

Fire Research Report

Improving the Fire Safety Knowledge & Practices of Vulnerable Groups

NZCER

June 2000

This report on the first year of NZCER's project, *Improving the Fire Safety Knowledge and Practices of Vulnerable Groups*, brings together data collected and analysed to further understanding of vulnerable groups and their fire safety needs.

The literature review reveals that psychological disabilities of people in vulnerable groups, physical disabilities (particularly of older people), cigarette smoking, alcohol abuse, unattended cooking, and the absence of smoke alarms are factors often involved in fire fatalities, as is pre-school children playing with cigarette lighters. Effective fire prevention and fire response education works best if it is community-based, continuous, and uses a range of strategies.

Personal interviews and focus groups were conducted with 90 low-income parents of pre-school children, and 90 older people. A third of the people were Maori. Participants lived in 14 main urban, provincial, or rural areas in New Zealand. The study shows that most people knew the main causes of house fires involving people similar to themselves.

The identification of dangerous behaviours that play a key role in fire fatalities was an essential component in the process of developing the draft concepts for the education resources. The design brief for the development of the resource concepts emphasised the need to encourage people to replace these dangerous behaviours with new, safe practices.

Anna Chalmers, New Zealand Council for Education Research
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**REPORT TO THE NEW ZEALAND
FIRE SERVICE
CONTESTABLE RESEARCH FUND**

**IMPROVING THE FIRE SAFETY
KNOWLEDGE AND PRACTICES
OF VULNERABLE GROUPS**

YEAR ONE REPORT

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JUNE 2000

New Zealand Council for Educational Research
Te Rūnanga o Aotearoa mō te Rangahau I te Matauranga

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EXECUTIVE SUMMARY

This report on the first year of NZCER's project, *Improving the Fire Safety Knowledge and Practices of Vulnerable Groups*, brings together data collected and analysed from five sources to further understanding of vulnerable groups and their fire safety needs. This information was obtained to inform the development of effective fire prevention and fire response education resources for the identified vulnerable groups. The five sources used were: a literature review; an analysis of coroners' reports; interviews with key informants; and interviews and focus groups with people from vulnerable groups.

Data from a sample of the New Zealand coroners' reports involving fire fatalities was analysed to provide information about the relative vulnerability of different groups and the causes of house fires.

The findings from this analysis were highly consistent with those from the comprehensive review of New Zealand and overseas literature namely that the three most vulnerable groups in terms of risk of house fire fatalities are:

- children under the age of five,
- adults 65 years and over (even more so, adults 75 years and over), and
- people on low incomes.

NZCER's analysis indicates that the vulnerability of the identified groups is consistent over time and across national boundaries. In other words, vulnerable groups tend to be vulnerable no matter where they are and remain so except where specific efforts are made to assist them.

Psychological disabilities of people in vulnerable groups, physical disabilities (particularly of older people), cigarette smoking, alcohol abuse, unattended cooking, and the absence of smoke alarms are factors often involved in fire fatalities. Pre-school children playing with cigarette lighters is another common cause of such fires. The literature suggests that ethnic minority group status in itself is not a risk factor; rather ethnic minority group status is made visible in fire fatalities through its relationship with low income.

Effective fire prevention and fire response education works best if it is community-based, continuous, and uses a range of strategies. This is clearly evident from the literature review and from the material from key informants with experience in fire safety education, or who work with vulnerable groups. In addition, such education for pre-school children and older people needs to involve intermediaries. This can be done by targeting the "significant others" in their lives, such as parents or guardians, in the case of pre-school children, and carers and family members in the case of older people.

Insights from the literature review, coroners' reports and key stakeholder interviews were used to inform the design of questionnaires for individual interviews and focus groups with people from vulnerable groups. The purpose of these interviews was to provide insight for the development of appropriate and effective fire prevention and fire response education resources. These resources have been conceptualised in this first year, and will be further developed, tested and confirmed in the second year of the study.

The personal interviews and focus groups were conducted with 90 low-income parents of pre-school children (a third being Maori parents), and 90 older people (or the carers of older people, living in their own homes, i.e. not in residential care). Again, a third of the older

people were Maori. Participants lived in 14 main urban, provincial, or rural areas in the North or South Islands. Some 15 support agencies were used to gain access to participants.

The study shows that most people knew the main causes of house fires involving people similar to themselves. Parents correctly identified the main risk as being children playing with lighters and matches. This is a very real risk, given that between half the parents in the non-Maori sample and three-quarters of the parents in the Maori sample smoked. Parents were also familiar with ways of reducing these risks.

Older people correctly identified unattended cooking, leaving appliances on unintentionally and having combustibles too close to heat sources as the main causes of house fires amongst their age groups.

All groups identified risks associated with cooking or smoking when under the influence of alcohol.

Parents, older people and carers had many useful ideas both about formats for fire safety information resources and ways of disseminating such resources. They were interested, concerned and engaged in the study, both in their individual interviews and in the groups, and were keen to continue to participate in the development and testing of resources in the second year of the study.

The identification of dangerous behaviours that play a key role in fire fatalities was an essential component in the process of developing the draft concepts for the education resources. These concepts are specific to the respective vulnerable groups, and will target dangerous behaviours associated with:

- adult use and care of matches or cigarette lighters, where children might become involved;
- inadequate parental supervision of young children, including children whom parents have identified as “tutu”, mischievous or unduly curious when it comes to fire;
- unattended cooking;
- leaving appliances turned on unintentionally;
- placing combustibles too close to heat sources;
- smoking when under the influence of alcohol; and
- cooking when under the influence of alcohol.

The design brief for the development of the resource concepts emphasised the need to encourage people to replace these dangerous behaviours with new, safe practices. This brief is provided as an appendix to this report.

