	0.63	2.32	0.63	1.27	0.21	Not available at time of research	Not available at time of research

Figure 6.1 compares the number fire fatalities per 100,000 per financial year in Tasmania with the number fire fatalities per 100,000 nationally. As can be seen the Tasmanian fire fatality rate has been generally higher than the national fire fatality trend across the 6-year recording period, with the exception of 2001/02.

Figure 6.1 Fire Deaths in Tasmania Compared to the National Trend

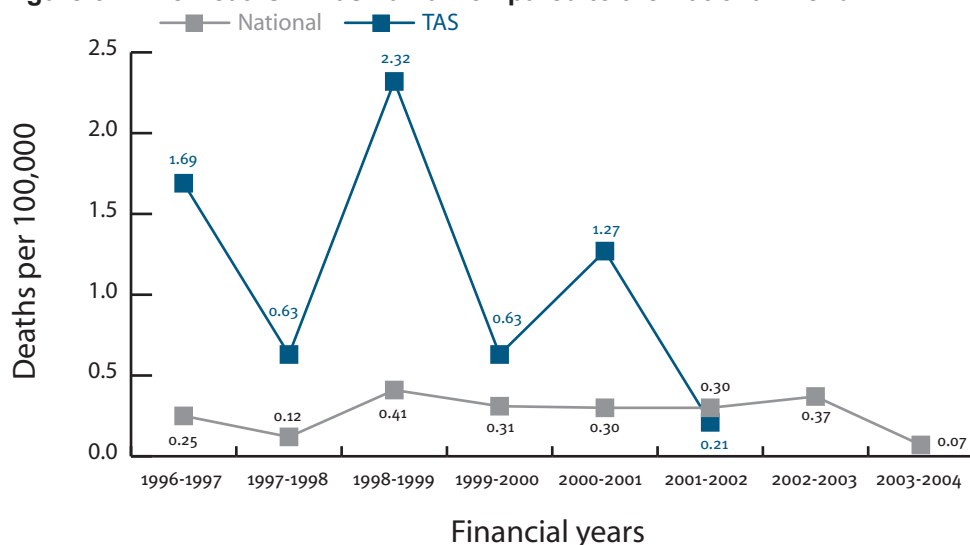


Table 6.2 Tasmanian Fires that Caused Multiple Deaths

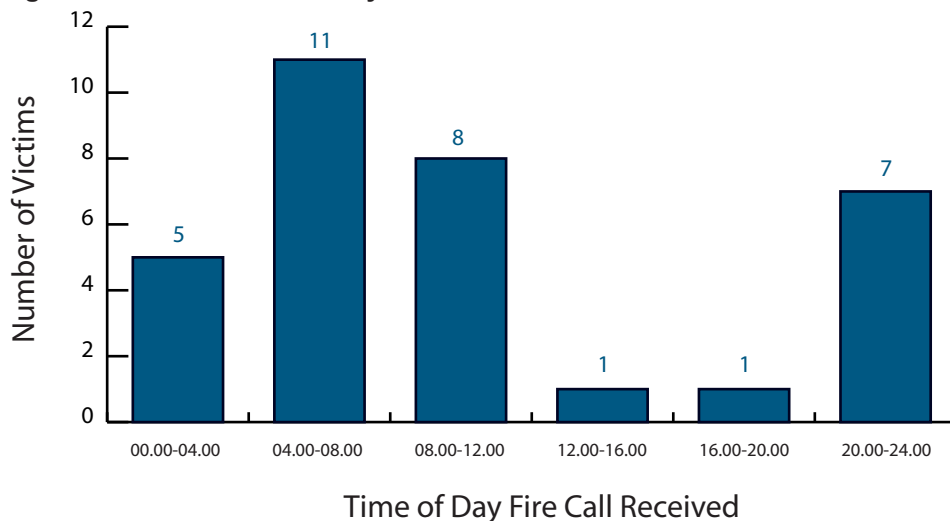
Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	4	8	2	6
1997/1998	3	3	0	0
1998/1999	9	11	2	4
1999/2000	3	3	0	0
2000/2001	7	7	0	0
2001/2002	1	1	0	0
2002/2003	-	-	-	-
2003/2004	-	-	-	-

6.2 Time of Fatal Fires

Time of Day

Figure 6.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. Of the 33 recorded fatalities the majority (23 victims, 70%) occurred during the sleeping times of 8pm- 8am, with a further 8 (24%) victims dying between 8am and 12 noon.

Figure 6.2 Deaths Time of Day



FINDING

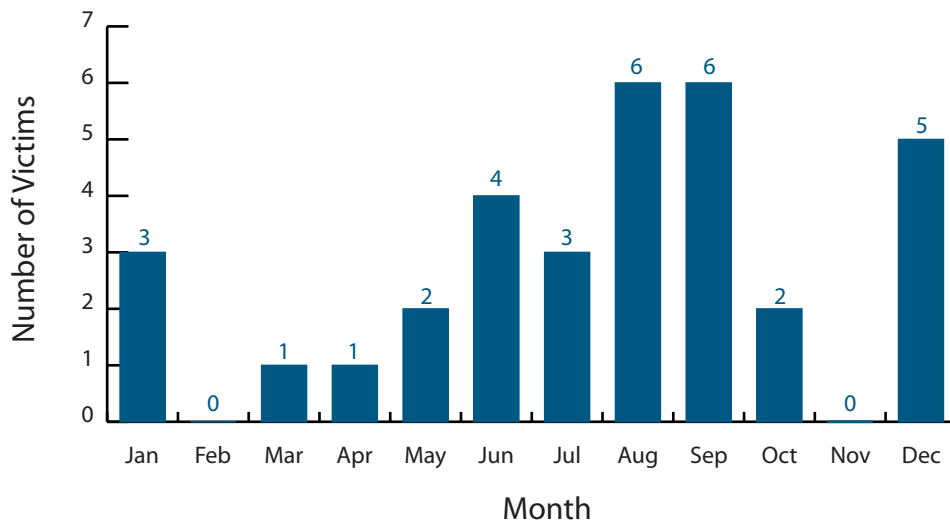
- The time period when most fire fatalities occurred was between the general sleeping times of 8pm – 8am.

Month of the Year

Figure 6.3 displays the frequency of fire fatalities collapsed across years for each calendar month. The only months where fire deaths were not recorded were in February and November. The majority of fires (21 victims, 64%) however occurred during the cooler months of the year, from June to October. Of the 21 fire fatalities that occurred during these cooler months the cause of 2 (10%) was not recorded. Where a cause was recorded, the majority, 8 (38%), was attributable to heater/open fire/ lamp and a further 3 (14%) was attributable to smoking materials/equipment.

In addition, there was also a peak in fire fatalities over the holiday months of December and January (8 victims, 24%). Over-interpretation of this later peak is cautioned however, as 4 of the total 8 deaths during this period occurred as a result of the one fire. Furthermore, 5 (63%) of these victims who died during this Christmas period registered a blood alcohol reading, this is likely to be consistent with the finding that individuals consume more alcohol over the festive season. The cause of the fire in these 8 incidents was undetermined/not recorded in 4 (50%) instances. Of the remaining 4 incidents, 1 (33%) was caused by an electrical fault, 1 caused by smoking in bed, 1 by a bead head light and 1 caused by an unattended gas lamp.

Figure 6.3 Deaths per Month (period 1996/97 to 2003/04)



FINDINGS

- The majority of fire deaths occurred during the cooler months of the year. A total of 39% of fire deaths occurred in the winter months of June, July and August. An additional 24% occurred in September and October.
- Other peaks occurred in the holiday months of December and January, with 24% of fire deaths occurring in these two months alone.

6.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Of the 23 Tasmanian fire fatalities, the majority (21 victims, 64%) of victims were male. Figure 6.4 depicts the gender breakdown of Tasmanian fire fatality victims.

Figure 6.4 Gender of Fire Victims

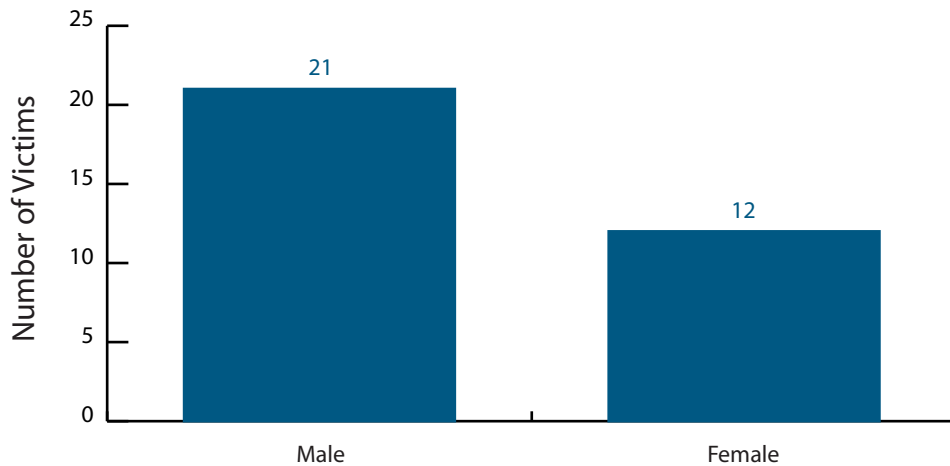


Table 6.3 presents a tally of the age breakdown of Tasmanian fire fatality victims. There appears to be three peak ages. Firstly, the majority of victims (13 victims, 39%) were aged 60 years or older. Another substantial portion of the fire fatality victims (7 victims, 21%) were children aged between 0 and 9 years.

Both the very young and the elderly are over-represented in residential fire fatalities when compared to the overall proportion of individuals who fall within these age brackets within Tasmania’s total population (refer to Table 6.3 below). There was also a small, yet still noteworthy peak of deaths in the 20-29 year old age bracket (5 victims, 15%). Of the 5 fire fatality victims aged between 20-29, 100% registered a blood alcohol level (BAL) that was above the legal 0.05 intoxication level (BAL ranged from .168-.309).

Table 6.3 Age of Tasmanian Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of TAS population
0 – 4 years	5	15%	7%
5 – 9 years	2	6%	7%
10 – 14 years	0	0	7%
15 – 19 years	0	0	7%
20 – 24 years	2	6%	6%
25 – 29 years	3	9%	6%
30 – 34 years	0	0	7%
35 – 39 years	2	6%	8%
40 – 44 years	2	6%	8%
45 – 49 years	1	3%	7%
50 – 54 years	1	3%	6%
55 – 59 years	2	6%	5%
60 – 64 years	3	9%	4%
65 – 69 years	0	0	4%
70 – 74 years	3	9%	4%
75 – 79 years	3	9%	3%
80 – 84 years	2	6%	2%
85 +	2	6%	1%
Unknown age	0	0	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

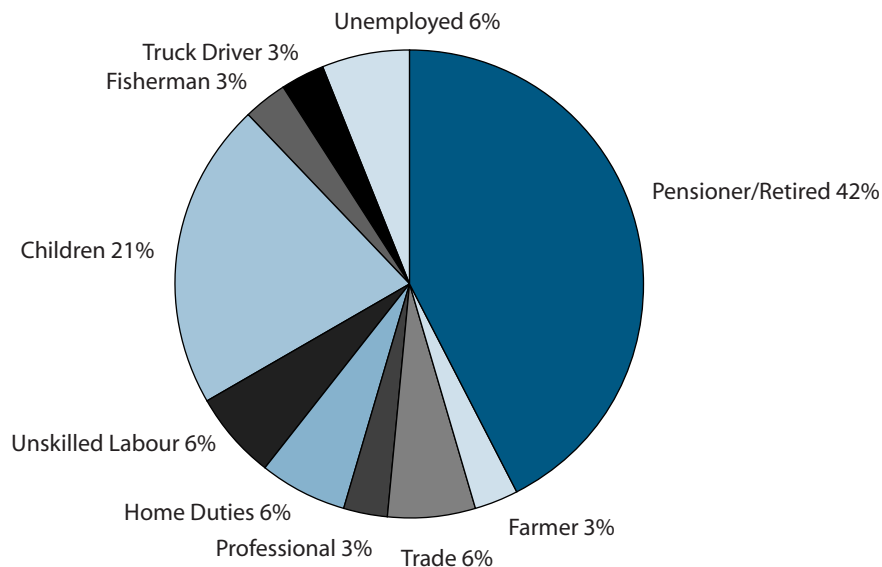
FINDINGS

- The majority of fire fatality victims were male (64%).
- The majority of victims were either young children aged between 0-9 years (21%) or elderly persons aged 60 years and older (39%).
- 100% of victims aged between 20 and 29 years registered a 'legally intoxicated' (i.e., greater than 0.05) blood alcohol level.

Occupations of the Victims

Of 33 Tasmanian fire fatality victims 7 (21%) were children. Of the remaining victims, the majority (42%) were pensioners/retired. This finding is consistent with the previously mentioned trend that the majority of fire victims were aged 65 years or older. Figure 6.5 presents a more detailed breakdown of the victims' occupations.

Figure 6.5 Occupational Breakdown of Victims



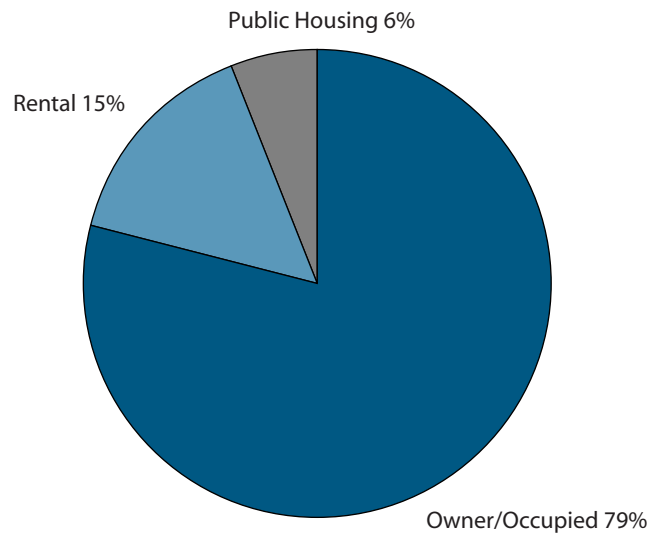
FINDING

- The majority of fire death victims were recorded as being pensioners / retired (42%).

6.4 Property Type and Ownership

A classification of the property types where fire fatalities occurred was performed. Of the 33 cases, 29 (88%) of fire fatalities occurred in residential houses. Figure 6.6 below provides the complete breakdown of the property type where fire fatalities occurred. As mentioned earlier the proportion of owner occupied, rental and public housing should be taken into consideration when interpreting these results.

Figure 6.6 Property Status Where Fire Fatality Occurred



FINDING

- Fire fatalities were most likely to occur in premises that were classified as owner occupied (26 victims, 79%).

6.5 Major Cause of Fatal Fires

In 4 (12%) of the fires the cause of the fire was either undeterminable or not recorded. Of the remaining 29 fires there was an array of causes; the 3 most prevalent causes were open fires/heaters/lamp (14 victims, 48%); electrical faults (6 victims, 21%); and 3 victims (10%) for both smoking in bed; and smoking materials/equipment.

FINDING

- The majority of fires, 69%, were caused either by open fires/heaters or electrical faults.

6.6 Cause of Death

Of the 33 victims, the most common causes of death were smoke inhalation/ poisoning which accounted for 15 (45%) fatalities, and smoke inhalation/burns which accounted for 13 (39%) fatalities.

FINDINGS

- The majority of victims died from smoke inhalation alone (45%).
- An additional 39% died from a combination of smoke inhalation and burns.

6.7 Smoke Alarms

For 3 fatalities no data on whether a smoke alarm was present was recorded. In 19 (63%) homes no smoke alarm was present. Only 11 (37%) homes were recorded as having an alarm present, of which 3 (27%) were not working at the time of the fire.

FINDINGS

- The majority of homes did not have a smoke alarm installed (63%).
- Of the homes that did have an alarm present, 27% of the alarms were not work at the time of the fire.

7. AUSTRALIAN CAPITAL TERRITORY

7.1 Overview

In the Australian Capital Territory the exact recording period is unknown. Only the dates of two fatalities have been recorded during the general period of 1996 to 2004 there were 2 residential fires that resulted in 2 deaths. There were no multiple fatality fires during this 8-year period.

Table 7.1 presents the number of fire fatalities that occurred in the Australian Capital Territory in each financial year, and also presents how many deaths in the Australian Capital Territory per 100,000 that resulted from fire. In general, there have been very few fatal fires in the last 8 years.