SECTION A

INTRODUCTION

The aims of the study are to:

- (i) provide a clear picture of the current levels of understanding of fire safety amongst individuals from groups defined as vulnerable; and
- (ii) produce resources which will improve knowledge and practice of fire safety to achieve the following outcomes: a reduction in the fire risk of vulnerable individuals and groups, and an increase in their abilities to respond safely to fires while still small, and/or escape safely from a fire.

Scope of the Study

This study has been developed to take place over two years. This first year comprises:

- (i) a literature review;
- (ii) interviews with key informants;
- (iii) an analysis of coroner's reports involving fire fatalities;
- (iv) individual interviews with representatives of vulnerable groups to identify their current knowledge regarding fire safety and likely practices;
- (v) focus groups with representatives of vulnerable groups to ascertain their views on disseminating fire safety information so that people similar to them will use it;
- (vi) the development of draft resource concepts to improve fire safety knowledge and practices.

The analysis of coroners' reports was not originally included in the scope of the study, but was undertaken to improve the level of understanding of the New Zealand situation. The need for such qualitative data in the form of case studies became apparent during the initial stages of design of the data collection for the individual interviews and focus groups, and coroners' reports were used for this purpose.

Arson has been excluded from this study.

The intention in year two of the study is to further develop, trial and confirm the draft education resources with the participants from year one.

Outline of this Report

This report presents firstly the key findings from the literature review, followed by information from the key informants, and the coroner's reports. The findings from the individual interviews and focus groups, and an outline of how the draft resource concepts were developed, complete the body of the report. Appendix 1 provides the full literature review, and Appendix 4, the full case studies from the coroners' reports. The design brief can be found in Appendix 10. The other appendices provide supporting documentation.

SECTION B

KEY FINDINGS FROM THE LITERATURE REVIEW

Introduction

The literature review (Appendix 1) contains a survey of approximately 200 items. For the most part, the items cover material relating to fire risks and public safety education programmes in the United States, the United Kingdom, and New Zealand. Most publications date from the 1990s, although there are some from the 1980s, and a few from the 1970s.

Public fire safety education has become a growing field over the past 25 years as the focus in the study of humans and fires has moved from the technical aspects of fire engineering and fire fighting to a consideration of the psychological aspects of human behaviour in fires.

The focus on human behaviour in fire education became more pronounced in the 1990s due to a shift from prescriptive building codes to performance-based codes, which are influenced by human behaviour; a belief that maximum gains from fire engineering have been made; and the fact that flashover points in domestic fires (where an entire room spontaneously ignites due to the level of heat of the fire) are occurring much sooner than in the past.

In New Zealand, the typical flashover point in a domestic fire is around three minutes. This leaves very little time for fire fighting to prevent deaths and makes human actions on discovering a fire the critical factor in determining whether lives will be lost or saved.

Designing a public fire safety education programme involves focusing on the question “what strategies and actions would best reduce the fire risk of vulnerable groups and the consequences of fire?” This question requires knowledge on who is vulnerable, why they are vulnerable, what changes are needed, and how these changes might be brought about. The categorisation system used frequently in the fire safety literature is based on that of vulnerable groups. Fire data usually analyses which groups, under which circumstances, are most at risk of fire injury or death. Most public fire safety education programmes are aimed at specific vulnerable groups.

In broad terms, the literature shows that the three most vulnerable groups, based on relative fire risk, are children under the age of five, adults aged 65 and over (even more so, adults aged 75 and over), and people on low incomes in urban and rural settings. Older people at risk often live alone and are physically or mentally impaired, while children at risk are often unattended. When people, particularly those from vulnerable groups are under the influence of alcohol or drugs, they are even more at risk.

Vulnerable Groups

Children Under the Age of Five Years

Pre-schoolers have a higher fire risk than the general population.

A disproportionate number of fires in which pre-school children die are caused by children playing with fire.

Child fire play is usually motivated by curiosity, with the setting of actual fires an accident rather than the intent.

The likelihood of child fire play resulting in actual fires decreases as a child's fire competence increases. Thus, one main way to address the issue of child fire play is to teach children competence with lighting materials in a controlled environment; it is also important to keep lighting materials away from children in unsupervised contexts.

The key factor in protecting pre-school children is constant supervision; many parents do not fully realise that leaving a young child alone, even for a few minutes can be highly dangerous.

Older People

Older people face a higher fire risk than the general population and older fire victims are more likely to have been involved in the cause of the fire that kills them. Older people are often less capable of escaping from a fire due to physical or mental impairments. At highest risk are older people who are poor and live alone. The main causes of fires are smoking materials, combustibles placed too close to cooking or heating, and unattended cooking.

Lower Socio-economic Groups

Variations in fire rates over time are best explained by factors related to socio-economic status such as income, education, the quality of housing, and home crowding. Such factors have been found by various studies to explain between 20–40 percent of variations in fire rates each, and together they account for up to two-thirds of the variance in fire rates.

Specific high-risk fire causes such as smoking, and children playing with fire are associated with low income.

The reasons why lower socio-economic status leads to a higher fire risk can be understood at household and individual levels.

At the household level, houses are less likely to be well maintained, have fewer fire safety devices, have more occupants, and possibly adult occupants provide less child supervision. At the individual level, less education increases fire risk, and risky behaviours such as smoking are more common.

Rural Population

Generally, fire deaths are higher in rural than non-rural areas. This appears to be largely due to lower incomes in rural areas, leading to a greater use of unsafe heating, a lack of smoke detectors, and geographical distance from the fire service.

The American rural fire risk is strongly linked to a higher level of use of less safe forms of heating.

Other main causes of rural fire deaths in America are smoking materials and electrical distribution systems.

Ethnic Groups

The evidence on ethnic minority status and fire risks is unclear. It appears that any link between the two can be mostly accounted for by socio-economic factors, notably income.

Alcohol and Drug Use

The exact level of involvement of alcohol impairment in fatal fires is unknown, but around 50 percent of fatal fires are estimated to involve alcohol impairment.

The most common cause of alcohol-related fires is the dropping of cigarettes by alcohol-impaired persons. Another main cause is cooking by alcohol-impaired persons. Evacuation behaviours may also be negatively affected by alcohol impairment. Fire victims impaired by alcohol tend to be middle aged, and male. Fires started by alcohol-impaired adults often kill children living in the same household.

Alcohol impairment leading to fire risks may be a behaviour pattern for certain individuals, rather than a one-off occurrence; one study found that a large proportion of alcohol-related fire fatalities are people who have caused a previous fire incident in similar circumstances.

Smoke Detectors

Smoke detectors reduce fire fatalities from 10 in every 1000 fires where there is no operational smoke detector present, to three in every 1000 fires where there is an operational smoke detector present.

Smoke detectors are least commonly owned by renters, those aged 65 and over, those in lower socio-economic groups, and the non-white.

The level of smoke detector use is high in both the USA and the UK.

Around 20–30 percent of smoke detectors are non-operational, usually due to dead or removed batteries.

Smoke detectors will not directly help those who are unable to escape a fire due to physical or mental impairments. However, smoke detectors will alert others in the same household to the fire, creating the possibility of assistance for those who are impaired, and not living alone.

Smoke detectors need to be installed, at least, outside sleeping areas and on each level of a house. Better still, there should be one in each bedroom. They need to be maintained properly, and to be supported by escape plans.

A combination of advertising and targeted programmes has had great success in increasing smoke detector use in both the UK and the USA.

Specific groups may be most effectively encouraged to use smoke detectors by give-away and installation programmes; in particular this applies to the older people and to lower socio-economic groups.

Smoke detector maintenance can be encouraged through a special advertising campaign, school programmes, and incorporation into existing successful programmes and advertising.

Fire Incidents Attended by the New Zealand Fire Service in the Past Decade

Generally, New Zealand fire risks appear to be broadly similar to those found overseas.

Older people and the very young are at a disproportionate risk of fire fatalities, as are males.

Many of those killed in fires are asleep or impaired by alcohol at the time of the fire.

Fatal fires occur almost exclusively in homes with no fire detection equipment, and disproportionately in non-conventional dwellings.

The main causes of fatal fires include smoking materials, children playing with fire, unattended ignition sources, and combustibles placed too close to a heat source.

The main difference found between New Zealand and overseas experiences are that New Zealand's rural communities are at less risk than in the USA, that arson is a low-risk fire cause in terms of fire fatalities, and that New Zealand's overall death rate from fire is low compared to many other Western nations.

What is Known by the New Zealand Public About Fire Safety

Data on the level of fire safety knowledge of individuals is limited and often gives highly variable results.

In broad terms, it can be said the greatest gaps in fire safety knowledge are: firstly, people under estimating their risk from fire; and secondly, people not understanding fire growth and the speed at which it occurs.

Presumably as a result of people not realising how quickly a fire progresses, the worst areas of fire safety behaviour in New Zealand are in regard to escaping fires:

- (i) lack of awareness that smoke will kill rather than wake up a person;
- (ii) over confidence in the ability of an individual to fight a fire unaided;
- (iii) failure to realise one should evacuate immediately and call the Fire Service, rather than fight a fire; and
- (iv) a relatively low level of escape plans, with an even lower level of practised escape plans.

The one escape behaviour widely known is the need to crawl low in fires.

In terms of fire prevention behaviours, the results of surveys are mixed. Knowing how to call the Fire Service has high levels of awareness. Knowing not to smoke in bed, not to leave heaters too close to furnishings, to close doors at night, not to overload electrical points, and to switch electrical points off at night, are all behaviours that have mixed results depending on the survey in question.

Awareness of smoke detectors is also mixed. It appears to be relatively high, with around two-thirds of New Zealanders overall claiming to own smoke detectors, and two-thirds of the owners claiming to check the smoke detector(s) regularly. Knowledge on the correct positioning of smoke detectors appears to be high. New Zealand evidence found that homes with children are more likely to have smoke detectors.

A link was found in New Zealand evidence between people recalling fire safety education efforts and the levels of fire safety actions practised, particularly in terms of smoke detectors and escape plans.

Older people were found to have a low level of escape plans, but a high level of smoke detector maintenance.

Children in New Zealand were found to have a high level of fire safety knowledge, and a lower level of ability to perform fire safe behaviours such as crawling low in smoke.

Human Behaviour in Fires

In fatal fires, victims are likely to be asleep, unable to act, or attempting escape. These behaviour patterns vary by age. Others in fatal fires often try to rescue the fatality victim or other family members.

Fire behaviours vary depending on the stage of the fire. They chiefly involve finding the fire, fighting it, notifying others, and evacuating.

People in domestic fires are more likely to attempt to find the fire, rate it as serious, and notify others in the house.

There are gender differences in common actions in fire, with men more likely to fight the fire, and women more likely to warn others.

Fire re-entry is common, especially by men.

Evacuation Behaviour

Fire engineering prior to the 1970s was focused on technical matters, with incorrect assumptions made about human behaviour in fires.

A burgeoning body of psychological literature, and interest in actual human behaviour in fires has corrected those assumptions.

Much human behaviour in fire is driven by a need for information and is informed by a number of factors such as self-perceived role, actions engaged in at the time of the fire, and group membership. For example, employees listen to bosses, while family members search for their families.

Actual evacuation is not immediate. The time taken to decide to evacuate is usually the longest time period in the entire evacuation process, and people tend to under-estimate the risk of a fire to themselves. In evacuation people do not usually use fire exits or routes, unless these are commonly used.

Before evacuation, people tend to either fight the fire or warn others.

The literature on behaviour in fires indicates that a key task for education is to improve people's understanding of both fire process and safe behaviour during fires. During a fire the simplest way to encourage fast evacuation is to provide information using verbal directions.