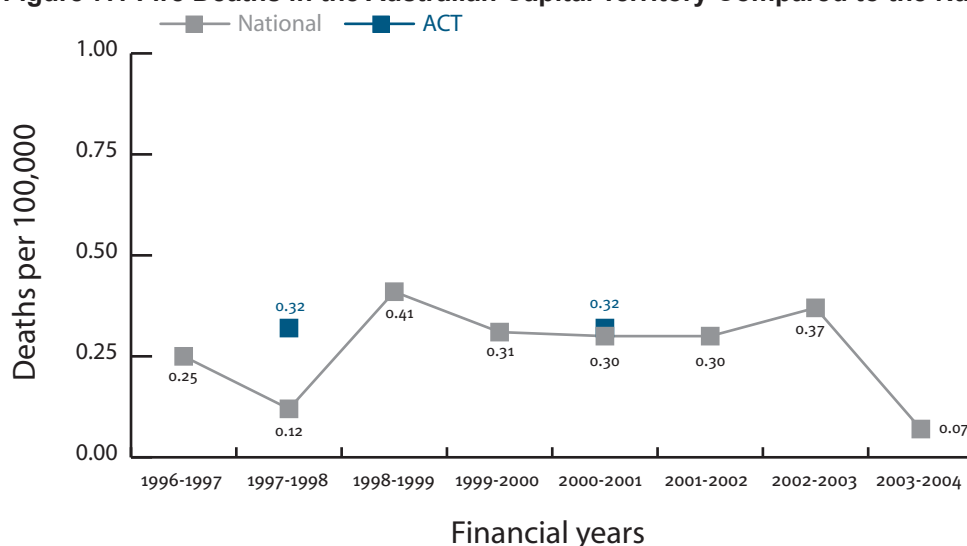
Figure 7.1 compares the number of fire fatalities per 100,000 per financial year in the Australian Capital Territory to the number fire fatalities per 100,000 nationally. As can be seen the Australian Capital Territory fire fatality rate has been lower than the national fire fatality trend.

Table 7.1 Fire Deaths in the Australian Capital Territory

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Number of Victims	0	1	0	0	0	1	0	0
Deaths per 100,000	0	0.32	0	0	0	0.32	0	0

* Please view these results with caution as data may not be complete.

Figure 7.1 Fire Deaths in the Australian Capital Territory Compared to the National Trend

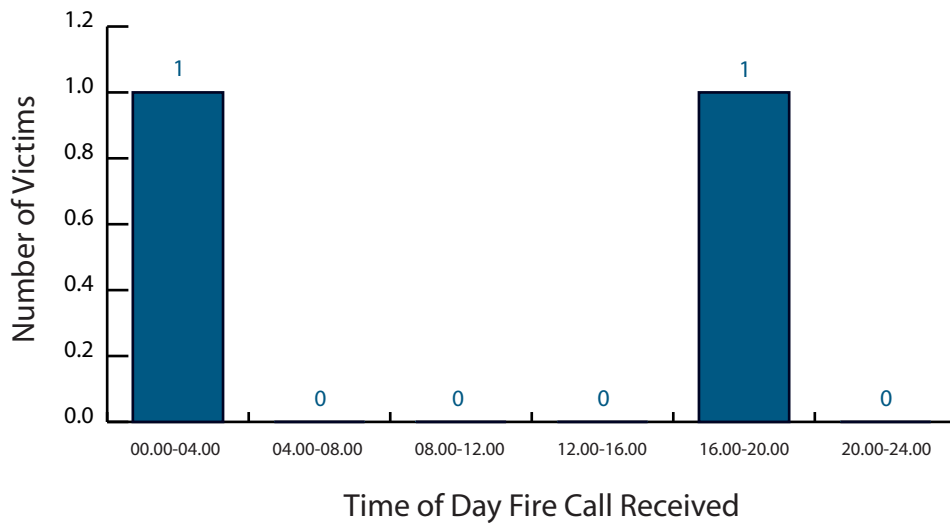


7.2 Time of Fatal Fires

Time of Day

Figure 7.2 illustrates the time when the fires occurred. This information was determined from the time of the fire call. A fire service alarm time was recorded in all cases. As can be seen from the figure below 1 fire occurred during the sleeping period of midnight- 4am and 1 occurred during the dinnertime hours between 4pm-8pm.

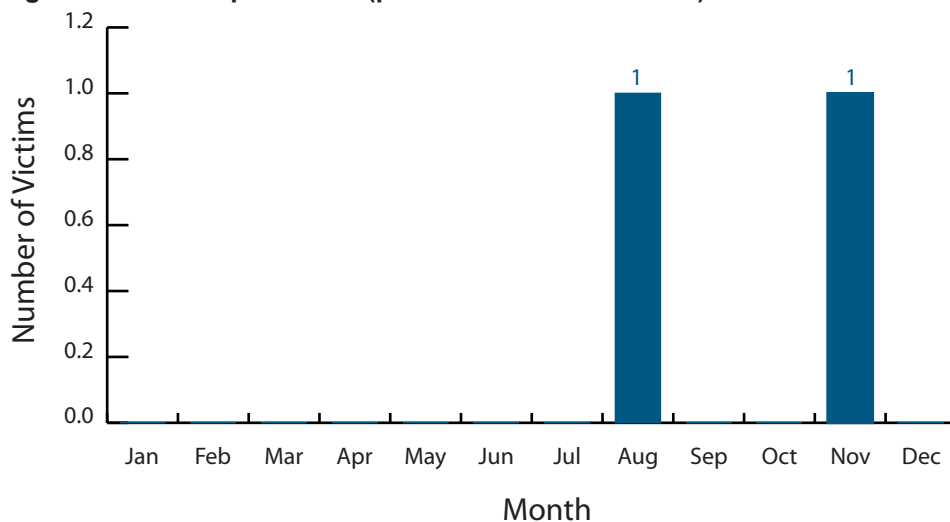
Figure 7.2 Deaths Time of Day



Month of the Year

Figure 7.3 depicts the number of fire deaths per calendar months, collapsed across the 8 years. As can be seen, one fire occurred in August, the other in November. The cause of 1 fire was undetermined, and the other was attributable to smoking materials/equipment.

Figure 7.3 Deaths per Month (period 1996/97 to 2003/04)



7.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Of the 2 Australian Capital Territory fire fatalities, there was 1 male and 1 female victim. Figure 7.4 depicts the gender breakdown of the fire fatality victims.

Figure 7.4 Gender of Fire Victims

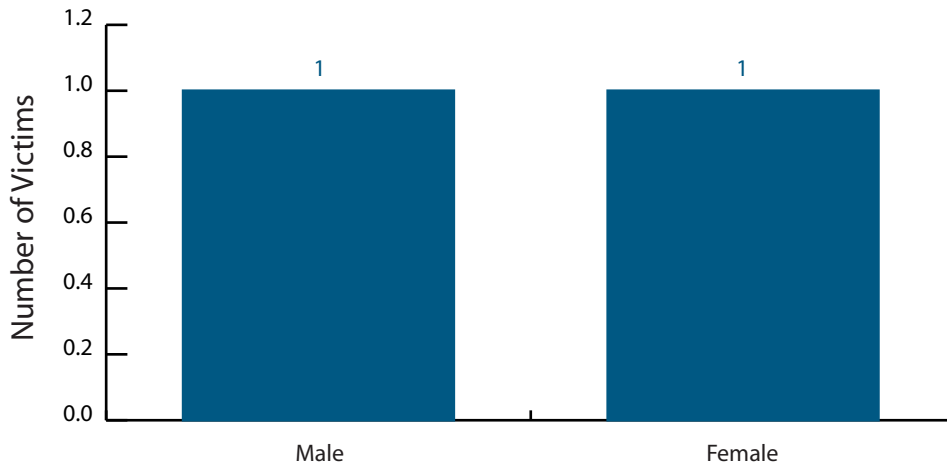


Table 7.2 presents a tally of the age breakdown of the fire fatality victims. The age of 1 victim was not recorded, the other victim was aged between 0-4 years.

Table 7.2 Age of ACT Fire Death Victims (Male, Female and Total no. of Victims)

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of ACT population
0 – 4 years	1	50%	7%
5 – 9 years	0	0	7%
10 – 14 years	0	0	7%
15 – 19 years	0	0	8%
20 – 24 years	0	0	8%
25 – 29 years	0	0	8%
30 – 34 years	0	0	8%
35 – 39 years	0	0	8%
40 – 44 years	0	0	8%
45 – 49 years	0	0	8%
50 – 54 years	0	0	7%
55 – 59 years	0	0	5%
60 – 64 years	0	0	3%
65 – 69 years	0	0	3%
70 – 74 years	0	0	2%
75 – 79 years	0	0	2%
80 – 84 years	0	0	1%
85 +	0	0	1%
Unknown age	1	50%	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

Occupations of the Victims

One of the Australian Capital Territory fire fatality victims was a child and the other was not recorded.

7.4 Property Type and Ownership

A classification of the property types where fire fatalities occurred was performed. One fire occurred in a residential house and the other occurred in a shed/garage. Ownership was undetermined or not recorded.

7.5 Major Cause of Fatal Fires

Of the 2 fatal fires the cause of 1 was undeterminable/not recorded. The other fire was attributable to smoking materials/equipment.

7.6 Cause of Death

The cause of death was undeterminable/not recorded for both fire fatalities.

7.7 Smoke Alarms

Data on the presence of a smoke alarm was not recorded for 1 of the fire fatalities. In the other case a smoke alarm was not present.

8. AUSTRALIA

8.1 Overview

Data from Northern Territory was not available at the time this report was produced and, therefore, not included in the following analyses. In Australia during the period from July 1996 to June 2004 there were 366 residential fires recorded which resulted in 412 deaths. Of the 366 residential fires during this 8-year period there were 32 fires, which resulted in multiple fatalities, refer to Table 8.2. In total these 32 multiple-fatality fires claimed the lives of 78 victims.

Table 8.1 presents the number of fire fatalities that occurred in Australia in each financial year and also presents how many deaths in Australia per 100,000 resulted from fire. As can be seen, there was a peak in the number of fire fatalities in the 1998/99, 1999/00 and 2002/03. The peak in fire fatalities during the 1998/99 financial year may be partly attributable to an elevated number of deaths, which resulted from multiple-fatality fires during this year. Figure 8.1 graphs the number of fire fatalities per 100,000 per financial year in Australia.

Table 8.1 Fire Deaths in Australia

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	Year Unknown
Number of Victims	47	22	78	59	57	58	74	15	2
Deaths per 100,000	0.25	0.12	0.41	0.31	0.30	0.30	0.37	0.07	Unable to calculate

* Please view with caution as data is not complete across all states and territories.

Figure 8.1 Australian National Fire Fatality Trend

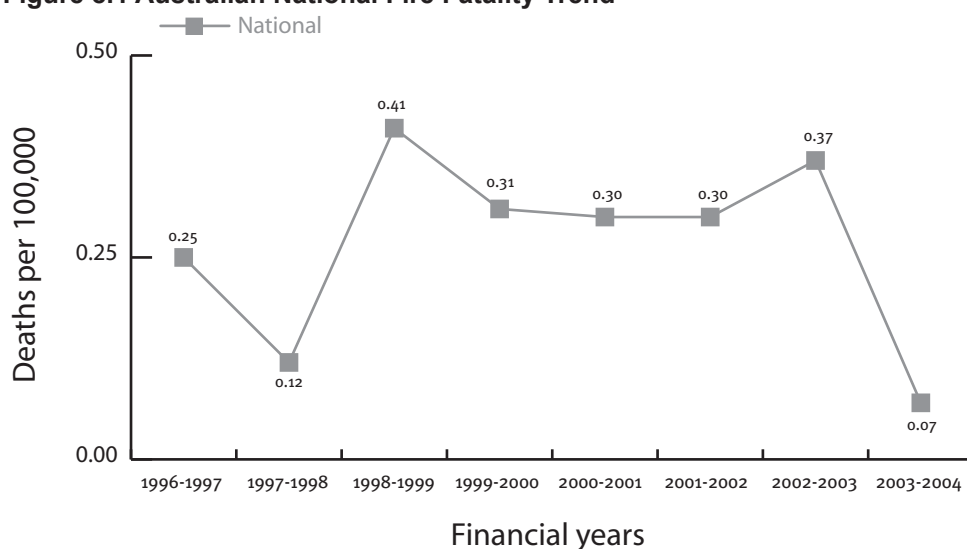


Table 8.2 Australian Fires that Caused Multiple Deaths

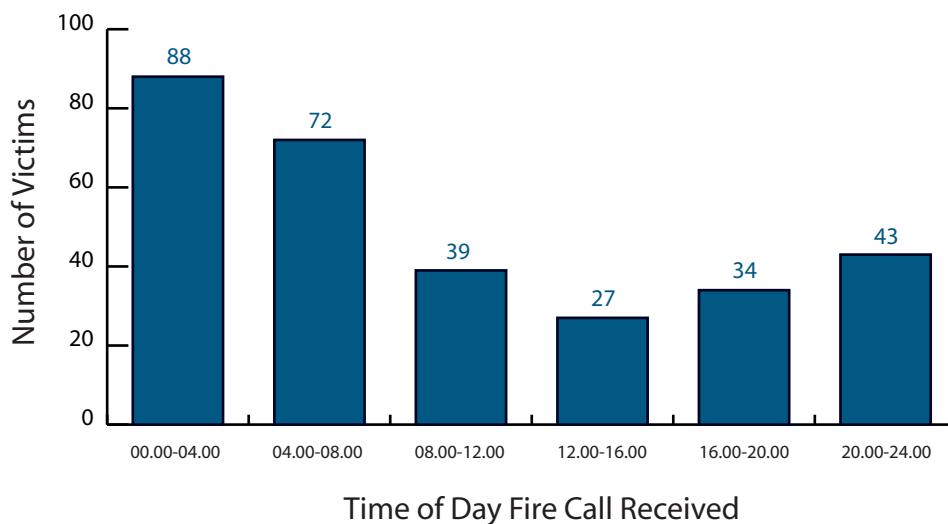
Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	34	47	8	20
1997/1998	19	22	2	5
1998/1999	62	78	12	28
1999/2000	56	59	1	5
2000/2001	56	57	1	2
2001/2002	58	58	0	0
2002/2003	64	74	7	18
2003/2004	15	15	0	0
Year Unknown	2	2	-	-

8.2 Time of Fatal Fires

Time of Day

Figure 8.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. Of the 412 recorded deaths a time of day was not recorded for 109 (26%). Of the remaining 303 cases, 217 (72%) occurred during the sleeping times of 8pm - 8am. The research indicates that in terms of time of day, fatal fires usually occur at night or early in the morning when victims may be sleeping and unaware that a fire has taken place or too confused to respond (Shai & Lupinacci, 2003).

Figure 8.2 Deaths Time of Day



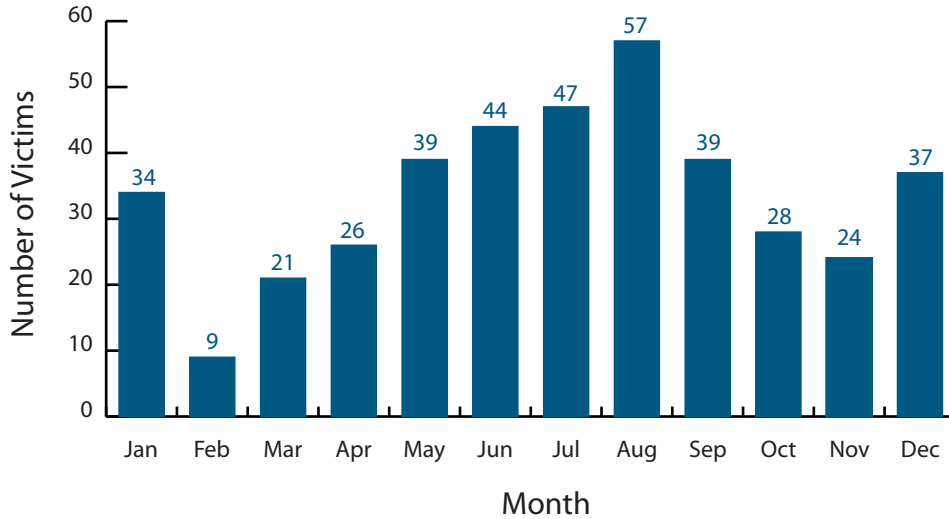
FINDING

- The time period when most fire fatalities occurred was between the general sleeping times of 8pm – 8am (72%).

Month of the Year

Figure 8.3 displays the frequency of fire fatalities collapsed across years for each calendar month. The time of year was not recorded for 7 fires. Fatality rates peaked during the cooler months from May to September (226 victims, 56%). Additional peaks in fire fatalities also occurred in the holiday and Christmas period from December-January (71 victims, 18%).

Figure 8.3 Deaths per Month (period 1996/97 to 2003/04)



FINDING

- The majority of fire deaths occurred during the cooler months from May-September (56%).

8.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Figure 8.4 depicts the gender breakdown of fire fatality victims. Of the 412 Australia fire fatalities, the gender for 25 (6%) was not recorded. Of the remaining 387 victims the majority were male (233 victims, 60%). This finding is consistent with worldwide research that males have a higher death rate from residential fires compared to females (Cropp, 1991; Ontario Fire Reporting System, 2004; United States Fire Administration, 2003; Shai & Lupinacci, 2003; Barillo & Goode, 1996; Istre, McCoy; Hall, 2004).