Features of Successful Public Fire Safety Education Programmes

Education is less likely to produce change than legal enforcement of fire safe practices or automatic protection through environmental modification.

Education is becoming more important as limits are reached in the viability of further modifying the environment or enforcing safe behaviour.

Education has a crucial role in supporting both legal enforcement and environmental modification.

The UK has had a non-unified approach to public fire safety education, with each brigade responsible for its own geographic area. The Community Fire Safety Task Force has proposed this approach be replaced by a nationally unified programme focused on fire prevention, detection and escape.

The USA has had a more unified approach based around the National Fire Protection Agency (NFPA), the Federal Emergency Management Agency (FEMA), and the United States Fire Administration (USFA). This approach has traditionally focused on child fire safety education and smoke alarms, and more recently work has begun on programmes for older people, and to improve escape behaviour.

Programmes should be targeted. Targeting is currently used as a strategy by most effective public fire education programmes. Successful targeting requires market research and sufficient funding.

Programmes should involve the community. Community involvement improves a programme by encouraging effective targeting, support and interest from the community, and a high level of personal contact. Community involvement is particularly effective for programmes for older people and lower socio-economic groups. Community involvement is currently being used as a strategy in New Zealand and the USA.

Programmes must teach positive actions which people can take in response to fire risks and fires. Attempting to scare people into action can have a negative effect. Graphic images of fire damage have a possible role in raising awareness and as examples of fire growth, but must be supported by positive, constructive, action-orientated messages. Fire safety messages should be limited to key points, and repeated. Lists of crucial factors from the NFPA and other researchers in the field expand upon the three key factors of targeting, community involvement and positive, constructive messages.

Programmes for Specific Target Groups

Much fire safety education research is either small-scale and experimental, or considers evaluations of actual programmes.

Experimental research is useful in isolating the effects of specific teaching methods.

Evaluations of programmes are useful in showing the effects of education on actual behaviour in fires. However, many programmes are not effectively evaluated for a number of reasons.

Fire safety education should draw on general educational theory, which emphasises that to be effective education must be focused, reinforced, appeal to multiple senses, and be supported by people close to the student.

Learning can be motivated by addressing the needs, outlined in Maslow's (1970) hierarchy of needs, that are specific to the audience in question.

Learning must address the various domains of learning— affective, cognitive and psychomotor.

Adults will often learn best in a goal—and task—directed manner, in a self-directed environment, once a need-to-know has been established.

Using the media in education requires supplying positive, constructive materials to the media.

Children

Learning theory is very age-specific.

Pre-schoolers will not understand cause and effect reasoning and are more likely to remember an image than its accompanying message. Thus, fire safety education for this age

group must be very carefully designed to avoid negative effects—for example, a pre-school child will remember a picture of a lighter and not the accompanying safety message; a pre-school child will also not realise that different safety behaviours are needed for different fire scenarios, unless each of these behaviours is taught separately.

Including adult components in programmes is very important, particularly for pre-schoolers.

For primary school children appropriate teaching links to their need to understand social roles and develop social and physical skills, and self-attitude.

Adolescents respond to teaching that draws on their need to develop conceptual thinking, responsibility, ethics, and community involvement. They also respond to role models, or to becoming a role model by teaching others.

Experimental research focuses on teaching techniques for primary school children.

Much experimental research is based on teaching suitable behaviours in response to a series of hypothesised fire situations.

Behavioural teaching, where children physically practise behaviours, is much more effective at improving children's ability to perform the behaviours in question than verbal or visual teaching alone.

Many school-based programmes use behavioural teaching.

The effects of behavioural teaching approaches can be improved by adding elaborative teaching or self-instruction strategies. These approaches improve children's understanding of the behaviours being taught, and promote retention of the behaviours.

Both elaborative teaching and self-statements have been found to reduce excessive levels of fear of fire in children, which should improve responses to actual fires.

Given the low levels of skill retention over time, even for the most effective programmes, it is clear that repetition, both within programmes and of programmes over time, is crucial.

Most programmes for school-aged children operate through schools.

The most widely used programme in the USA is the NFPA's "Learn Not To Burn", which has been successful in teaching fire safety skills. However, one study found no evidence that "Learn Not To Burn" is more effective than other programmes used in the USA, and that its success strongly depends on its administration. In 1994, "Learn Not To Burn" was given a stronger community focus through the Champion Award Programme, which uses trained education leaders to champion the programme.

School-based programmes often reach not only children but also their parents.

Targeting high-risk schools can be an efficient strategy if funds are limited.

Programmes for Children's Caregivers

Pre-school children cannot keep themselves safe; thus, children's caregivers need to be taught to keep them safe.

There are three key messages for caregivers: to supervise children; to understand the risks to children from fire; and to reduce environmental hazards, particularly the presence of matches and lighters.

Even a one-hour programme, designed to fire prevention to a range of child carers, can have a strong positive effect on the knowledge of caregivers.

Older People

Many successful programmes for older people use home visits to reach a range of older people.

A number of sources comment that many older people respond negatively to any emphasis on their high-risk status; having spent years looking after themselves and others, they do not wish to be told their ability to do so is declining. This can be circumvented by appealing to a wish to create a safe environment for partners, friends, grandchildren or pets. Alternatively, fire safety can be presented as a general health and safety issue. This taps into existing concerns of the older people, and modifies the suggestion of incapability into a more neutral health or safety focus, akin to a regular medical check-up.

Older people are unlikely to respond to media campaigns. They are better reached through community groups, social events, or personalised appeals by people they respect, such as medical practitioners.

Linking fire safety with community groups, peer counselling or social events not only improves the involvement of the older people in fire safety programmes, but also addresses a major need of much of the older population: the need to build dependable relationships with others. This can have a positive effect on overall safety also, as it counteracts the tendency of some older people to respond to a general fear for their safety by isolating themselves.

Fire safety education for older people needs to be interactive and draw on their knowledge and life experience.

It needs to be mindful of the physical limitations of older age; for older people who are not solely responsible for their own care, the education of caregivers is also effective.

The supply and installation of smoke detectors is a frequent and successful part of fire safety education programmes for older people.

Lower Socio-economic Groups

Lower socio-economic groups appear to be not so much hard-to-reach as hard-to-influence.

The key factor in influencing lower socio-economic groups to adopt fire safe practices is to involve the community to be targeted in the design and implementation of fire safety programmes. Programmes which use this approach have had a great deal of success.

A main aspect of many programmes for lower socio-economic groups has been smoke detector give-aways. If a give-away scheme is carefully targeted and involves the community in its administration and implementation, it can result in significant reductions in fire fatalities.

Rural Population

Successful fire safety education in rural areas appears to involve the same factors considered important for other groups: community involvement and coalition building.

In the case of poorer rural communities, strategies used with lower socio-economic groups, such as smoke detector give-away programmes, are likely to be successful.

Ethnic Groups

There is little material on programmes aimed specifically at ethnic groups.

A key way to reach various ethnic groups appears to be producing educational materials in the appropriate language.

Community involvement in the design and implementation of programmes would presumably have a positive effect.

Evaluating Public Safety Education Programmes

Proof of the effectiveness of public fire safety education can range from weak evidence, such as knowing a new programme has been introduced, to strong evidence, such as finding a reduction in fire fatalities.

Proof of effects may come in the form of anecdotes. It has been argued that this is acceptable “since at the local level, or even nationally, it does not take many anecdotes to drastically change the fire loss picture”. This would be true of New Zealand where the actual number of fire deaths each year is small.

Determining cause and effect—such as whether fire deaths were reduced due to a programme—can be extremely difficult due to uncontrollable factors such as climate changes or random variations in fire statistics.

SECTION C

KEY INFORMANT INTERVIEWS

Methodology

The research proposal stated that the study would include 10 to 20 interviews with key informants, including employees of the New Zealand Fire Service. The proposal suggested that these interviews would cover: the interviewees' experience in working with the public; opinions of the interviewees as to whether approaches outlined from the overseas literature would work in New Zealand; and interviewees' views of likely organisations to work with to reach vulnerable groups. Interviews were tailored to the specific interests and expertise of the interviewee. For instance, one interviewee's experience included fire safety programmes that led to a reduction in fire fatalities amongst older people in another country, and accordingly the interview included a focus on this aspect.

Sixteen interviews were undertaken in September and October 1999 with representatives from 13 organisations. The organisations are listed in Appendix 2. Initially, the organisations represented were identified by brainstorming using information from the literature review to inform this process. From this point, "snowballing" was used to widen the range of interviewees, thereby gaining access to perspectives not previously covered.

All but two interviews were conducted face-to-face. These two were undertaken by telephone. All interviews were taped (with the interviewees' permission), so that the data could be transcribed and analysed systematically.

A letter outlining the study was sent to interviewees before their interview. A copy is attached as Appendix 3.

Findings

Key informant interviews confirmed what was known from the literature review and the analysis of coroners' reports about the identity of the vulnerable groups, namely, older people, children under five years, people with low incomes (generally identified here by their living in rental accommodation, apart from the older people who may live in their own home but have a low-income), and ethnic minorities (including Maori and Pacific people). These factors cluster so the same people can often be identified in more than one of these groups. For instance, many Maori will have a low income and their families will include children under five years. The interviews provided some additional insights into particular issues relating to these groups. They also suggested ways of accessing people from such groups for focus groups, and made suggestions as to how such people could be influenced to improve their fire safety understanding and practices.

Older People

Trends

One informant suggested the safety of older people living at home, particularly those living alone, is an increasingly important issue as the trend is for more older people to be living in their homes, at an older age than previously. She has noticed the level of disability of people

who are remaining at home rather than moving to rest homes is much higher than it was in the past, and that includes people with varying levels of dementia.

Risk factors for older people

Key informants emphasised the particular vulnerability of older people, especially those living alone with mobility difficulties, hearing difficulties or some memory loss. An informant involved with low-income housing believed single, older men living alone to be the highest risk group.

Another informant listed a number of risk factors for older people. These were the tendency to:

- (i) feel the cold more than other age groups, so older people are more likely to sit close to a heating source;
- (ii) put clothes near a heating source to dry or warm them;
- (iii) live alone (and therefore not have someone in the house who could raise the alarm and help them to escape safely from a fire);
- (iv) fall while trying to escape a fire;
- (v) leave electric blankets on for long periods of time;
- (vi) forget to turn appliances off causing over heating and a subsequent fire;
- (vii) leave elements turned on with a saucepan on the stove;
- (viii) not keep up-to-date with new developments in fire safety, such as smoke alarms;
- (ix) hoard items, such as newspapers thereby creating a fire risk;
- (x) be reluctant to ask for help; and
- (xi) not believe that they need help, or that their practices are unsafe.

Older people also tend to live in homes with some or all of the following characteristics: “making do” with old (and as such, unsafe) wiring; old plugs in the walls; old extension cords; old heaters, electric blankets and other appliances that may be past their “use by” dates. One informant described some older people as having their homes stacked with “the stuff of a lifetime” so that, for instance, there is a corridor just wide enough for one person to pass down the hallway. Obviously this would be a barrier to exiting safely in the event of a fire.

Fire safety education

An informant mentioned the need for her staff who cleaned older people’s homes to put furniture back in exactly the place they found it because the older people used the furniture as handrails, and if the furniture was moved, they were unable to get from room to room.

She felt any fire safety education would need to be delivered to such people on a one-to-one basis directly to them at home and explained to them, and it would need to focus on fire prevention. An informant discussed his involvement with a service organisation, which had recently attempted to install smoke alarms in residential property in one suburb. They approached people door-to-door, provided the occupants with a pamphlet, and asked if they would like a smoke alarm installed free of charge. There was much resistance from the older people, and only half of the 50 smoke alarms purchased were installed. Working through two churches was not successful either. He described the exercise as embarrassing, and said

that if this were done again, they would leave the pamphlets and provide a phone number for people to call if they wanted a smoke alarm installed.