Figure 8.4 Gender of Fire Victims

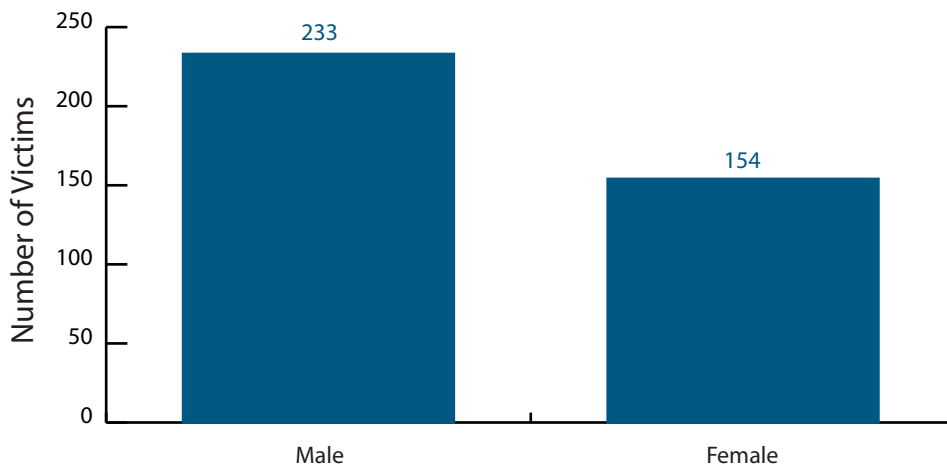


Table 8.3 presents the age breakdown of fire fatality victims. People aged 65 and over accounted for 92 or 22% of fire fatality victims. This age group is over-represented in the number of fire fatality victims as this age group only accounts for 13% of the Australian population.

According to the United States Fire Administration (NFPA; cited in Barillo & Goode, 1996), of the 5,000 fire victims each year, more than 1,200 are senior citizens. NFPA estimates that those aged 65 or over have a fire death rate over twice that of the national average. The risk increases to three times the national average at age 75 and to 4 times the average at age 85. A similar elevated pattern is evidenced in the United Kingdom with one-quarter of fatal dwelling-house fire deaths occurring amongst elderly people (Duncanson, Woodward, Langley, Clements & Harris, 2000).

Petraglia (1991), Leth, Gregersen, and Sabroe (1998) cite several reasons for why the elderly are at highest risk of a fire fatality. They maintain that the elderly suffer from diminished visual acuity, depth perception, hearing and odour perception, a faltering sense of balance, and slower movements and reflexes. Together with other impairments caused by medications and chronic ailments, older people are more likely to suffer serious disability and even death from accidents. With reduced sensory ability, the elderly are less able to recognize dangerous warning signs related to fires and their reduced mobility may limit the ability to escape. Elderly people also do not recover from smoke exposure as easily as their younger counterparts, and smoke may exacerbate existing respiratory problems. Petraglia (1991) also maintains that another reason for increased fire fatality rates in the elderly is that many are intimately involved with the ignition of the fire that caused their deaths (e.g., smoking materials, cooking).

Table 8.3 Age of Australian Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Total no. Victims	% of Total	Age group as a % of AUS population
0 – 4 years	34	8%	7%
5 – 9 years	9	2%	7%
10 – 14 years	8	2%	7%
15 – 19 years	11	3%	7%
20 – 24 years	16	4%	7%
25 – 29 years	19	5%	7%
30 – 34 years	16	4%	8%
35 – 39 years	21	5%	8%
40 – 44 years	23	5%	8%
45 – 49 years	19	5%	7%
50 – 54 years	22	5%	6%
55 – 59 years	17	4%	5%
60 – 64 years	19	5%	4%
65 – 69 years	14	3%	4%
70 – 74 years	20	5%	3%
75 – 79 years	16	4%	3%
80 – 84 years	21	5%	2%
85 +	24	6%	1%
Unknown age	84	20%	N/A

*Source: Average of ABS Estimated Resident Population June Quarter 1996 to 2003. The percentage totals may not add up to 100% due to the rounding of individual age brackets.

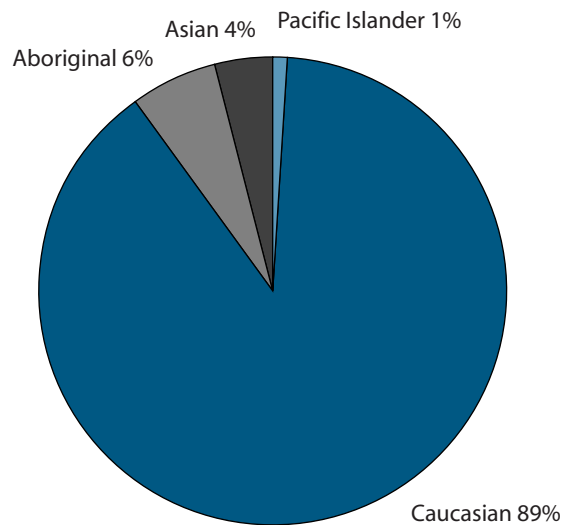
FINDINGS

- The majority of fire fatality victims were male (60%).
- Victims aged 65 and over were over-represented in fire fatalities, with this age group alone accounting for 22% of the fire fatalities.
- Children aged between 0 and 4 years were also over-represented in relation to fire fatalities.

Ethnicity of the Victims

Figure 8.5 displays the ethnicity of Australian fire fatality victims. However, over-interpretation of these results is cautioned, as the ethnicity of fatality victims was not recorded/ unknown in most cases (344 victims, 83%).

Figure 8.5 Ethnicity of Fire Fatality Victims



FINDING

- Most fatalities occurred among Caucasian (89%), although over-interpretation of these findings should be cautioned due to the large number of missing cases.

Occupations of the Victims

Of the 412 Australian fire fatality victims, the occupation of 296 (72%) were undetermined or not recorded. Of the remaining 116 victims, 21 (18%) were classified as children and the majority were pensioners/ retired (27.5%).

FINDING

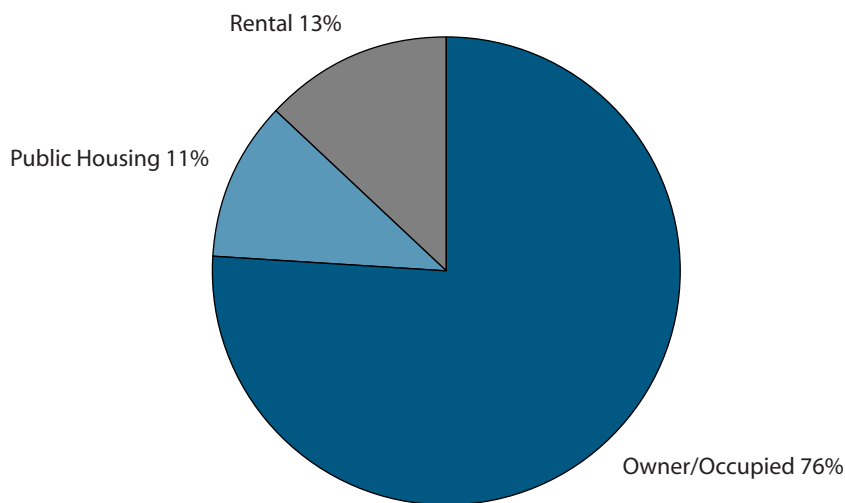
- A large proportion of fire death victims were recorded as being pensioners/ retired (27.5%) and children (18%).

8.4 Property Type and Ownership

A classification of the property types where fire fatalities occurred was performed. Of the 412 fatalities, the property type was not recorded in 128 (31%) of incidents. Of the remaining 284 incidents, the most common property types were as follows: houses (80%) and units/apartments (6%).

Figure 8.7 below provides a breakdown of the property ownership status where fire fatalities occurred. Note that the ownership status for 327 (79%) cases was undetermined or not recorded.

Figure 8.6 Property Status Where Fire Fatality Occurred



FINDING

- Fire fatalities were most likely to occur in houses (80%) that were classified as owner occupied (76%).

8.5 Major Cause of Fatal Fires

In 224 (54%) fatality cases, the cause of the fire was either undetermined or not recorded. Of the remaining 188 cases, 47 (25%) were due to smoking material/equipment, 44 (23%) were due to electrical faults, and 50 (27%) were due to heater/open fire/lamp.

FINDING

- The majority of fires (74%) were caused either by electrical faults, smoking materials or heaters/open fires/lamps.

8.6 Cause of Death

Cause of Death

The cause of death was undetermined/not recorded for 271 (66%) cases. Of the remaining 141 cases, the 4 most common causes were as follows: 61 (43%) were due to smoke inhalation/poisoning, 32 (23%) were due to burns/incineration, 16 (11%) smoke inhalation/burns and 12 (9%) were due to a combination of causes.

FINDING

- **The majority of victims died from smoke inhalation/poisoning (43%) and burns/incineration (23%). Again, caution should be taken in interpreting this data, given the large number of undetermined/unrecorded cases.**

8.7 Smoke Alarms

Of the 412 cases, data on whether or not a smoke alarm was present was not recorded/undetermined in 240 (58%) of the incidents. In the remaining 172 cases, 94 (55%) did not have a smoke alarm present, and 78 (45%) had an alarm present. Of the 78 cases where a smoke alarm was present, 24 (31%) were not functioning at the time of the fire.

FINDINGS

- **The majority of homes did not have a smoke alarm installed (55 %).**
- **Of the homes that did have an alarm present, 31% of the alarms were not working at the time of the fire.**

9. NEW ZEALAND

9.1 Overview

In New Zealand during the period from July 1996 to September 2003, there were 126 residential fires that resulted in 155 deaths. Of the 126 residential fires during this 8-year period there were 19 fires that resulted in multiple fatalities (refer to Table 9.2). In total these 19 multiple-fatality fires claimed the lives of 52 victims.

Table 9.1 displays the number of fire fatalities that occurred in New Zealand in each financial year, and also presents how many deaths per 100,000 that resulted from fire. As can be seen, there were an elevated number of deaths in the 1996/97, 1997/98, 1998/99, 2001/02 and 2002/03 financial years.

The increased number of fires across each of these years may be partly attributable to the fact that fires resulting in multiple fatalities occurred in each year of recording (refer to Table 9.2), thereby acting to inflate the total number of recorded victims. Overall, there were fewer fires in the last 4 financial years (2000/01-2003/04) as compared to the previous 4 financial years (1996/97-1999/00), with 82 fires occurring in the earlier 4-years as compared to only 69 in the latter 4-years.

Figure 9.1 compares the number fire fatalities per 100,000 per financial year in New Zealand to the number fire fatalities per 100,000 in Australia. As can be seen the New Zealand fire fatality rate has been higher than the national fire fatality trend across the 8-year recording period, with the exception of 1999/00.

Table 9.1 Fire Deaths in New Zealand

Financial Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Number of Victims	27	21	23	14	17	26	23	4
Deaths per 100,000	0.70	0.54	0.60	0.36	0.44	0.67	0.60	0.10

Figure 9.1 Fire Deaths in New Zealand Compared to the Australian Trend

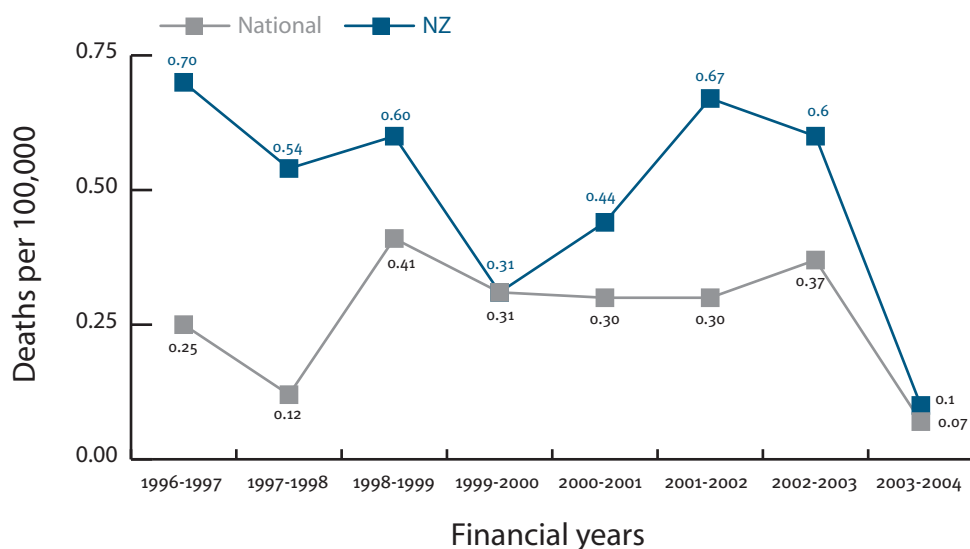


Table 9.2 New Zealand Fires that Caused Multiple Deaths

Financial Year	Total no. Fires	Total no. Victims	No. of fires where multiple deaths occurred	No. of victims in multiple fires
1996/1997	20	27	4	11
1997/1998	19	21	2	4
1998/1999	20	23	3	10
1999/2000	11	14	3	6
2000/2001	15	17	1	3
2001/2002	21	26	3	8
2002/2003	17	23	2	8
2003/2004	3	4	1	2

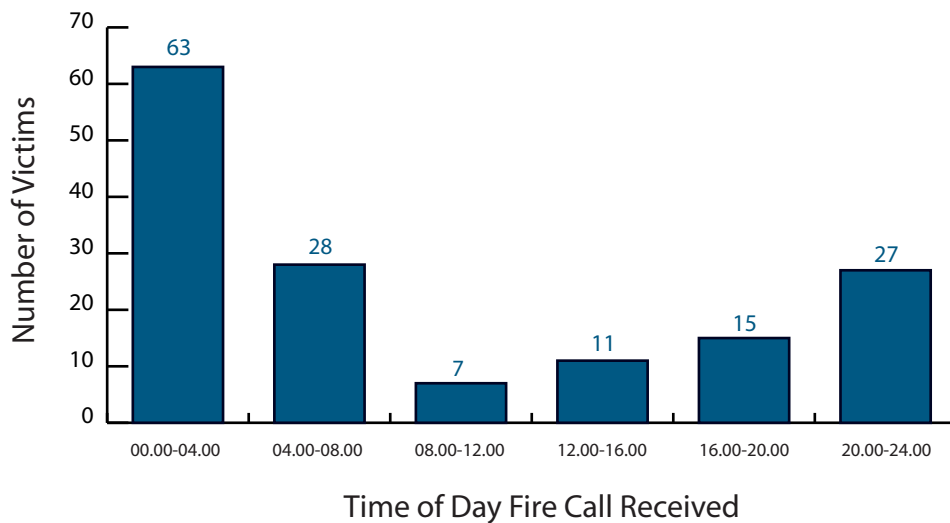
Of these 155 deaths, 4 victims were not confirmed and therefore have been excluded from the analyses, making subsequent analyses based on a total of 151 victims.

9.2 Time of Fatal Fires

Time of Day

Figure 9.2 illustrates the time of day when the fires occurred. This information was determined from the time of the fire call. As can be seen from the figure below, 118 (78%) occurred during the sleeping times of 8pm- 8am, with a peak occurring between midnight- 4am (63 victims, 42%).

Figure 9.2 Deaths Time of Day



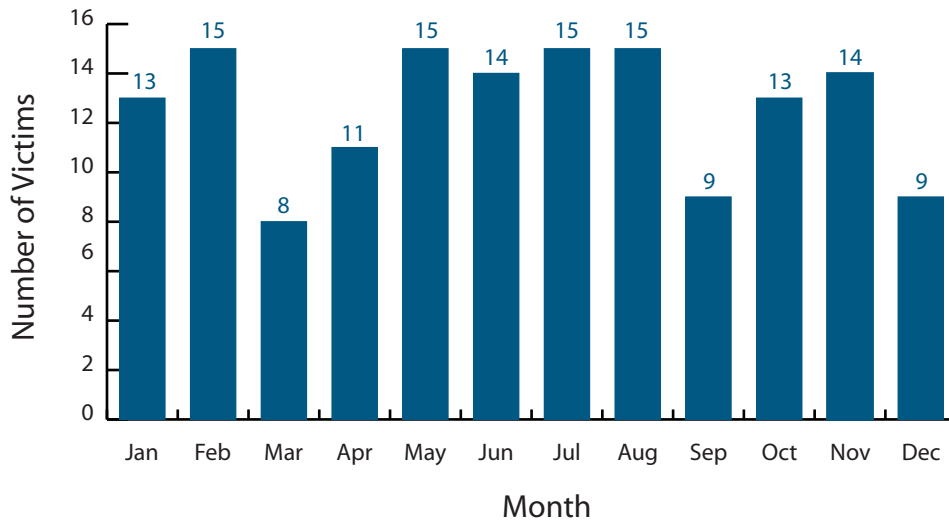
FINDING

- The time period when most fire fatalities occurred was between the general sleeping times of 8pm – 8am (78%), with a peak occurring between midnight- 4am (42%).

Month of the Year

Figure 9.3 displays the frequency of fire fatalities collapsed across years for each calendar month. Overall, fatalities were fairly evenly distributed over the year. However, a significant proportion of fatalities did occur across the cooler months of May to August, with 59 (39%) fatalities in total. Of the 59 fire fatalities that occurred during these cooler months the cause of fire for 11 (19%) cases was unknown. Where the cause was known, the main causes were smoking in bed (19%), smoking materials/equipment (19%), and heater/open fire/lamp (19%). A further 12 cases were caused by electrical (13%) and kitchen fires/cooking materials (13%).

Figure 9.3 Deaths per Month (period 1996/97 to 2003/04)



FINDING

- Fire fatalities occurred consistently throughout the year, although a significant proportion did occur during the cooler months of May to August (39%).