The use of intermediaries

One suggestion made by several informants, and reported by one informant as being tried successfully in one other country, was to reach older people living alone by working directly with members of their family. This includes, for example, sons or daughters who may be experienced in influencing their parent and concerned about their well-being, but unsure of what the issues are or how to proceed in overcoming these.

Issues relating to family members who are carers of the older people were discussed. It was felt that sometimes it is hard to identify the carer. This person may resent their role, minimise it, deny it, or simply not recognise themselves as a carer in any programme to target carers. Such people will not necessarily be immediately open to further information or tasks relating to their role as a carer. They may feel they do not have the time for such education, particularly if they are in other employment as well as being a carer. Others may be very open and welcome the support. The point was made that both family and professional care of older people at home is a growing area, and generally, carers are just beginning to be educated in knowing what to look for in fire safety, as is the person being cared for.

One informant working with a national organisation for care of older people felt it could be very effective to educate family carers, or professional carers who visited the older people at home to assist them with such routines as bathing, cooking, shopping, and cleaning.

Another informant suggested there were four important issues in developing fire safety education for older people to be used by carers. First, get on board with carers, don't make assumptions about what carers might want, think or need, but go and talk to them and find out; second, identify their expectations and be very clear about what carers expect; third, focus on the client; and lastly, involve the community so that this is a community supported response, rather than a government or public body driven response.

In the case of professional carers at least, there would be a number of contractual employment and procedural issues to resolve before proceeding formally with such an idea. Co-ordination between organisations would be important for such a scheme to work and effective co-ordination requires good communication. Messages in a campaign about smoke alarms, for instance, would need to be simple, realistic, supported by the community, accessible and use a range of delivery methods from putting information out with rates, power and telephone bills to magnets for the refrigerator. Testing the safety of electric blankets was identified by one informant as being necessary. "In the past this was service was available free of charge from the power board but now it costs \$15 from Leemings". It was suggested that intermediaries could assist older people in accessing such a service.

Characteristics of older people to consider

General characteristics of older people were discussed by some informants. One was their interest in obtaining a bargain. It was felt this could be used as the focus in a campaign to provide them with reasonably priced smoke alarms and free installation. This had been done successfully overseas. Another informant thought this would only work if arrangements

could be made for social service agencies who visited the older people in their homes to take responsibility for replacing batteries. This, too, was known to have been done successfully in one overseas country.

Another characteristic was the crime safety consciousness of some older people which meant that they use a deadlock on the inside of their door that can only be opened with a key, and if anything happened no one could get into the house to get them out.

One informant felt that approaching mobile older people who like to mix with others and attend social centres regularly would be a useful way to develop a focus group, as it would be tapping into an existing infrastructure.

Low-income People, Including Families With Children Under Five Years

General characteristics

A key informant pointed out that apart from some older people who may be “asset rich” living in their own home but cash poor, most fire-vulnerable low-income people will be living in rental accommodation. As such, low-income people are less likely to live in a building with smoke alarms. This includes students and other young people who are flatting, Maori, Pacific people and other minority ethnic groups, single parent families, and people who are unemployed or are sickness beneficiaries.

Identifying low-income people by focusing on those who live in rental accommodation is useful because prevention strategies can be developed around the installation and maintenance of smoke alarms in bedrooms and hallways in rental accommodation. One difficulty is that people who are focusing on basic survival and their immediate needs will have less time and energy to focus on fire safety as it is not an immediate daily issue to be faced. Several informants pointed out that factors such as over-crowding, poverty, ill-health, fatigue and depression, especially in the case of single mothers with young children, increase stress on people and have a detrimental effect on their energy levels and coping skills.

It was suggested that emphasising what was good for their children was the way of ensuring that low-income families focused on fire safety.

Mothers in single parent families

One informant felt that mothers in single parent families often take considerable notice of a medical practitioner or Plunket nurse as they are giving them good practical information about their children. She felt the infrastructures supporting these experts could be used to deliver three (unspecified) key messages on fire safety. Low-income families where the parent is in paid employment often build relationships with staff in the childcare centre their child attends, or with their child’s home-based carer. One informant thought fire safety information for these families could be channelled through such intermediaries. Focus groups of mothers who come together in playgroups for their children to play together could be used to develop and test ideas for resources for “mothers at home”. Plunket, Playcentre and Parents’ Centres organise such groups and there are probably others within different cultures, perhaps church based.

People who smoke

Informants stated that as low-income adults are more likely to be smokers than people with higher incomes, useful fire prevention messages are those emphasising the safe disposal of smoking materials, especially when associated with drinking alcohol, and the need to keep smoking materials secure from young children, as is the standard for medicines.

Students and other young people flatting

One informant suggested, as was successfully achieved overseas, that parents of young people who are flatting could be targeted to raise the standard of fire safety in flats. Such a tactic could use emotive advertising showing a run-down and unsafe flat and asking “would you want your son or daughter to be living here?”. It was also felt that students flatting could be targeted to raise their awareness of fire safety through information supplied at orientation, and through university and polytechnic accommodation services. The use of fire wardens in student flats and other rental blocks was another strategy discussed, and it received support from accommodation officers. This scheme was being successfully used in housing provided by another social service organisation.

Another idea was to develop “flatmate awareness” where flatmates learn to watch out for one another and help one another to keep fire-safe, at the same time raising awareness about their own fire safety. In thinking about the links between alcohol intoxication and fire risk in young people, it was suggested that youth could be made aware of the need for someone in their group to be designated the role of staying sober to watch out for the life safety (including fire safety) of the others. This would work in the same way as designating a group member to stay alcohol-free to drive. Two informants said an additional fire risk for young people flatting could be their use of candles to create an atmosphere or for spiritual reasons. Another point made was that young people who are very heavy sleepers may sleep through a centrally located smoke alarm. This pointed to the need for alarms in bedrooms. One informant had knowledge of kitchen fires caused by items catching fire when stoves were used to produce cannabis products.