9.3 Demographics and Socioeconomic Characteristics of the Victims

Gender and Age of the Victims

Figure 9.4 depicts the gender breakdown of the fire fatality victims. Of the 151 New Zealand fire fatalities, the majority (89 victims, 59%) were male.

Figure 9.4 Gender of Fire Victims

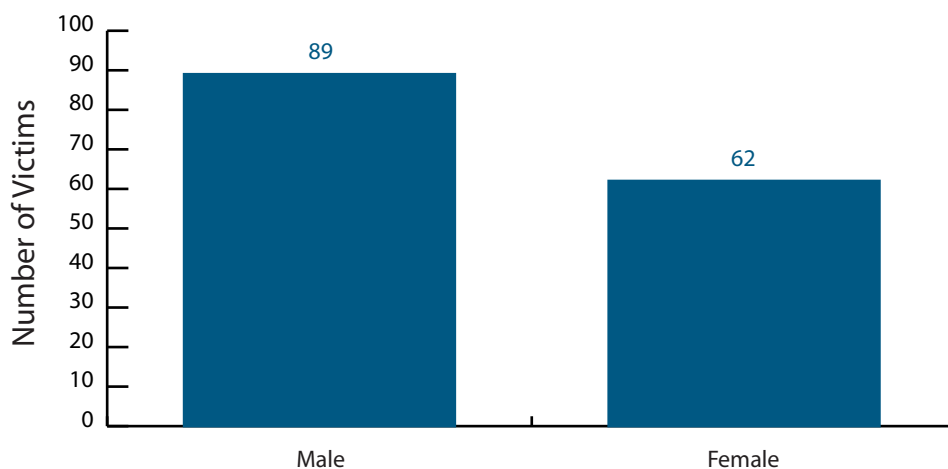


Table 9.3 presents the age breakdown of all fire fatality victims. There appears to be two major peak age groups. Specifically, an over-representation of fatalities occurred among persons aged between 0 and 9 years, with 41 deaths or 27%, compared to 15% of the New Zealand population within that age bracket. Most of these 41 cases were the result of fires caused by smoking materials/equipment (10 victims, 24%), playing with heat source (7 victims, 17%), and smoking in bed (5 victims, 12%). Another peak was recorded amongst persons aged 80 plus years, with 18 (12%) deaths occurring in this age group, compared to 3% of the New Zealand population within that age bracket. Of the 18 fatalities, the cause of death was unknown for 4 (3%) of cases. When the cause was known most were caused by electrical failure (3 victims, 17%), failure to use ordinary care (2 victims, 11%) and kitchen fires (2 victims, 11%).

Table 9.3 Age of New Zealand Fire Death Victims (Male, Female and Total no. of Victims)*

Age groupings (years)	Male	Female	Unknown Gender	Total no. Victims	% of Total	Age group as a % of NZ population
0 – 4 years	18	6	0	24	15.89%	7%
5 – 9 years	7	10	0	17	11.26%	8%
10 – 14 years	4	1	0	5	3.31%	8%
15 – 19 years	3	3	0	6	3.97%	7%
20 – 24 years	6	3	0	9	5.96%	7%
25 – 29 years	3	3	0	6	3.97%	7%
30 – 34 years	4	3	0	7	4.64%	8%
35 – 39 years	11	4	0	15	9.93%	8%
40 – 44 years	4	3	0	7	4.64%	7%
45 – 49 years	7	3	0	10	6.62%	7%
50 – 54 years	2	1	0	3	1.99%	6%
55 – 59 years	1	1	0	2	1.32%	5%
60 – 64 years	5	2	0	7	4.64%	4%
65 – 69 years	2	1	0	3	1.99%	3%
70 – 74 years	5	2	0	7	4.64%	3%
75 – 79 years	2	3	0	5	3.31%	2%
80 – 84 years	3	7	0	10	6.62%	2%
85 +	2	6	0	8	5.30%	1%
Unknown age	0	0	0	0	0	N/A

The percentage totals may not add up to 100% due to the rounding of individual age brackets.

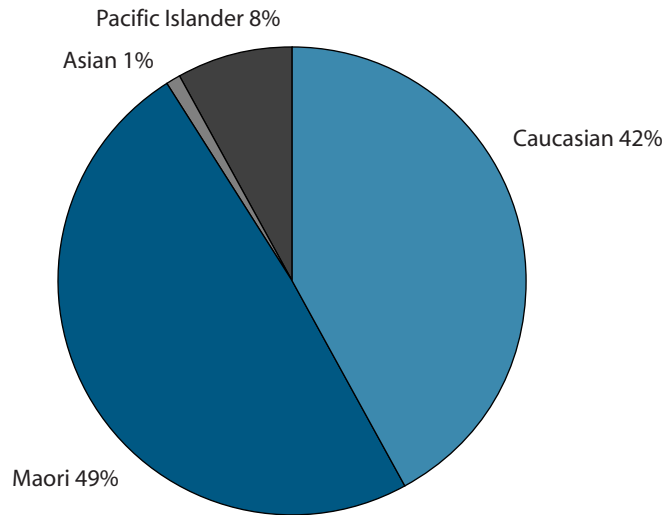
FINDINGS

- **The majority of fire fatality victims were male (59%).**
- **Disproportionately high fatality rates were recorded among young children from 0 to 9 years of age (27%) and those aged 80 plus years (12%).**

Ethnicity of Victims

Figure 9.5 presents a detailed breakdown of the fire victims' ethnicity. Of the 151 New Zealand fire fatality victims, the ethnicity of most victims was not recorded (53%). Of the remaining cases, most victims were Maori (49%), followed by Caucasian (36%).

Figure 9.5 Ethnicity Breakdown of Victims



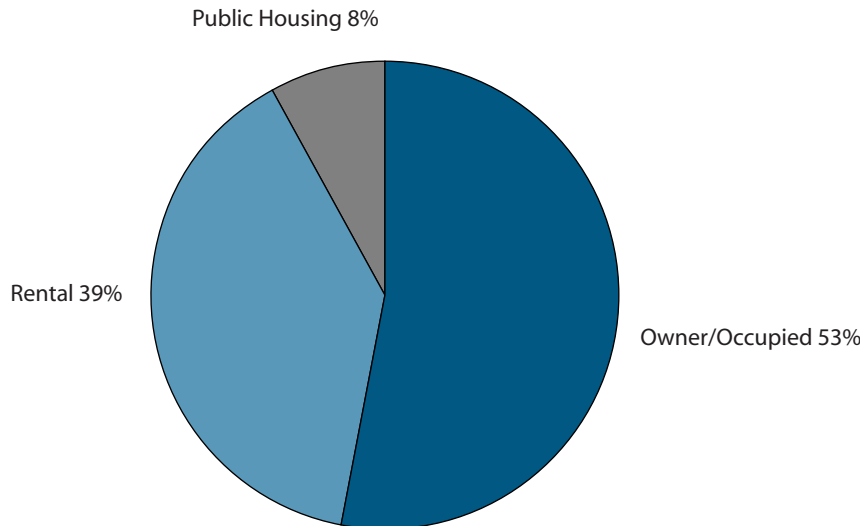
FINDING

- For fatalities where ethnicity was recorded, most fatality victims identified as being Maori (49%).

9.4 Property Type and Ownership

The property type for all 151 cases was not recorded. A classification of the property ownership status however was examined. For 28 (19%) incidents a property status was undetermined or not recorded. Of the remaining 123 cases, 65 (53%) fire fatalities occurred in residential houses. Figure 9.6 below provides the complete breakdown of the property type where fire fatalities occurred.

Figure 9.6 Property Status Where Fire Fatality Occurred



FINDING

- Fire fatalities were most likely to occur in premises that were classified as owner occupied (53%).

9.5 Major Cause of Fatal Fires

The cause of 25 (16.5%) fires was undetermined/not recorded. Of the remaining 126 fires there were an array of causes; the three most prevalent causes were open fires/heaters/lamp (26 victims, 21%), kitchen fire/cooking materials (26 victims, 21%), and electrical fault (18 victims, 14%). Other important causes were smoking in bed (15 victims, 12%), smoking materials/equipment (14 victims, 11%), accident/explosion (12 victims, 10%), and operating equipment failure (11 victims, 9%).

FINDING

- 56% of fires were caused either by open fires/heaters, kitchen fire/cooking materials or electrical faults.

9.6 Cause of Death

The cause of death for all 151 cases was not recorded.

9.7 Smoke Alarms

No data on the presence of smoke alarms was recorded in the New Zealand database.

RESIDENTIAL FIRE FATALITIES

Literature Review

June 2004

“Two young children died and their mother and brother are critically ill after deadlocked doors stopped them escaping from their blazing house in Sydney today. Neighbours and fire crews desperately battled thick black smoke and flames to try to free the family from the inferno in the two-storey townhouse in suburban Matraville about 4am (AEST) today, the fire brigade said.”
(The Courier Mail, June 7, 2004)

1.0 PROJECT OVERVIEW

The purpose of this report was to examine the worldwide body of research on residential fire fatalities. The aims of this report were threefold: 1) to identify demographic and socio-economic factors of fire victims to assist Queensland Fire and Rescue Service (QFRS) in identifying ‘at risk’ groups that can be targeted for preventative interventions; 2) to identify contributing factors to residential fire fatalities; and 3) to examine interventions being used to reduce the total number of residential fire fatalities. It was found that those with an elevated risk of fire fatality were persons who were ethnic minorities, low socio-economic status, alcohol impaired, children (especially males) and the elderly. It is likely that these ‘at risk’ groups are not mutually exclusive. For example, research indicates that ethnic minorities are over-represented in lower socio-economic groups. It was suggested that lower socio-economic groups suffer more fire fatalities because of a reduced ability to respond to fire safety initiatives. It was found that there was an association between alcohol consumption and smoking such that smokers consume more alcohol than nonsmokers do. One of main reasons for the high incidence of child-related death was fireplay. The number of fires started as a result of children playing with sources of ignition raises important questions about supervision and the provision of a safe environment. Some research suggests an association between child fire fatality rates and maternal characteristics (i.e., maternal education, age, and number of other children). Among the reasons identified for the elderly being at risk was the underestimated perception of risk, the inability to independently maintain smoke alarms, the low level of awareness that assistance on smoke alarms was available from fire brigades, and the feeling that they might be getting in the way or wasting firefighters time. Current interventions aimed at reducing the total number of residential fire fatalities include industry partnerships, child resistant cigarette lighters, the composition of cigarette paper, fire retarding materials and upholstered furniture, provision of information, rehearsed escape plans, altering the elderly’s perception of risk, smoke alarms and sprinkler systems (used in conjunction). Finally, recommendations to reduce residential fire fatality rates were made.

2.0 INTRODUCTION

The term residential fire indicates that a fire took place in a house, apartment, or other residential dwelling. Residential fire incidents dominate annual emergency incident statistics around the world (Wong, 2001). For example, dwelling-house fires accounted for 30% of fatalities in household accidents and 10% of all accidental deaths, causing over 100 deaths each year in Scotland (Elder, Squires, & Busuttil, 1996). In the United Kingdom, residential fires caused at least 500 deaths in 1998 (DiGuisseppi, Edwards, Godward & Wade, 2000). In Dallas between 1991-1997, there were 12,019 fires in occupied residential structures which resulted in 125 deaths (Istre, McCoy, Osborn, Barnard, & Bolton, 2001). In 1996, there were an estimated 417,000 residential fires in the US, resulting in 4,035 deaths (Williamson, 1998). According to the National Fire Protection Association (NFPA), the total US national residential fire fatalities in 2002 for civilians was 2695. Australia is no exception. According to an October 1998 Research Report by the Department of Emergency Services, there were 550 fire fatalities in 451 structural fires between July 1991 and June 30 1996. From 1996-2000, New Zealand Fire Service responded to 105 recorded fatal

residential fire incidents, averaging approximately 21 fire incidents per year. From this number of fire incidents, a total of 127 fire fatalities occurred on residential property, with an average of 25 deaths every year (Wong, 2001).

The aims of this report are threefold:

- 1) To examine demographic and socio-economic factors of fire victims to assist QFRS in identifying 'at risk' groups that can be targeted for preventative interventions,
- 2) To identify contributing factors to residential fire fatalities, and
- 3) To examine interventions being used worldwide to reduce the total number of residential fire fatalities.

It should be noted at the outset that the author cannot comment on the validity or reliability of the findings presented in this report because details of the studies and research methodology were not sufficiently provided. Therefore, the conclusions presented in this report can only be taken at face value.

3.0 WHO IS DYING?

3.1 Gender

It is a well-established finding that males have higher death rates from residential fires compared to females (Cropp, 1991; Ontario Fire Reporting System, 2004; United States Fire Administration, 2003; Shai & Lupinacci, 2003; Barillo & Goode, 1996; Istre, McCoy, Osborn, Barnard & Bolton, 2001; Hall, 2004). This may be explained by the fact that male children have a higher reported incidence of fireplay compared to female children (Kolko, 1985).

3.2 Ethnicity

In the United States, among the racial and ethnic groups, the highest death rate was amongst Blacks. Using the fire death rate of non-Hispanic whites as the denominator, Blacks have nearly 4 times the risk of fire deaths, Hispanics have nearly 3 times the risk, and Asians more than 3.5 times the risk (Istres, McCoy, Carlin & McClain, 2002). In New Zealand, Maoris have higher fire injuries compared to non-Maoris (Kool & Ameratunga, 2003).

It is likely that it is not ethnicity per se that leads to higher fatality rates. Rather, in minority cultural groups such as Maoris, they are more likely to be over-represented in statistics associated with low income, poor housing and leaving school with low qualifications (Kool & Ameratunga, 2003). Therefore, ethnicity status might more accurately reflect underlying social and economic determinants. However, given that cultural minority groups are more likely to be victims of fire fatality, it may be necessary to develop culturally specific intervention strategies.

3.3 Economic Status

Fire mortality is more common in economically disadvantaged groups (Istre, McCoy, Osborn, Barnard, & Bolton, 2001; Kool & Ameratunga, 2003). Deaths from fires are more likely to occur in neighborhoods with low median income, low property values, and poor quality housing (Duncanson, Woodward, Langley, Clements, & Harris, 2000). Conley and Fahy (1994) found a link between poverty and high death rates. This finding is also supported in Australia where a large number of fire death victims were in the lower socio-economic status group, as measured by occupational status (Department of Emergency Services, 1998). For example, no fire death victims working in professional occupations were identified in Queensland fire fatalities (Department of Emergency Services, 1998). McCoy and McClain (2002; see also Istre, McCoy, Osborn, Barnard, & Bolton, 2001) found that for the lowest income group (< \$20,000 median income), the average annual childhood injury rate was 7.0 compared with 3.1, 1.2, 0, and 0 for each successively higher median income grouping. A plausible explanation for why lower socio-economic status groups suffer more fire fatalities may be that being poor means a reduced ability to respond to fire safety initiatives (e.g., less likely to have smoke alarms or to have safe heating systems; Petraglia, 1991).

3.4 Children and the Elderly

Young children and the elderly are particularly susceptible to residential fire deaths (Wong, 2001; Squires & Busuttil, 1996; Barillo & Goode, 1996; Hall, 2004; Mondozi & Harper & Boeckman, 2001; Cropp, 1991; Kool & Ameratunga, 2003; Duncanson, Woodward, Langley, Clements & Harris, 2000). Williams (1998) maintains that the very young and the elderly are 4 times more likely than the general population to suffer a fatal fire injury. Hall (2004) found those children less than 5 years and adults over 65 years are twice as likely to die in a home fire compared to the average person. While these estimates do vary, they consistently point to the fact that young children and the elderly clearly have significantly elevated risks of fire fatality.

Fire is a leading cause of accidental death in children. In New Zealand, fire or flames are the fourth most common cause of fatal injury in children aged from 1 to 15 years (Ministry of Health, 1998). Kool and Ameratunga (2003) examined the Auckland fire service records and the national minimum mortality data set and found that during a 10-year period a total of 19 childhood deaths resulted from 14 unintentional domestic fires. Byard, Lipsett and Gilbert (1998) examined fire deaths in children in South Australia from 1989 to 1998. A total of 14 deaths were associated with house fires (mean age 5 years and 10 months). In Australia between 1991 and 1994, there were 53 house fire deaths in children aged 4 years and younger, and 29 in the 5-14 age group (Byard, Lipsett & Gilbert, 1998). Children are at risk due to their tendency to play with matches and lighters, their lack of understanding of the dangers of fire, and their inability to escape from the immediate environment once a fire has started.

According to the United States Fire Administration (2003), of the 5,000 fire victims each year, more than 1,200 are senior citizens. NFPA (as cited in Barillo & Goode, 1996) estimates that those aged 65 or over have a fire death rate over twice that of the national average. The risk increases to three times the national average at age 75 and to 4 times the average at age 85. A similar elevated pattern is evidenced in the UK with one-quarter of fatal dwelling-house fire deaths occurring amongst elderly people (Duncanson, Woodward, Langley, Clements & Harris, 2000).

Petraglia (1991), Leth, Gregersen, and Sabroe (1998) cite several reasons for why the elderly are at highest risk of a fire fatality. They maintain that the elderly suffer from diminished visual acuity, depth perception, hearing and odor perception, a faltering sense of balance, and slower movements and reflexes. Together with more fragile bones, vulnerable joints, and other impairments caused by medications and chronic ailments, these changes mean older people are more likely to suffer serious disability and even death from accidents (Petraglia, 1991). The reduced ability of senses lessens one's ability to recognize dangerous warning signs related to fires. Reduced mobility may reduce the ability to escape. Medication may impair judgments or make people drowsy. Elderly people also do not recover from smoke exposure as easily as their younger counterparts. Smoke may exacerbate existing respiratory problems, and they tend to walk upright rather than crouching or crawling to avoid smoke. Another reason for increased fire fatality rates in the elderly is that many are intimately involved with the ignition of the fire that caused their deaths (smoking materials, cooking and heating equipment; Petraglia, 1991). Preventative interventions must target this age group because the older population is getting larger (e.g., increased life expectancy, better fitness and health care and medical services).

3.5 Alcohol Impaired

The association between fatality and alcohol is well documented. Alcohol is less frequently found to be associated with fire death in the elderly compared to younger individuals (Squires & Busuttil, 1996). According to data from the Ontario Fire Reporting System (2004), over a 7-year period between 1995-2001, 19% of fire fatality victims were alcohol-impaired. Nearly 70% of all alcohol-related fire fatality victims were aged between 25 and 54. The elderly (>74 years) accounted for the largest number of fire deaths but only 3% had consumed alcohol. A study conducted in Scotland between 1980-1990 examining records of 1064 adults (aged >17 years) who died in fires, found that blood alcohol (BA) levels were found in 694 cases, with four cases unable to be analysed for BA levels (Squires & Busuttil, 1997). The Minnesota Department of Health (as cited in US Fire Administration/National Fire Data Center, 2003) found that from 1996 to 2002, 36%

of fire fatality victims had alcohol levels of 0.1 or higher. Victims aged 45-54 accounted for the highest number of fire deaths (26%) that were under the influence of alcohol at the time of death, followed by victims aged between 35-44 (24%). In Oregon in 2001 there were 32 residential fire fatalities; of those, alcohol was a factor in 28% of these fatalities.

Alcohol depresses the central nervous system, and individuals who consume large quantities may experience disordered thought patterns, impaired judgment and perception, and a decreased generalized motor control (US Fire Administration/National Fire Data Center, 2003). Alcohol increases the risk of fire outbreak as it contributes to more negligent behavior (e.g., risky smoking) that results in a fire being started and a reduced ability to react quickly in alerting and/or helping others to safety (Squires & Busuttill, 1997; <http://www.keepingkidsalive.or/fire.htm>). Alcohol has consequences not only for the individual but also for those around them. It appears that there is an indirect relationship between alcohol and child death. Anecdotal evidence suggests that fire deaths of children may be attributed to parents' failure to perceive and respond to a fire emergency because of impairment of their sensory, judgment, or physical functions by alcohol consumption (US Fire Administration/National Fire Data Center, 2003).

4.0 WHY ARE THEY DYING?

4.1 Elderly's Perception of Risk

A report by the Office of the Deputy Prime Minister (2003) found that most people aged over 60 years believe that fire safety is not as important as personal security. Most elderly people were also reluctant to admit that their age may increase their risk of domestic fires or to see any need to specifically target 'old' people. While the majority of people surveyed had smoke alarms present, many relied on children or friends to check them or change the batteries. This may imply that maintenance of some alarms is unreliable. It was also found that there was a fairly low level of awareness that advice/assistance on smoke alarms was available from local fire brigades. Of those that were aware, some felt that they might be getting in the way or wasting firefighters time: "I'd much rather the fire brigade were there waiting to sort out a real emergency than coming around to my house to talk about fire safety". Respondents living in bungalows or first floor flats often held the opinion that they would be able to escape from a fire more easily than those who live in two-story houses.

4.2 Absence of Smoke Alarms

Smoke alarms are considered to be among the most important intervention strategies. Williamson (1998) claims that smoke alarms reduce the risk of death in a fatal fire by about 60%. Houses that are most likely to have fires are least likely to have functioning smoke alarms (Duncanson, Woodward, Langley, Clements, & Harris, 2000). Runyan, Bangdiwala, Linzer, Sacks and Butts (1992) found that the greatest increase in risk of fire-related mortality was associated with lack of smoke alarms. In 2001 in Oregon, there were 26 fatal residential fires with 32 fatalities. A smoke alarm was reported as present in 11 residences. Of these 11 residences reported as having smoke alarms, only 5 were reported as working. A working smoke alarm decreases the risk of a fire fatality in 71% of house fires (<http://www.keepingkidsalive.or/fire.htm>). According to the United States Fire Administration (2002), in multiple fatalities 57% had no alarm present. Of the remaining 43% where a smoke alarm was present, 21% did not operate. In single fatalities, 59% had no alarm present. Of the remaining 41% where a smoke alarm was present, 18% did not operate. According to the 2000 Civilian Fire Fatalities Report by the State of Oregon, in the 34 residential fire deaths occurring in 30 separate fire incidents, only 16 of the 30 residences had a smoke alarm present in the structure. Of the 16 incidents where a smoke alarm was present, 5 did not work (primarily due to missing battery, disconnected or discharged).

Those households identified most at risk (i.e., low socio-economic status) are often those least

likely to have smoke alarms. Despite an increased risk of fire in disadvantaged households, smoke alarm ownership is considerably lower than in the general population (Rowland, Afolabi & Roberts, 2002). The Philadelphia Fire Department (as cited in Shai & Lupinacci, 2003) supplied data on 146 residential fires that were fatal to children younger than 15 years during 1989-2000. They found an activated smoke alarm was present in only 18.9% of the residences. It is recommended that the public is educated about the relative worth of these devices and more people need to be encouraged to install and maintain smoke alarms in their homes.

4.3 Child Fireplay

Fireplay is defined as any fire that was determined by fire inspection specialists to have been the result of children playing with fire or combustible material (Istre, McCoy, Carlin, & McClain, 2002). In Philadelphia, among children younger than age 6 who died in residential fires, one-third was caused by children playing with matches or fire (Shai & Lupinacci, 2003). It has also been estimated that in 1998 children playing with fire caused 232 civilian deaths in the United States (Shai & Lupinacci, 2003). From 1991-1998 in Dallas, Texas, 39 children died in residential fires with the highest rate occurring in the youngest children (<5 years); 62% of deaths in children 0-4 was from fireplay (McCoy, Carlin, & McClain, 2002). In Scotland between 1980 and 1990 there were 168 child deaths occurring in 118 house fires. In the 0-5 age group, 40% of deaths occurred as a direct result of the actions of the children (Squires & Busuttill, 1996). The number of fires started as a result of children playing with sources of ignition raises important questions about supervision and the provision of a safe environment.

4.4 Maternal Characteristics

There are certain maternal characteristics thought to increase the risk of young children dying in residential fires. A study in Tennessee examined children born between 1980 and 1995. Over that period, there were 270 deaths from fire (4.99 per 100,000 child years) and 231 fatal fires. It was found that the number of fatal fire events was strongly associated with maternal characteristics. Factors associated with greater than a threefold increase in fatal fire events included maternal education, age, and number of other children. Compared with children whose mothers had a college education, children whose mothers had less than a high school education had 19.4 times increased risk of a fatal fire event. Children whose mothers had two or more other children had 6.1 times increased risk of a fatal fire event compared with children whose mothers had no other children. Children of mothers less than 20 years of age had 3.9 times increased risk of a fatal fire event compared with children whose mothers were 30 years or older. Other factors that were associated with increased risk of fatal fire events was gender (i.e., being male; see also section 3.1) and having a mother who was unmarried or had delayed prenatal care (Scholer, Hickson, Mitchel, & Ray, 1998). Rather than maternal characteristic per se, it is likely that behavioral and environmental factors more fully explain these findings (e.g., cigarette use, alcohol consumption, and lack of smoke alarms).

These findings are further supported in research conducted by Shai and Lupinacci (2003). They found that lack of education, particularly maternal education, is a factor strongly related to fire rates. A low level of education of the head of the household was associated with increased unintentional injury mortality in children and young adults. Although the relationship between education and fire deaths is not well understood, it is likely that lower educated parents live in more hazardous conditions and are less knowledgeable about injury prevention. Unmarried mothers are at higher risk of fatal fires involving young children, due partly to the fact that there is only one parent to rescue them. It was also established that children of unmarried mothers have less supervision and fewer resources. Further support for these findings come from a study conducted by Byard, Lipsett and Gilbert (1998) who found that factors associated with an increased risk of death from fires in children include maternal age of less than 20 years, low maternal education, and more than two children in the family.

5.0 CONTRIBUTING CAUSE

Smoking

Smoking is the leading cause of fire deaths, and smokers consume more alcohol than nonsmokers (US Fire Administration/National Fire Data Center, 2003). The finding that the most common cause of residential fire deaths in Denmark is smoking often combined with alcohol intoxication and handicap further supports this (Leth, Gregersen, & Sabroe, 1998). Ballard, Koepsell, and Rivara (1992) investigated the importance of alcohol and tobacco as risk factors for fire accidents with fatal/nonfatal injuries. They found a close association between the magnitude of tobacco use and fire injuries. Households with high alcohol consumption had an increased risk but these households also had a high tobacco consumption that was the main underlying risk factor. Smoking, the leading cause of fire fatalities in Minnesota and across the US, was the cause of 26% of fatalities in Minnesota; of these smoking related fire fatalities, 62% had blood alcohol levels of 0.1 or higher (as cited in US Fire Administration/National Fire Data Center, 2003). Based on the Ontario Fire Reporting System (2004), open flame, smoking, cooking, and heating were the leading causes of Ontario fire deaths. A total of 28% of the cases where smoking was the cause were also alcohol impaired. Runyan, Bangdiwala, Linzer, Sacks, and Butts (1992) found fires associated with smoking were more common among the fatal fires than among the control fires. Most of the fires were associated with smoking, candles and cooking (e.g., clothing fires ignited by gas cooker and fires caused by deep fryers left on a stove).

Reynolds (1996) found in Britain between July 1994 and June 1995 that smoking materials, accidents involving heaters and electrical faults were identified as some of the major causes of fatal fires. A study conducted in New Zealand found that the largest category of heat source that resulted in residential fire fatalities were those involved in cigarettes, matches, and candles (Wong, 2001). The largest category of supposed causes involved carelessness with heat sources, which accounted for 44.1% of all residential fire fatalities, or 56 deaths over the 5-year period considered. Included in this category were the following: falling asleep or kitchen/cooking fires (9.4%); careless disposal of cigarettes, cigars, ashes and embers (8.7%); people playing with heat sources (7.9%); falling asleep other (7.1%); heat source placed too close to combustibles (6.3%); carelessness with unspecified heat sources (1.6%); people otherwise impaired (1.6%); inadequate control of heat sources (0.8%); and people impaired by drugs or alcohol (0.8%). Based upon these studies, it appears that cigarettes, matches and candles are the most common heat source in fatal residential fires, while carelessness with heat sources was the dominant supposed cause of such fires. Considering this, it becomes apparent that the ignitability of household objects, such as furniture, soft goods, and wearing apparel is exceedingly important in assessing the contribution of these items to residential fire fatalities.

It is possible that the cause of fatality varies with age. In a study conducted by Squires and Busuttill (1996), 45% of incidents in which an individual aged 75 years or more died, electrical items were the cause, compared to 21% of fires in which a younger person died. The major cause of death in persons under 75 years (52% of incidents) was smoking materials such as cigarettes, matches and pipes. However, this is not a well-established finding and contradictory evidence can be found. For example, Leth, Gregersen, and Sabroe (1998) found that many elderly people die in fires associated with cigarette smoking. Petraglia (1991) maintains that fires caused by smoking materials are the leading killer of older victims, followed by fires that begin with heating equipment and those that start during cooking.

6.0 INCREASED RISK PERIODS

6.1 Season

It is well established that fire-related deaths are lowest in summer and highest during winter, most likely due to increased use of heating and cooking appliances (Leth, Gregersen, & Sabroe, 1998; Barillo & Goode, 1996).

6.2 Time

Leth, Gregersen, and Sabroe (1998) found that most fatal fires take place on weekends. In terms of time of day, fatal fires usually occur at night or early in the morning when victims may be sleeping and unaware that a fire has taken place or too confused to respond (Shai & Lupinacci, 2003). Fire fatalities peak between midnight and 2am when most people are asleep. After 2am, fatalities decline until 2pm after which it increases. Slightly more than half fatalities occur between 10pm and 6am. There is a slight peak in fatalities from 6pm to 8pm, which corresponds to dinner hour and increased cooking (Ontario Fire Reporting System, 2004). For children, Squires and Busuttil (1996) found that of the 168 child deaths that occurred in 118 fire incidents, most fires occurred between midnight and midday, with 42 incidents (37%) in the 6 hours after midnight and 41 (36%) between 6am and noon. Based on data collected by the Ontario Fire Reporting System (2004), alcohol-related deaths begin climbing at 4pm and peak at 5am.

7.0 LOCATION WHERE FIRE STARTS

7.1 Property Type

Squires and Busuttil (1996) found that most fire fatalities occurred in properties rented from the local housing authority, followed by homes rented from a housing association or a private landlord. The fewest occurred in owner occupied.

7.2 Room

According to the United States Fire Administration (2003), the leading area of multiple fatalities is the lounge areas such as living rooms or family rooms. Data collected from New Zealand from 1996 to 2000 found that bedrooms and lounge areas were the two most common rooms of fire origin in fatal residential fires. In contrast, most residential structure fire incidents originated from kitchens, with bedrooms and lounge areas the fourth and fifth most common rooms (Wong, 2001). This suggests then that fires commencing in the bedroom or lounge area pose a greater risk (see also <http://www.keepingkidsalive.org/fire.htm>). Shai and Lupinacci (2003) also found that the two most frequent locations were the bedroom and living rooms.

8.0 CURRENT INTERVENTIONS

The greatest tragedy is that many fire fatalities are preventable. Fatal fires are generally reported as tragic accidents. This disguises the causal link between fire outbreak and human behavior. The term 'accident' conveys a sense of unpredictability whereas evidence suggests that fatal fires tend to occur in predictable circumstances, and therefore are preventable (Squires & Busuttil, 1996).

Preventing the onset of fire is the cornerstone of primary prevention. Most people are killed as a direct consequence of human activity. It follows that behavior modification is likely to lead to a decrease in the number of fires and, consequently, number of deaths. Preventing the causal link between child behavior and fire outbreak is a function of supervision, environment, and awareness of risk. There is a priority to educate. The problem is twofold: children have a limited concept of risk and risky behavior, and continuous, direct supervision is not feasible. Therefore, preventative interventions need to look at supervision and education, in conjunction with providing a safe environment (<http://keepingkidsalive.org/fire.htm>). Because of the varied causes of fire fatalities, it is likely that diverse interventions, targeted to those at risk (e.g., elderly, young children, low SES) may be required. In developing intervention strategies, it must be considered that fire prevention and education be provided with minimal or no cost.

8.1 Industry Interventions

8.1.1 Partnerships

A partnership between Cheshire Fire Service and Cheshire Health Care Trust has been established. Cheshire Fire Service have trained over 200 district nurses and health workers to identify where a person is likely to be vulnerable from fire, by process of a tick-box questionnaire. The firefighters then go out to the houses and complete a full home fire safety check upon request.

One unique program focusing on the elderly is a joint project between National Association of Home Builders, United States Fire Administration, and the Architectural and Transportation Barriers Compliance Board. This is the adaptable firesafe demonstration house which has many enhanced firesafety features tailored to older adults and the disabled (e.g., open flowing floor plan, an iron that shuts off automatically, flashing strobe lights, in the event of a fire a blind or deaf person can be awakened by an overhead fan or a bed-vibrating mechanism; Petraglia, 1991).

8.1.2 Child Resistant Cigarette Lighters

According to Smith, Greene and Singh (2002), the United States Consumer Product Safety Commission estimated that children younger than age 5 playing with cigarette lighters ignited 5900 residential fires that resulted in 170 deaths and 1150 injuries annually for the period 1986-1988. Disposable lighters were involved in 97% of those fires. Upon introduction of the safety standard for child resistant cigarette lighters, there was a 58% reduction in cigarette lighter fires caused by children younger than age 5. It was also estimated that the standard was responsible for reductions of 3300 fires, 100 deaths, 660 injuries, and \$52.5 million in property loss in 1998.

8.1.3 Cigarette Paper

The cigarette paper at present contains a number of chemicals that ensure a cigarette does not go out when it is not being smoked. Both in Denmark and the United States, the tobacco industry is working on the development of cigarettes that incorporate a higher degree of fire safety (Leth, Gregersen, & Sabroe, 1998).

8.1.4 Fire retarding materials

The use of fire-retarding materials for bedclothes, mattresses, sofa cushions, and clothing can prevent ignition. Fire classification regulations for furniture, particularly sofas and beds, and for clothing are important. People should be warned of the dangers of wearing loose fitting clothes when in the vicinity of lighted candles and when cooking over a naked flame. Candles should be quality tested and consumer guidance should be provided on the packaging. Smoking aprons and smoking aids can reduce the risk of fire (Leth, Gregersen, & Sabroe, 1998).