Working with low-income families

Targeting low-income families directly with fire safety education, and obtaining their input to develop appropriate resources was thought to be very difficult. One social service organisation representative said it was almost impossible to get them to come to meetings, but that offering a grocery voucher for adults or a music voucher for teenagers and younger school-aged children proved successful in gaining their involvement in focus groups. He suggested the need to target 12–14 year olds with visual material as a lot are remedial readers. He felt youth radio would be effective as they listen to the radio to keep up with the latest music. Using channels such as radio where adolescents could access the information almost subconsciously, and focusing on a very few key messages like smoke alarms was discussed and supported by informants.

Education in schools was generally felt to be useful for primary school children who will come home and educate their parents with the key messages. One informant felt this would be less successful with Pacific families (this is discussed below).

Another idea was to make a video with positive messages showing the same fire scenario once with a smoke alarm operating and the other without, and using the scene of a room bursting into flames in three minutes.

It was suggested that corporate sponsorship could be obtained to make inexpensive or free smoke alarms available to low-income people with free installation and maintenance, thereby making it as easy for them as possible. This has successfully been done in at least one overseas country. An option which had been used by one group was to hard wire the smoke alarms so there was no need for replacement batteries.

Landlords

A residential landlord identified an issue for landlords who rent out residential accommodation. They are legally required to meet fire safety standards which, in his view, were not workable and were really designed for commercial rental property.

Maori

Maori are over-represented in low-income statistics and, as described by one informant, are more likely to be smokers, drinkers, unemployed, living in rental accommodation, of average to low health, and possibly sole parents. This suggests they are very vulnerable when it comes to house fire risk. The informant said a cross-organisational approach is needed throughout the country. He is developing fire safety messages in Maori for use with Maori in his fire region, and he suggested this work could be furthered in other regions. If material was being produced in Maori for other areas it would need to be modified for different dialects around the country. He suggested building up rapport and working in partnership with local iwi, and delivering the education in person to groups of Maori. In his work, he includes experiences such as simulating a smoke filled room with artificial smoke and getting people to discuss this. He also provides people with key messages in the form of written resource materials so they do not have to remember everything that is presented. He emphasised the importance of working within existing infrastructures that Maori are already accessing, such as Work and Income New Zealand (WINZ). In conclusion, he stated that the big issues for Maori are life safety, being careful about the use of alcohol and being aware of fire hazards in the home.

Pacific People

General issues

The informant felt the key issues were drinking and then cooking, and forgetting the stove was on; a general lack of awareness about the dangers of frying food and the possibility of fat fires; and the supervision of young children by older children as the older children may not have the necessary understanding of fire safety. He pointed out the difficulty of trying to ask people who are focused on the basic immediate needs of survival, such as providing food and health, to focus on fire safety, which is very much lower in their priorities.

Working with Pacific people

In thinking about effective ways for communicating with Pacific people about fire safety, the informant thought that something specific that would attract their attention must be used. A campaign focusing on a specific issue and using a whole range of methods that complement one another could be effective, and he gave the following example. If the issue was smoke alarms, first the community would have to be approached in a way that made them feel comfortable, which is face-to-face. The key issue would be agreed. It might be, for instance, that Pacific people are more likely than other groups to be caught in fires. A radio campaign could be developed to play on Pacific radio where community leaders talk about the issues, as well as someone from the Fire Service, and there could be discussion. Then meetings could be arranged to talk more, and in those meetings links could be developed with community operators with key networks. It was suggested that printed information should only be used to tell people there is a 0800 number to call for more information, as too much information at one time can cause confusion.

He did not feel that educating school children who might then educate their families would work with Pacific people. This is because of the cultural requirements for Pacific children to defer to adults. In his view, it would be better to focus on the family as a unit from the outset. Using Pacific people who are effective at linking into community networks to disseminate information within the community would be another strategy to consider. In working with focus groups of Tongan or Samoan people, the groups would need to be conducted in the appropriate language using their traditional processes based on integrity and trust, as part of a strategy for long term education on fire safety issues.

The informant felt it was most important to start work immediately on this issue, because with the overcrowding in homes, and the low level of fire safety behaviour “there is a disaster waiting to happen”. In conclusion, he said a clear communication strategy is needed that is targeted to particular communities, such as Tongan or Niuean “to go where they go”; provide information in the ways they understand; consult them and do something about the problem.

Conclusion

Key informant interviews confirmed the need for effective fire safety prevention strategies to be developed to use directly with older people and through intermediaries.

Useful ways of influencing low-income groups, including families, ethnic minorities, and young people flattening, were suggested. These involve working with local communities, linking to existing social service support infrastructures, and developing simple key messages on fire prevention and fire evacuation that emphasise the responsibilities of adults for the safety of children in their care.

The findings show a high level of consistency within the key informant data, with the information from the literature review, and with the analysis of New Zealand coroners’ reports involving fire fatalities. This suggests the key informant interviews generally covered the range and types of fire safety expertise and knowledge residing in people in New Zealand.

SECTION D

INFORMATION FROM CORONERS' REPORTS

Methodology

Coroners' reports relating to house fire fatalities occurring between 1995 and 1998 were sought to undertake secondary data analysis on the circumstances of the fatalities. Reports published between 1995 and 1998, which could be successfully identified as involving a fire fatality and were able to be obtained in the first round of searching, were analysed. Suicides and car fires (which occurred both on and off the residential property), were excluded. Caravan and sleepout fires were included where these were used to house the occupants on a residential property. This process resulted in 33 relevant reports, which were then analysed.