8.1.5 Upholstered Furniture

Upholstered furniture refers to full-scale, generic furniture, with a basic frame, padded with foam and covered with fabric. According to a New Zealand study (Wong, 2001), upholstered furniture was involved in 35.4% of all residential fire fatalities in a 5-year period between 1996 and 2000. The fire behavior is influenced by a combination of foam, fabric and frame materials used in its construction. These factors influence the initial ignitability of the fabric, the rate of fire growth once flaming has begun, the peak heat release rate, its fire spread characteristics and as a consequence, its threat to the occupants present (Wong, 2001). Upholstered furniture is usually the most significant contributor to the fuel load present in a room or space during a fire (Wong, 2001).

Some countries have mandatory or voluntary regulations concerning the manufacture and sale of upholstered furniture. While there is no mandatory national standard for the flammability of upholstered furniture in the United States, trade organizations (e.g., Consumer Protection Safety Commission) have adopted voluntary regulations. On a state level, California has adopted a mandatory standard for all upholstered furniture offered for sale. These standards contain labeling requirements and performance tests to measure the cigarette and small-flame resistance

of all components and finished items of upholstered furniture. In the United Kingdom, there is the Furniture and Furnishings (Fire Safety) Regulations 1988, amended in 1989, intended as a supplementary to the 1980 cigarette ignition regulation. In 1992, the regulations were further amended to include second-hand furniture in holiday homes. These regulations apply to most upholstered furniture manufactured after 1950 and all new items. It specifies a series of open-flame performance requirements for upholstered furniture, and prohibits the use of polyurethane foams, except for ignition-resistant 'combustion modified' foams, for use in residential upholstered furniture.

8.2 Provision of Information

One way to change people's unsafe behaviors is through the provision of information (e.g., special warnings about not smoking in bed). One common method being used to communicate firesafety awareness and activities is providing tips and guidelines (smart smoking behaviors, smart cooking behaviors, electrical behaviors, general behaviors, in-case-of-fire tips; Petraglia, 1991) via websites and printed brochures. Other interventions have included published newsletters that reach target populations (e.g., the elderly); information sessions held at various facilities that house older people. Some programs also provide workshops and distribute educational literature and checklists on home firesafety for older adults.

In New York, an education centre has been established in an old fire station. The Safety Learning Resource Centre is designed to educate all ages as to fire danger, prevention, and what to do in case of fire. Two sessions are held daily with approximately 1000 people educated each month.

As an intervention to reduce burn and fire-related injuries in children, Mondozzi and Harper (2001) developed two burn and fire prevention games. These games were distributed to 164 elementary schools reaching more than 1035 children in grades 1-4. Before the game, children were given a multiple choice pre-test. The game involved a sheet game with two houses. The instructors attached an even number of felt flames to each house. One group had a blue house and the other group had a green house. Play begins with one team going first; if they answer a question correctly they remove a flame. If they miss, the other team has the option to 'steal' the question. The first team to remove all the flames from the house wins. The questions are either true/false or multiple choice. Example items include the following:

- Q1. When plugging in appliances you must make sure your hands are dry to:
- a) get a better grip on the plug
 - b) avoid electrical shock*
 - c) avoid making the plug wet
- Q2. If you find a lighter who should you give it to?
- a) your best friend
 - b) keep it yourself
 - c) give it to a parent, teacher, or grown up*

A similar post-test was administered after the game to determine mastery and knowledge retention. Pre-test and post-test results indicated that students gained and retained significant knowledge.

Information can also be disseminated through health care centres to appeal to mothers to educate their children about fire and fire safety, and pediatric and geriatric physicians who can stress the dangers of fire in the home and promote home fire safety. Other referral sources may include schools, child-care facilities, police, juvenile justice, social services, mental health services, and other medical centres.

8.3 Escape Plans

Fire escape preparedness is an important prevention strategy, yet a United States national survey found that only 53% of Americans have a family escape plan and of those, only 16% have practiced it (<http://keepingkidsalive.or/fire.htm>).

8.4 Altering the Elderly's Perception of Risk

A report by the Office of the Deputy Prime Minister (2003) found that many respondents did not consider themselves to be old, something, which should be considered when trying to target this group. Some older people will not get involved with those associations aimed at 60+ since they do not see themselves as old. Perhaps targeting over 50s would be more likely to attract more support than those for pensioners or those over 70. A report from the West Midlands Fire Service (as cited in Meldrum, 1997) found that the perception of fire in the elderly is underestimated. Preventative education strategies may need to educate them into realizing the potential dangers and the difficulty in making good their escape. Results of a survey sent to people above 50 years found that the risk of fire is underestimated compared to home burglary. A total of 23% were not worried about the risk of fire and therefore fire safety campaigns may need to be directed to overcome this complacent attitude toward fire risk, given that the elderly are one of the 'at risk' groups.

8.5 Smoke Alarms

The value of a functional, correctly situated smoke alarm is well established as it provides for early detection and escape. Smoke alarm give-away programs have demonstrated higher rates of compliance than just providing information on the need for smoke alarms alone and have decreased home fire injury rates by up to 80% during a 4-year intervention program (Franklin, Pucci, Arbabi, Brandt, Wahl, & Taheri, 2002). However, the problem with smoke alarms is twofold: 1) efficacy of a smoke alarm is dependent on it being correctly situated and maintained; 2) it is a passive safety device that serves only to alert occupants that a fire already exists (Squires and Busuttil, 1996).

8.6 Residential Sprinkler Systems

Residential fire sprinklers may soon follow the same path smoke alarms did. Fire sprinklers are designed to extinguish or control the fire until it is manually extinguished by the fire department. They can help to prevent fire spread and sufficiently limit exposure to building elements to prevent total collapse. They may limit the need for search operations beyond the immediate fire area at least initially, reducing the demand for fire service resources.

Some argue that the costs of introducing mandatory residential fire sprinklers cannot be justified. Their argument is based on the fact that fire sprinklers only help the homeowner after the fire has started and is only effective in certain fires. Others would argue, however, that it is easier to change residential design than it is to change human behavior (e.g., changing people's behavior so that they never smoke dangerously). Those against the introduction of mandatory sprinkler systems in residential dwellings also argue that the odds of being in a residential fire fatality are very low. Quite simply, they believe that the costs, in terms of installation and maintenance, relative to potential benefits do not add up. However, in Canada and America there are various bodies advocating that the National Building Code be changed to make sprinklers mandatory in new houses. Smoke alarms can only warn of fire but sprinklers warn and immediately act to extinguish the fire. Many counties in America have now made it a legal requirement that residential homes be fitted with sprinkler systems. The New Zealand Fire Service has several objectives in regards to residential fire sprinklers. Some of their objectives include the following: to have legislation enacted by 2008 requiring new homes to install home sprinklers; to have legislation enacted by 2010 requiring those existing homes that can achieve cost effective installation to have home sprinklers; and to achieve legislative changes to make installation of home sprinklers compulsory by 2013 in all New Zealand homes. The decision to introduce mandatory residential sprinkler systems is based on the many benefits believed to result from the introduction of sprinkler systems.

8.6.1 Benefits of Sprinkler Systems

8.6.1.1 Reduced Injuries and Fatalities

A 1984 report by the Bureau of Standards/National Institute of Standards and Technology estimated that the effect of adding fire sprinklers when smoke alarms are already present could reduce the number of fire fatalities by 63%. An NFPA analysis of national data, collected from 1983 to 1992, indicates the number of fire deaths per 1,000 fires was reduced by 57% in homes with sprinklers (<http://www.nfsa.org/info/thecase.html>). Smoke alarms and sprinkler systems combined could reduce fire-related deaths by 82% (<http://keepingkidsalive.or/fire.htm>).

There have been no fire fatalities in residences with a sprinkler system in Napa, California, or Cobb County, Georgia since the inception of various sprinkler programs. Additionally, there has not been a single fire fatality in Prince George's County, Maryland in a building with a sprinkler system. Limited evidence suggests that sprinklers can save an additional 7.8 lives per million houses per year (Research and Development Highlights).

In the mid 1980s, 'Operation Life Safety' which is a public/private partnership whose goal is to reduce fire fatalities (in conjunction with USFA and NFPA) collected some 600 voluntary reports on residential sprinkler activations since 1983 and in none of these was there a fatality (Fire Sprinkler Association). Between December 13 to 24, 1989, three major fires in senior citizen housing facilities killed 23 older adults. One common factor was the absence of automatic sprinklers (Petraglia, 1991). In New Zealand, where all fires have been reported for over 100 years, records show that sprinklers have been effective in 99.7% of cases (Fire Sprinkler Association). Another comprehensive data set on life safety in sprinklered buildings in Australia and New Zealand indicates that in 100 years up to 1986, there were 11 fatalities in 9022 sprinklered fires. This represents a fatality rate of 1.1 per 1000 buildings with fire sprinklers, as compared to 4.5 and 2.3 per 1000, over roughly the same period in Australia and New Zealand, respectively (ENTEC, 1997).

Analysts at the National Institute of Standards and Technology (NIST) in the United States examined and estimated the impact of sprinklers and smoke alarms (used together) on home fires and associated losses and found the following:

- The introduction of smoke alarms in dwellings would reduce fire deaths by 52%,
- Additional sprinklers would further reduce the original death rate by 30%, for a total reduction of 82% and,
- The introduction of only sprinklers would reduce the original death rate by 69% (as cited in ENTEC, 1997).

NFPA (as cited in ENTEC, 1997) estimated the reduction in average civilian deaths per 1000 fires due to automatic sprinkler systems for the annual average of 1982-1991 (refer Table 1). The fires shown are only those that were reported to fire departments, as sprinklers often control the fire before the fire department are notified. The impact of sprinklers on death rates depends to some degree on how low the basic fire risk is in the property before sprinklers are added. For example, the death rate per 1000 fires in unsprinklered educational properties is already low, so the addition of sprinklers does not do much to reduce it, as opposed to unsprinklered hotels and motels, which have by far the highest death rate. While these figures do not report on the percent reduction in residential houses as a result of the introduction of sprinkler systems, the results do provide ancillary support for the argument that sprinklers do contribute to reduced fire fatality rates.

Table 1. Estimated Reductions in Average Civilian Deaths Per 1000 Fires Due To Automatic Sprinkler Systems for the Annual Average of 1982-1991.

Property Use	Unsprinklered	Sprinklered	% Reduction
Public assembly	1.3	0.1	91
Educational	0.4	0.3	9
Health care	4.2	2.1	51
Hotels and motels	7.5	2.6	65
Stores and offices	1.1	0.4	65
Manufacturing	2.0	1.2	37

8.6.1.2 Reduced Property Loss

In the United States, the average national property loss in homes with sprinklers is 38% lower than homes without sprinklers, according to a NFPA survey of home fires reported to fire departments from 1983-1992. In Scottsdale, Arizona, for over 10 years it has been a requirement that all properties, including domestic properties, have sprinkler systems (introduced January 1, 1986). The population has grown threefold in those 10 years but there has been no need to increase the size of its fire service. A study examining the effects of the ordinance over its first ten years and, based on 18 single-family fire sprinkler incidents during that time, presented the following results:

- The average fire loss per sprinklered incident was \$1,689, compared to non-sprinklered costs of \$9,571,
- Total sprinklered loss was \$30,402 while the total potential loss was estimated at \$5.4 million, and
- Homeowner’s insurance rates were an average 10% less compared to similar non-sprinklered homes (as cited in Koski, 2000).

ENTEC (1997) reports on experimental fire tests that were undertaken by the Fire Research Station in Borehamwood following the fire at Woolworth’s Manchester in May 1979 which claimed the lives of up to 10 people. The tests simulated conditions in the store at the time of the fire, and smoke characteristics were monitored in both sprinklered and unsprinklered fires. Conditions were improved considerably when sprinklers were installed, with the following observations being made:

- The maximum ceiling-level temperature at the exit of the rig dropped from 940°C to 190°C,
- The carbon monoxide at ceiling height reduced from 50,000ppm to 2,000 ppm,
- The volume of smoke generated was reduced by over 75% and,
- The amount of burnt furniture was only 10% of that destroyed in the unsprinklered test.

With the introduction of residential sprinkler systems, there may also be reduced indirect costs (e.g., temporary shelter, wages).

The public needs to be informed of the numerous benefits associated with the introduction of sprinkler systems in residences. A possible barrier that fire services and advocates of compulsory sprinkler systems face is the many myths associated with sprinklers (e.g., sprinklers cause water damage, if one sprinkler head goes off, they all go off). A systematic and comprehensive education program will be required to dispel such myths and to gain public support.

9.0 CONCLUSIONS

This report has identified various groups considered to be 'at risk' of a residential fire fatality. These 'at risk' groups were the very young (especially males), the elderly, persons impaired by alcohol, ethnic minorities and lower socio-economic groups. It is likely that not all of these groups are mutually exclusive. It was suggested that some possible causes for young children being at risk were child fireplay and maternal characteristics (maternal education, age, number of other children). Some of the possible causes for the elderly being at risk included reduced mobility and ability to escape, existing respiratory problems, medication that may impair judgment or cause drowsiness, and (more importantly in terms of preventative campaigns) the underestimated perception of risk. As for what to include in a comprehensive intervention program to reduce the number of residential fire fatalities, there is currently no clear solution. Worldwide, there are several preventative interventions that target supervision and education, in conjunction with providing a safe environment. Because of the varied causes of fire fatalities, it is likely that diverse interventions targeted to those at risk groups may be required.

LITERATURE REVIEW:

WHY ARE SOME GROUPS MORE AT RISK OF RESIDENTIAL FIRE FATALITIES?

1.0 SUMMARY

According to the research, the risk factors for household fire injury or fatality are low socioeconomic status, smoking, alcohol consumption, children, elderly, male gender, disability, and non-white race. Identification of these risk factors may assist fire prevention programs to be developed in such a way that interventions target those identified as most at risk. It is also imperative, however, to gain some insight as to why these 'at risk' groups are more susceptible to residential fire fatalities. Obviously, factors such as low socioeconomic status are not directly responsible. Rather, they are specific measures that are more broadly indicative of an individual's general access to social and economic resources.

Drawing from the psychological and sociological health research, this report examines the relationship between low socioeconomic status and stress. It has been found that low socioeconomic status is associated with more stressful life events (e.g., job loss) and higher social strain. It is possible that low socioeconomic groups consume higher levels of alcohol and smoke more in an attempt to cope with an environment that is stressful and isolating. Using such coping behaviors elevates this group's risk of suffering fire-related injuries/fatalities.

Several theoretical explanations for why low socioeconomic status groups generally experience higher mortality rates are proposed. The cultural/behavioral perspective sees class differences in mortality, generally, as a product of class differences in the consumption of harmful commodities (e.g., tobacco), leisure time exercise and utilization of preventive health care. The structural perspective sees behavior as inextricably linked with the social structure through such factors as access to education and knowledge, and through shared ways of seeing and constructing the social world. Another perspective sees the health behaviors of the low socioeconomic groups as reflecting the beliefs, attitudes, and values of a separate subculture. Its characteristic traits are said to be a lack of knowledge about, and indifference to health, and a lack of orientation to the future. The reasons for socioeconomic differences in health behaviors probably lie somewhere among the three competing positions. A further explanation for why low socioeconomic status groups report higher mortality rates views class differences in health as being a consequence of the unequal distribution of resources and material wealth, which characterizes most societies. Those groups experiencing least access to resources are likely to experience a lower standard of living, as measured by indicators such as the quality of housing.

The role that social support plays in buffering the stress associated with a low socioeconomic position is also examined. Research has demonstrated that quality of social relationships predicts psychological functioning. However, in low socioeconomic groups there is often a lack of social support, which may contribute to socioeconomic inequalities and increased engagement in risk behaviors (e.g., excessive alcohol consumption). In terms of explaining why children are considered an 'at risk' group, factors associated with low socioeconomic status, particularly those relevant to psychological functioning, are evident at birth. A broad range of influences that affect children suggests they are one of the groups that is at high risk in terms of injuries and fatalities due to household fires (e.g., single-parent families, the quality of family functioning, emotional support, supervision, stimulation, parental aspirations and involvement). Socioeconomic status also contributes to explaining why the elderly are also considered 'at risk' of residential fire injuries/fatalities. The reason for this is that an individual's socioeconomic status endures through to old age. Socioeconomic status of the elderly also suggests that they may use older appliances, such as portable heaters or heating blankets. Other factors that have been identified as contributing to the elderly's elevated risk of a residential fire are that the elderly are known to have fewer smoke

alarms, may be hearing impaired (which if they do have a smoke alarm they might not hear it), impaired mobility which slows their escape or completely prevents it, and they generally live in older homes and therefore the fire risk is higher.

This report concludes with an examination of the translation model of fire safety. This model proposes that safety knowledge is part of ongoing safety practices. That is, knowledge is formed by and through social relations, and is acquired through social participation. This model suggests that fire safety information is most effective in the environment where fires take place (i.e., the community). To be effective in fire prevention, this model proposes that a coordinated approach involving government, law enforcement and dedicated community members is necessary in order to create a safety culture in the community.

2.0 OVERVIEW

Across many countries household fires are a significant cause of injuries and fatalities (Warda, Tenenbein & Moffatt, 1999a). Although many households in the developed world are fitted with one or more smoke alarms, there appears limited awareness that household fire injuries and fatalities remain a major public health issue. For example, in New Zealand the statistics for household fires for 1986–1998 report 27 deaths per year from fires, and 25% of these claim the lives of children under 15 years of age (Duncanson, Woodward & Reid, 2000). An international analysis of fire fatalities and injuries reported that the third leading cause of injury or fatalities for children (i.e., 1 to 14 years of age) in eight of the 11 countries studied was household fires (Fingerhut, Cox, & Warner, 1998). In this context, researchers and fire departments have developed the strategic direction of discovering causal factors of household fires, with the overarching aim of developing effective implementation of preventive measures. In an attempt to minimize injuries and fatalities associated with fires, researchers have identified ‘risk groups’ and ‘risk behaviors’, which are commonly associated with household fires (Loyd & Oen, 2002).

The current review proceeds in the following order. The first section briefly reviews the risk factors associated with fire injuries and fatalities. The next section overviews socioeconomic status and the negative consequences of living in socioeconomic disadvantage (e.g., stress). This section also examines socioeconomic status, and the associated outcomes, stress, psychological disorders, and risk behaviors (e.g., excessive consumption of alcohol). This section is followed by an explanation of how the family’s socioeconomic status interacts with the children to affect the quality and status of their childhood, persisting through to adulthood, wherein previous research on children and risk behaviors is reviewed. This is followed by a brief overview of the risk factors that have been linked with the elderly in terms of injuries and fatalities caused by fires. Lastly, the translation model of fire safety is briefly outlined.

3.0. RISK FACTORS

The research is very clear on one point; the relationship between knowledge of risk factors and improved fire safety is extremely complicated. Characteristics of a specific population that determine injuries or fatalities are referred to as ‘risk factors’. Outlined below are the risk factors for household fire injury or fatality identified by the research (see Warda et al.1999; Marshall et al., 1998):

- Low socioeconomic status;
- Smoking, and alcohol consumption;
- Children;
- Elderly;
- Male gender;
- Disability; and
- Non-white race.

Armed with this knowledge of risk factors, fire prevention programs can now focus their efforts on developing interventions that target those identified as most at risk.

4.0. EFFECT OF LOW SOCIOECONOMIC STATUS

Death in Australia (as elsewhere) is patterned in ways which suggest that those with the least access to material and economic resources are significantly disadvantaged in terms of health. Compared with affluent and educated groups, socially disadvantaged groups have higher age-standardized death rates for almost all known causes of death (Lupton & Najman, 1997). There is much empirical evidence to support this idea that mortality rates vary greatly according to socioeconomic position, which includes level of education, income, and occupation (Davey Smith, Shipley & Rose, 1990; Sorlie, Backlund & Keller, 1995; Pappas, Queen, Hadden & Fisher, 1993). In one study (Siskind, Copeman & Najman, 1987), the population of Brisbane was divided into five similarly sized areas which were then ranked on the basis of each area's socioeconomic characteristics to produce an index of relative disadvantage. The results indicated that those aged less than 75 years from advantaged areas in Brisbane had significantly lower rates of mortality from all causes of death than those did from the most disadvantaged areas. This negative relationship between socioeconomic factors and risk behaviors has been recorded in different historical contexts, geographic locations, and populations (Blaxter 1987; Haan, Kaplan & Syme, 1989; Link & Phelan, 1995). Furthermore, similar results have been reported by empirical research conducted in developed countries, finding that socioeconomic differences in health status occur over a life-time; however, these differences are the greatest in adult years (House et al., 1994; Mustard, Derksen, Berthelot, Wolfson & Roos, 1997). Obviously, education, income and occupational factors are not directly responsible; rather they are specific measures which are broadly indicative of an individual's general access to social and economic resources (Lupton & Najman, 1997).

Lifestyle choices such as tobacco use, alcohol consumption, a sedentary lifestyle, and obesity are reportedly associated with increased mortality rates (Healthy People 2000, 1990; McGinnis & Foege 1993; Fraser et al., 1997). In particular, the prevalence of these health-risk behaviors is higher among individuals with lower socioeconomic positions (i.e., low levels of education and low income; Liu et al., 1982; Winkleby, Fortman & Barrett, 1990; Lynch, Kaplan & Salonen, 1997; National Centre for Health Statistics, 1998). Specifically, Lynch, Kaplan and Shema (1997), reported on data from the Alameda County Study, that found those with incomes less than 200% of the poverty level in 1965, 1974 and 1983 had a significantly higher rate of problems with physical and psychological functioning in 1994. Furthermore, there was a positive relationship between low socioeconomic position (i.e., economic hardship) and psychological functioning. This means that the lower the socioeconomic position a person holds, the poorer psychological functioning and, conversely, the higher the socioeconomic position a person holds, the better the psychological functioning. Therefore, the empirical research clearly indicates an increased prevalence of major health 'risk behaviors' among people of lower socioeconomic position, which accounts for increased risk of negative health outcomes (Williams 1990; Krieger, Rowley, Herman, Avery, Phillips, 1993; McGinnis & Foege 1993; Blaxter 1997).

4.1 Theoretical Explanations For Low Socioeconomic Status & Higher Mortality Rates

Drawing from the health and illness literature, there are several interpretations as to why low socioeconomic status groups experience higher mortality rates. The first interpretation focuses on a cultural/behavioral perspective. This perspective maintains that health inequalities among class groups can be accounted for by class differences in behavior. More specifically, class differences in mortality are seen to be the product of class differences in the consumption of harmful commodities (e.g., tobacco, alcohol), leisure time exercise and utilization of preventive health care (Blane, 1985). Low socioeconomic groups are more likely to engage in behaviors that increase their risk of mortality.

The second interpretation sees mortality rates as being largely a consequence of structural influences. Behavior is seen to be linked with the social structure, through such factors as access to education and knowledge and through shared ways of seeing and constructing the social world (Blane, 1985). Put simply, individuals are not seen as being totally autonomous and unconstrained when making health-related behaviors.

The third interpretation sees the health behaviors of the low socioeconomic groups as reflecting the beliefs, attitudes, and values of a separate subculture. Its characteristic traits are said to be a lack of knowledge about, and indifference to health, and a lack of orientation to the future (Health Targets and Implementation Committee, 1988). As part of this view, lower class groups are seen to value current indulgence rather than the more middle class pattern of deferred gratification. This orientation, it is theorized, leads to higher rates of smoking and alcohol use among lower socioeconomic groups. Clearly, the reasons for socioeconomic differences in health behaviors lies somewhere among the three competing positions. It is likely that health behaviors are determined and shaped by personal traits and vagaries as well as in response to the wider social, cultural, and economic environment (Lupton & Najman, 1997).

Another explanation for why low socioeconomic status groups experience higher mortality rates focuses on class differences. Supporters of this explanation view class differences in health as being a consequence of the unequal distribution of resources and material wealth, which characterizes most societies. The class structure is seen to produce and reproduce educational, occupational, and income inequalities, with some groups experiencing relatively unrestricted access to these 'necessary' resources and other groups having very limited access. Those groups experiencing least access to these resources are likely to experience a lower standard of living, as measured by indicators such as the quality of housing. Ultimately, these disadvantaged class groups will experience higher levels of mortality as a consequence of their marginal economic position (Lupton & Najman, 1997).

4.2 Low Socioeconomic Status & Stress

There is evidence to suggest that the differences in health and behavior between high and low socioeconomic status can be attributed to stress resulting from the numerous adverse factors of a low socioeconomic status. Specifically, the stress of low socioeconomic status has been attributed to living under conditions of disadvantage (McEwen & Seeman 1999; Lynch, Davey, Kaplan, 2000). Furthermore, individuals with a low socioeconomic status are more likely to experience stressful life events such as death of a loved one, job loss, and criminal victimisation (Fang, Madhavan, Bosworth, & Alderman, 1998; Massey & Shibuya, 1995; Krivo & Peterson, 1996). Similarly, low socioeconomic has been associated with higher levels of social strain because of negative social interactions and the experience of discrimination (Schulz et al., 2000b; Sampson, Raudenbush & Earls, 1997; Kirschenman & Neckerman, 1991; Anderson, 1990). These stressors negatively affect the individual's health indirectly through facilitating the adoption of behaviors such as smoking and excessive consumption of alcohol, quite possibly in an attempt to cope with an environment that is stressful and isolating (Boardman, 2004, Lupton & Najman, 1997).

Research investigating the individuals' exposure to stress and the link to their physical and psychological well-being has increased in recent years (e.g., Baum, Garofalo, & Yali, 1999; Brunner & Marmot, 1999; Landale, Oropesa, Llanes, & Gorman, 1999; Turner & Lloyd, 1999; Dohrenwend, 2000; Boardman, Finch, Ellison, Williams, & Jackson, 2001). The stress-health relationship has been explained in terms of the fight-or-flight response, in which the body prepares for an emergency situation by producing hormones (e.g., cortisol and other glucocorticoid hormones). While the release of these hormones is extremely important for the individual's survival during an emergency, they can negatively affect the individual's physical health if the person is confronted by too many stressors, or if these stressors last for too long a time period (i.e., daily stress associated with low socioeconomic status). In this regard, the otherwise functional role of cortisol production has an unintended effect. That is, this excessive production of cortisol breaks down important physiological processes. This is described as 'allostasis' or 'allostatic load', which negatively affects the individual's cardiovascular system, metabolic rate, immune system, brain activity, and/or central nervous system functioning (McEwen, 1998), therefore affecting psychological functioning and subsequent engagement of risk behaviors.

An important factor that is known to buffer the stress associated with a low socioeconomic status is social support (i.e., access to social resources; Lin & Ensel, 1989; Power, Stansfeld, Matthews, Manor & Hope, 2002). As the research demonstrates, the quality of social relationships predicts psychological functioning, which is further complicated for those with a low socioeconomic status (Power, Stansfeld, Matthews, Manor & Hope, 2002). In particular, low socioeconomic status is

often characterised by a lack of emotional support and which is associated with higher rates of psychological distress (Oxman, Berkman, Kasl, Freeman, & Barrett, 1992; Stansfeld, Fuhrer, & Shipley, 1998b).

Social support is important as it has been shown to predict all causes of mortality for all ages (Blazer, 1982; House, 1981; Berkman, 1984; Welin, Svardsudd, Ander-Peciva, Tibblin, Tibblin, Larsson, & Wilhelmsen, 1985; Schoenbach, Kaplan, Fredman, & Kleinbaum, 1986; Kawachi, Colditz, Ascherio, Rimm, Giovannucci, Stampfer & Willett, 1996). As well as mortality, social support has been related to a wide range of health outcomes including well-being and depression (Brown, Andrews, Harris, Adler, & Bridge, 1986; Aneshensel, & Stone, 1982; Brown & Harris, 1978; Brugha, Bebbington, MacCarthy, Sturt, Wykes & Potter, 1990; Stansfeld, Rael, Head, Shipley & Marmot, 1998), pregnancy outcome (Turner & Marino, 1994; Hoffman & Hatch, 1996 and Rogers, 1994), perinatal health of mother's and children (Norbeck, Peterson & Tilden, 1983; Oakley, Rigby & Hickey, 1994; Kearns, Neuwelt, Hitchman, & Lennan, 1997), post traumatic distress disorder (Stephens & Long, 1997), improved immune status following drug therapy for cancer (Lekander et al., 1996), anorexia and bulimia nervosa (Tiller et al., 1997) and various chronic conditions such as rheumatoid arthritis (Fitzpatrick, Newman, Lamb, & Shipley, 1988; Fitzpatrick, Newman, Archer, & Shipley, 1991) and diabetes (Kaplan and Hartwell, 1987).

In sum, social support may contribute to socioeconomic inequalities and increase the engagement of risk behaviors (e.g., excessive consumption of alcohol), which consequently increases mortality rates of those exposed to a low socioeconomic status. This link between social support and health is an important consideration in terms of fire injuries or fatalities. It demonstrates that perhaps the limited social support associated with a low socioeconomic status reduces the individual's knowledge, focus on health, and fire safety behaviors.

4.3 Socioeconomic Status & Psychological Disorders

Socioeconomic status influences psychological functioning and risk behaviors through a number of factors (e.g., the environment, and experiences from childhood to adulthood). These factors combine to create specific levels of health and psychological functioning (Lynch et al., 1997). Generally, the results of empirical research suggest that higher rates of psychological disorders are evident in lower socioeconomic groups. For example, in lower socioeconomic groups higher rates of the following psychological disorders have been observed: schizophrenia, anti-social personality disorder and affective disorders, specifically depression and anxiety (Dohrenwend & Dohrenwend, 1974; Leaf, Weissman, Myers, Tischler, & Holzer, 1984; Dohrenwend, 1990; Bruce, Takeuchi, & Leaf, 1991; Dohrenwend et al., 1992; Kessler et al., 1994; Lewis et al., 1998).

For example, the results from a nationally representative sample of American adults showed that both education and income had strong, graded associations with change in self-rated health and psychological health status in a 7.5 year longitudinal study (Lantz, Lynch, House, Lepkowski, Mero, Musick and Williams, 2001). Specifically, education and income appeared to make unique contributions to changes in psychological health. This study suggests that those with higher levels of education have higher levels of psychological health which may, in part, account for the differences in engagement of high risk behaviors between low and high socioeconomic status groups.

Low socioeconomic status could affect psychological status and the engagement of risk behaviors through a process of social comparison. Individuals with a low socioeconomic status are negatively affected because of perceived inequity, which may reduce psychological functioning (Wilkinson, 1997). Adverse circumstances affect educational achievement, family structure and relationships which, in turn, may increase the risk of poor psychological functioning, although financial disadvantage may exacerbate or even underlie these risks, for example, as experienced by single parents (Brown & Moran, 1997; Hope, Power, & Rodgers, 1999a).

Thus, there appears to be mechanisms linking low socioeconomic status and psychological functioning (Power, Stansfeld, Matthews, Manor & Hope, 2002). By implication, this suggests individuals with a low socioeconomic status may have a higher tendency to engage in risk

behaviors which would account, in part, for the higher injuries and fatalities due to fires. However, there are other factors associated with a low socioeconomic status that may also be contributing factors to the high injuries and fatalities, these are outlined below. Furthermore, the factors associated with a low socioeconomic status presumably operate in combination and therefore the relationships that result are complex and difficult to disentangle.

4.4. The Link Between Low Socioeconomic Status & Fire

Research has identified the specific reasons for the relationship between low socioeconomic status and injuries/fatalities caused by household fires (Warda, Tenenbein & Moffatt, 1999). For example, the fact that smoke alarms are usually not fitted in houses in poor, rural, and remote communities dramatically increases the risk of injury or fatalities in the event of a fire (Hall, 1985, 1994; Baker, 1992; Hoffman, 1986). Furthermore, generally a low socioeconomic status is characterized by substandard houses, which often use substandard processes to heat the house (e.g., using wood stoves and kerosene) that obviously introduce additional risk factors.

4.5. The Link Between Low Socioeconomic Status, Psychological Disorders, Excessive Alcohol Consumption & Injury

Globally, psychiatric disorders account for 10% of all diseases (Murray & Lopez 1997), and excessive alcohol consumption is reported to be the most important cause of neuropsychiatric problems after major depression, ranking among the 10 leading causes of disability (Brundtland, 2000). Furthermore, there is evidence to suggest that those who have minor psychiatric disorders are more likely to abuse alcohol (Mendoza-Sassi & Béria, 2003). Excessive consumption of alcohol causes more years of potential life lost through death and disability than any other substance (i.e., tobacco or illicit drugs; World Health Organization, WHO, 2001). It is also related to several chronic degenerative diseases and fatalities associated with violence (WHO, 2001).

Socioeconomic status may be a predictor of excessive alcohol-related problems. There is evidence that individuals with a low socioeconomic status are at a higher risk of developing alcohol-related habits that are harmful (Mendoza-Sassi & Béria, 2003). Perhaps a contributing factor is that minor psychiatric disorders, including anxiety and depression, are frequent in this population (Mendoza-Sassi & Béria, 2003; Wang & Patten 2002), which perhaps may be attributed to the higher levels of stress associated with a low socioeconomic status.

Excessive consumption of alcohol is characteristic of low socioeconomic status, and it contributes significantly to the reduced life expectancy of those in disadvantaged socioeconomic circumstances (Casswell, Pledger & Hooper, 2003; Crawford et al. 1987; Romelsjo 1989; Dooley et al. 1992; Janlert & Hammarström, 1992; Dooley & Prause 1998; Bobak et al. 1999; Jose et al. 2000). The risk behavior of excessive alcohol consumption is strongly linked to unintentional injuries and fatalities caused by house fires (Warda, Tenenbein & Moffatt, 1999). The relationship between smoking and excessive alcohol consumption is a major issue as both habits are considered risk behaviors due to the negative and harmful health consequences (Mendoza-Sassi & Béria, 2003).

The most common cause of fatalities in household fires is careless smoking, which is responsible for up to 65% of deaths (Ballard, Koepsell, Rivara, 1992; Barillo, 1996; Mierley & Baker, 1983; Chernichko, Saunders, Tough, 1993). Moreover, when victims are tested for alcohol consumption, in some studies over half exceed the legal limit set for driving (Mierley, & Baker, 1983; Chernichko et al., 1993; Patetta, & Cole 1990). Additionally, research conducted in America estimates that 25% of fatalities that are attributed to household fires are the direct result of smoking while intoxicated (Warda, et al., 1999). For example, in relation to fatalities due to household fires there is evidence that victims were legally impaired in 85% of cooking related fires, 60% of smoking related fires, and 39% of heating related house fires (Patetta & Cole, 1990). Another example from the American research highlights that dangerous smoking habits are common. In a survey of American Indian households, 25% had a family member who smoked while in bed and 38% had a family member who consumed alcohol and smoked at the same time (Mobley, Sugarman, Deam, 1994).

4.6 Summary Of The Effects Of Low Socioeconomic Status

Extensive evidence demonstrates that low socioeconomic status is associated with higher morbidity and mortality which has largely been attributed to higher levels of psychological disorders, stress, and high engagement of risk behaviors (e.g., consumption of excessive amounts of alcohol and high rates of cigarette smoking; (Mendoza-Sassi & Béria, 2003; Wang & Patten 2002). In summary, these risk behaviors are characteristic of low socioeconomic status, and contribute significantly to the reduced life expectancy of those in disadvantaged socioeconomic circumstances (Casswell, Pledger & Hooper, 2003; Crawford et al.1987; Romelsjo 1989; Dooley et al.1992; Janlert & Hammarström1992; Dooley & Prause 1998; Bobak et al. 1999; Jose et al. 2000).

The combination of low socioeconomic status and poor socio-psychological health may be particularly harmful, as it may facilitate increased engagement of risk behaviors (Ben-Shlomo et al., 1993; Martikainen & Valkonen, 1998). High socioeconomic status creates material advantages that enable the purchase of high quality food and housing and, in addition, the purchase of services that may facilitate feelings of control and autonomy, resulting in higher levels of social participation. All of these factors have been thought to have important influences on risk behaviors and psychological functioning (Seeman, 2000). Furthermore, these supportive networks created through high socioeconomic status are a potential source of practical help and advice and, therefore, may buffer the effects of stress (Berkman, Leo-Summers, & Horowitz, 1992; Uchino, Cacioppo, & Kiecolt-Glaser, 1996).

5.0 YOUNG CHILDREN AT HIGH RISK OF INJURY/ FATALITY IN HOUSEHOLD FIRES

Disturbingly, a survey of the world's 26 richest nations has revealed that 40% of all deaths in children aged between 1 and 14 years are the result of intentional and unintentional injuries (United Nations Children's Fund [UNICEF], 2001). Injury alone accounts for almost one half of all deaths in preschool-aged children (Eichelberger, Gotschall, Feely, Harstad, & Bowman, 1990; Horwitz, Morgenstern, DiPietro, & Morrison 1988; Peterson, Farmer, & Kashani, 1990; Roberts 1993). For example, in Canada, almost 10 children per 100,000 died annually between 1991 and 1995 as a result of injury (intentional and unintentional), claiming the lives of 2,665 children for that time period (UNICEF, 2001). Although a considerable amount of research has focused on the nature and causes of injuries to children with the aim of prevention, unintentional injuries remain the leading cause of mortality and morbidity in children. In addition to the demand on health care systems, childhood injuries may have long-term consequences for the child and the family (Bruce, Lake, Eden & Denney, 2004). Despite numerous investigations of both individual children and parent factors, no single factor has been unambiguously identified to explain childhood injuries. However, one promising factor that researchers have investigated is the relationship between parental attitudes and preventive behaviors.

5.1. Factors Associated With Childhood Injuries

Previous research has reported a relationship between demographic factors (e.g., age, sex, race, temperament) and rates of childhood injuries (Graham et al 1993 and Harris and Kotch 1994). However, the relationships that have been found are weak and do little to explain why certain demographic factors lead to childhood injury (Irwin, Cataldo, Matheny, & Peterson, 1992). Additionally, children's behavioral characteristics and the relationship to injury rates have also been extensively studied (Davidson, Taylor, Sandberg, & Thorley, 1992). Although researchers have demonstrated a relationship between child behavior characteristics and injury rates, the magnitude of the relationship does not lead to the conclusion that targeting these behaviors through intervention strategies would have practical value (Speltz, Gonzales, Sulzbacher, & Quan, 1990).

5.2 Children & Socioeconomic Status

Because of this lack of evidence for contributions of child factors, the relationship between parental stress and childhood injury has been investigated in an attempt to understand and prevent childhood injuries. For example, it has been suggested that childhood injury is predicted by the frequency of stressful family life events (Horwitz et al., 1988). In particular, single parenthood, low maternal education, low maternal age at birth, poor housing, large family size, and parental drug or alcohol abuse, are family characteristics that have consistently been associated with childhood injuries (UNICEF, 2001). For example, Harris and Kotch (1994) found that as family conflict increased so too did unintentional injuries in infants. One reason for these findings has been suggested by Matheny (1986) who found that mothers of injured toddlers rated themselves as more emotionally overwhelmed and less energetic. Furthermore, when mothers had low social support and stress increased, so too did the probability of injury of their children.

Supervision of children has also been examined as a predictor of injury rates. Study results have established that maternal supervisory style was an important predictor of safety hazards in the home, second only to socio-demographic factors (Glik, Greaves, Kronenfeld, & Jackson, 1993). Further support for this theory was demonstrated by study findings of an inverse relationship between childhood rate of injuries and caregiver supervision (Garling & Garling, 1993). This means that as the level of caregiver supervision decreased, the childhood injury rates increased; or conversely, as the level of caregiver supervision increased, the childhood injury rates decreased.

Recently, Bruce, Lake, Eden and Denney (2004) conducted a study to investigate if differences existed between a sample of injured and non-injured children. Specifically, the relationship between children's injury behaviors, the parents' perceptions of risk and hazard, parenting stress, and parents' safety behaviors for two groups of children (injured and non-injured) were examined to ascertain if unique characteristics could be identified for injured children. It was reported that there were significant differences between the two groups of children (i.e., children who were injured and those who were not) in relation to the frequency of their injury behaviors. That is, children in the injured group reported more injury behaviors than children in the non-injured group (Bruce et al., 2004).

In sum, researchers have demonstrated that the relationship between high stress and unintentional childhood injuries are modified by the presence or absence of social support for the primary caregiver (Harris & Kotch, 1994). Given that the research demonstrates that social support is almost non-existent for those with a low socioeconomic status, unintentional injuries to children may be best targeted by focusing interventions for the individuals living in low socioeconomic conditions. Perhaps community-wide interventions combined with individual interventions may succeed due to the resulting increased provision of social support.

5.3 Summary Of Risk Factors For Children

Childhood factors that continue through to adulthood appear to be involved in the development of the differences between low and high socioeconomic status. Furthermore, it has been demonstrated that psychological disorders, which are more prevalent in low socioeconomic groups influences educational achievement from early in childhood (Offord et al., 1992) and continues in relation to adolescent conduct disorders (Jayakody, Danziger, & Kessler, 1998; Miech et al., 1999). In turn, levels of educational achievement strongly influence adult socioeconomic status (Caspi, Elder, & Herbener, 1990; Kuh, Head, Hardy, & Wadsworth, 1997). This is due to the fact that childhood educational experiences contribute to the development of emotional well-being (Hertzman & Wiens, 1996), which occurs through the development of self-esteem, and which continues to play a role through to adulthood (Power, Stansfeld, Matthews, Manor & Hope, 2002).

To conclude, factors associated with low socioeconomic status, particularly those relevant to psychological functioning are evident from birth (Power & Matthews, 1997). This is attributed to conditions of the family home environment, which are central to the development of emotional well-being for children (Offord et al., 1992). A broad range of influences that effect children

suggests they are one of the groups that is at high risk in terms of injuries and fatalities due to household fires (e.g., single-parent families, the quality of family functioning, emotional support, supervision, stimulation, parental aspirations and involvement). Young children are at high risk for injuries or fatalities due to household fires for a number of other reasons:

- They may be more likely than older children to play with fire;
- Developmentally young children are unable to react appropriately and escape;
- They may be left unsupervised; or
- When supervised, and in the event of a fire, they are dependent upon their family to be able to escape the hazardous situation (Squires & Busuttil, 1998).

6.0. ELDERLY

Some of the poorest Australians are pensioners living in rented private accommodation (Lupton & Najman, 1997). There is compelling evidence that shows the health of elderly people varies according to differences in socioeconomic circumstances and socio-psychological characteristics (Grundy & Sloggett, 2003). Socioeconomic status and socio-psychological functioning are entangled in complex relationships. It is known, for example, that there are social class differences in patterns of social interactions that can be attributed to attitudes developed during childhood. These attitudes have an important and long lasting effect on life circumstances (e.g., health behaviors and coping mechanisms). Furthermore, these attitudes exert strong influences on childhood experiences and, thus, adult socioeconomic and sociodemographic experiences (Barker, 1992; Bartley, Blane, & Montgomery, 1999; Bosma, van de Mheen, & Mackenbach, 1999; Brunner, Shipley, Blane, Smith, & Marmot, 1999; Davey Smith, Hart, Blane, Gillis, & Hawthorne, 1997; Wadsworth, 1997).

An individual's socioeconomic status represents one of the most enduring of all risk factors. This suggests that a low-socioeconomic status endures through to old age (House, Kessler, & Herzog, 1990; Crimmins, Hayward, & Saito, 1996; Rogers, 1992). That is, mortality in older age cohorts for those who have a low socioeconomic position is increasing. Based on the research that suggests a pattern of low socioeconomic status continues from childhood through adulthood, it is reasonable to speculate that the elderly who live in a low socioeconomic environment are at high risk of the factors outlined above. Extensive evidence has been outlined in this review, which suggests that one of the most important factors associated with low socioeconomic status is stress (physical, economic and/or social). The elderly are less able to buffer the effects of stress using social support because the likelihood of living alone increases with age (Lupton & Najman, 1997). However, the elderly face additional obstacles due to their age and associated mobility. The elderly are at high risk for house fire death for a number of reasons:

- They are known to have fewer smoke alarms (Hall, 1985; 1994);
- They may be hearing impaired, which if they do have a smoke alarm they might not hear it;
- Generally, their mobility is impaired, which slows their escape or completely prevents it;
- Socioeconomic status suggests they may use older appliances, such as portable heaters or heating blankets;
- Lastly, they generally live in older homes; therefore, the fire risk is higher (Elder, Squires, & Busuttil, 1996).

Importantly and, as previously alluded to, social support may contribute to socioeconomic inequalities and consequently mortality. Given that the elderly are generally less mobile, this may contribute to their reduced social support network, which is especially important if the individual has a low socioeconomic status. Based on the research that suggests the elderly are a risk group due to age, income and mobility, if the elderly individual also has a low socioeconomic status the implications would suggest this group is particularly vulnerable to injuries or fatalities caused by fire.

7.0. SUMMARY OF THE SOCIOECONOMIC STATUS & RISK BEHAVIORS

In conclusion, the evidence strongly suggests that a socioeconomically disadvantaged background reflects a life course process in which adverse family, individual, school, and peer factors combine to increase individual susceptibility to engage in risk behaviors more frequently (such as excessive alcohol consumption and cigarette smoking). Engaging in such behaviors is perhaps a means to compensate for the limited social support, which increases the number of injuries and fatalities caused by household fires. Lack of material resources available to individuals and adverse living conditions are known to be associated with psychological distress, which may facilitate increased engagement in risk behaviors. The effects of low socioeconomic status in adult levels of psychological functioning and the engagement in risk behaviors may be understood as resulting from an accumulation of events, which are affected by environments and experiences from childhood to adulthood (Lynch et al., 1997). Therefore, the degree to which the higher prevalence of risk behaviors among people of lower income and education levels contributes to socioeconomic disparities in health status is an important issue for public health policy. Interventions focused on the risk behaviors associated with low socioeconomic status to reduce fatalities and unintentional injuries due to fires are required at the individual and community level, which is outlined in the translation model of fire safety.

8.0. TRANSLATION MODEL OF FIRE SAFETY

The translation model was developed by sociology researchers and it is based on the 'Actor-Network-Theory' (ANT; Latour, 1987; Law, 1992, 1994; Law & Hassard, 1999). The most relevant application of ANT to aspects of safety is the work of Gherardi and colleagues (Gherardi, 1999; Gherardi et al., 1998; Gherardi and Nicolini, 2000). They suggest that safety knowledge is not pre-existing. Rather, it is something that is continually enacted, transformed and adapted in the social contexts where it is put into use. Similarly, the 'translation' model emphasises that knowledge is a part of ongoing social practices. Accordingly, it is suggested that knowledge is formed by and through social relations, and is acquired by social participation. Thus, it is dynamic and provisional.

Recently, Loyd and Oen (2002) successfully used the translation model to demonstrate the interaction of the social processes when engaging in fire safety education. This model suggests that fire safety information is most effective in the environment where fires take place (i.e., the community). As noted by Gherardi et al. (1988), people do not learn "safety"; rather, they learn safe working/living practices. To illustrate, when a household fire occurs, we often ask 'What went wrong?' There are two main tendencies in responding to this question (and both create 'risk factors'). Firstly, there is the 'pigeonhole' approach, which aims to detail the specifics (e.g., a person made a mistake, or a heater was faulty). Secondly, there is the 'system' approach, which focuses on how the factors combine to produce the result (probably the best example of the system emphasis is 'Normal Accidents Theory' (see Vaughan, 1999; Coopersmith, 2001).

Answers to 'what went wrong' are offered in terms of functions and relations. For example, a task was not completed, a connection not made, hence a fire results (Law, 2000). For example, in Mallonee et al.'s (1996) study of the effectiveness of a smoke alarm give-away program, it is clear that their interest is in the effectiveness of a system, not individuals. Perhaps more importantly, as Warda et al. (1999) emphasised, individual initiatives are limited by a lack of enforcement at the community level.

Therefore, a co-ordinated approach involving government, law enforcement, and dedicated community members is necessary to ensure that fire prevention is effective (Warda et al., 1999b, pp. 224). They argued that improvement in overall coordination at the community level would ultimately reduce household fire injuries and fatalities. Therefore, according to the translation model of fire safety the goal is to improve knowledge of fire-safety and to put such knowledge into practice in every household and its occupants. Hence the model suggests creating a safety culture, which translates to a 'community of practice' (Gherardi et al., 1998).

8.1. Summary Of The Translation Model Of Fire Safety

The overview of the empirical research suggests the complexity of the relationship between at-risk groups and fire safety is dependent upon factors associated with low socioeconomic status. This model is particularly relevant because it focuses on interaction, connections and associations between individuals, communities and fire fighting departments. The translation model suggests that accumulated knowledge of fire fighters is best actioned by fire fighters dealing with and engaging residents of the community. In particular for 'risk groups', fire-fighters are a key to linking the systems, sub-systems and individuals in households 'at risk' of fire injuries or fatalities.

To summarise this model, Law (2000a) suggests that fire safety knowledge can be translated in action: 'this arises when two content areas and two realities are successfully enacted as dovetailing together' (Law, 2000a; pp. 383). In other words, there is successful coming-together of fire-fighters and residents in and through the assessment of fire safety in the household. This may create a network of support previously missing for those with a low socioeconomic status, which encourages safety and presumably reduces fire risk.

9.0. CONCLUSION

Based on research findings, this report has identified risk factors for residential fire fatalities to be low socioeconomic status, smoking and alcohol consumption, children, elderly, male gender, disability, and non-white race. Armed with this knowledge, fire prevention programs can be specifically developed to target these 'at risk' groups. However, more information is needed in order to understand, for example, why people in low socioeconomic groups are considered to be at high risk of a residential fire fatality. It is clear that their socioeconomic status is not directly responsible. Several psychological and sociological health explanations were presented. These explanations included the cultural/behavioral perspective, social structure perspective, perspectives that viewed health behaviors of the low socioeconomic groups as reflecting the beliefs, attitudes, and values of a separate subculture, and another perspective that viewed class differences in health as being a consequence of the unequal distribution of resources and material wealth. A common theme underlying this research report was that low socioeconomic status is closely associated with the experience of more stressful life events and higher social strain, but less social support. As a consequence of elevated stress and lack of social support, it was proposed that low socioeconomic groups consume higher levels of alcohol and smoke more in an attempt to cope with an environment that is stressful and isolating. Obviously, using such coping behaviors elevates this group's risk of suffering fire-related injuries/fatalities. Socioeconomic status was also used to explain why children are also considered 'at risk' groups. Influences thought to elevate children's risk of residential fire fatalities were single-parent families, the quality of family functioning, emotional support, supervision, stimulation, parental aspirations and involvement. Socioeconomic status also contributed to explaining why the elderly are considered an 'at risk' group. The reason for this was that an individual's socioeconomic status endures through to old age. Socioeconomic status also suggests that they may use older appliances, such as portable heaters or heating blankets. Other factors identified as contributing to the elderly's elevated risk of a residential fire were that the elderly are known to have fewer smoke alarms, may be hearing impaired (which if they do have a smoke alarm they might not hear it), have impaired mobility which slows their escape or completely prevents it, and they generally live in older homes and therefore the fire risk is higher. This report concluded with a review of the translation model of fire safety which proposes that safety knowledge is part of ongoing safety practices, and that fire safety information is most effective when delivered by firefighters in the environment where fires take place (i.e., the community).

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