The file for each fatality compiled by the coroner's office contains the *Findings of the Coroner under the Coroners Act 1988*; the *Deceased Person Identification Form* authorised by the New Zealand Police, with supporting documentation; and the *New Zealand Fire Service Investigation Report*, also with supporting documentation.

Data from these sources was analysed according to a number of factors identified from the literature review as contributing to the vulnerability of particular groups to house fire fatalities. These factors are listed below. It should be noted that not all factors were covered in all coroners' reports. For instance, the ethnicity of the deceased was reported in very few cases so the names of the deceased were used to provide an indication of ethnicity. Where the deceased had at least one Maori or Pacific name, their ethnicity has been defined as "Maori" or "Pacific Islander". For this reason, the information on ethnicity should be used with caution. The factors used in the analysis were:

- age of the deceased;
- gender of the deceased;
- presence or absence of rental accommodation;
- employment status and type of employment of the deceased (where the deceased was a child, the employment status and type of employment of the parent/s was examined);
- ethnicity of the deceased;
- cause of the fire;
- involvement of the deceased with alcohol prior to the fire (where the deceased was a child, parental involvement with alcohol was examined);
- presence or absence of smoke alarm/s; and
- presence or absence of a disability in the deceased.

Information from 28 fires involving 33 fatalities is summarised below. Twelve of the fatalities occurred in 1998, thirteen in 1997, and the remainder in 1996 and 1995. This represents approximately a third of the fatalities which occurred in 1998 and in 1997, and smaller percentages of the fatalities occurring in 1996 and in 1995. Because this analysis involved only a small number of fires, a brief discussion, which compares these findings to those of an earlier New Zealand study, is included. This study was undertaken by Cropp¹ in

¹ Cropp's study is reported in the literature review (Appendix 1)

1991 and is one of very few published New Zealand studies of this kind. Further information about each of the 28 fires is provided in the form of case studies (Appendix 4).

Findings

Age and Gender of the Deceased

Two age groups, recognised in the literature as particularly vulnerable, made up nearly half (45 percent) of these fire fatalities. The groups were children under five years who accounted for a fifth of the deaths (n=7), and people aged 65 and over who made up a quarter of the deaths (n=8), with six of these aged 75 years or over.

Overall, almost twice as many males as females died. Twenty-one of the deceased (63 percent) were males, and 12 (36 percent) were females. In the under five age group, five of the seven deceased were males.

These results are similar to those of Cropp, referred to above, in his study of fire-related deaths between 1986 and 1990. He found that people aged 75 years and over, and children under the age of five had the highest death rates.

Cropp also found that males were twice as likely as females to die, even in the under five age group. Cropp states “one surprise from this study is that the difference in death rates between the sexes exists even in the under five age group. It could be expected that children of this tender age had little control over their circumstances, and the risk of fire to which they are exposed. The differences appear to extend even to children under three, though the numbers are too small to draw any definite conclusion”.

Returning to the present study, an analysis of the cause of the five fires in which the seven children under five died, shows that three of these fires were caused by male children playing with cigarette lighters, and one of the other two fires was probably caused by the sister of the nine week old deceased male playing with matches.

Rental Accommodation

Seven of the fires were reported as occurring in rental accommodation. One fire was described as occurring in privately owned accommodation, and in the other cases this information was not specified. Cropp (1991) found that rental properties, particularly those privately rented, seemed more vulnerable to fatal fires. This study has not been able to obtain sufficient data from coroners' reports in this area to make any meaningful comparison with Cropp's finding.

Employment Status

Twelve deaths occurred amongst people aged between 17 and 65 years. Occupation was not provided for seven of these people. A quarter (n=4) of the deceased were described as unemployed, one was a housewife, and two worked in unskilled or semi-skilled jobs.

Ethnicity

Twenty of the deceased had European names, 10 had Maori names (with one person recorded as being Maori), two had Pacific names and one was recorded as being Indian. Cropp does not include any information about ethnicity.

Disability

A third (11) of the deceased had a physical disability that either contributed to them being unable to escape from the fire in time, or may have contributed to the cause of the fire (e.g., Alzheimer's disease probably causing the deceased to forget to turn off an appliance).

Cause of the Fire

Smoking materials² caused, or were the likely cause, of a little over a third (39 percent) of the fires, (n=11). This included the careless disposal or use of smoking materials, and children playing with a cigarette lighter or matches. A little over a quarter (29 percent) of the fires (n=8) were caused by a combustible too close to a heating source (e.g., bedding falling on to a heater). The remaining third of fires were caused or thought to be caused by cooking sources left turned on and unattended (5), or by electric faults.

The Involvement of Alcohol

Alcohol was involved in nearly half the deaths (n=13). Eight of the deceased were reported as having a blood alcohol level defined as being "serious intoxication" or "dangerous intoxication".³ The blood alcohol level was not specified in the other five cases, but witnesses reported heavy intoxication. In a case where an infant died, the mother was reported as being heavily intoxicated.

The Presence of Smoke Alarms

Smoke alarms were reported as being in use in only two of the fires. In one case there were two alarms in the house, but both were poorly situated and in the other case the alarm did not activate in time, as there were two closed doors between the fire and the alarm.

Conclusion

A very clear pattern, consistent with other New Zealand and overseas research findings, emerges from the analysis of this small sample. All 28 fires, apart from two, involved people from vulnerable groups namely: the elderly, Maori, other ethnic minorities, children under five years, and people with disabilities.

² Smoking materials are defined here as unextinguished cigarettes, matches or cigarette lighters.

³ "Serious intoxication" is defined as 100–200mg of alcohol/100ml of blood and "dangerous intoxication" is defined as 200–400mg/100ml (O'Hagan, Robinson and Whiteside, 1993, p.22).

In the two cases where the deceased persons were not from a vulnerable group, they were seriously or dangerously intoxicated by alcohol⁴. Alcohol was involved in nearly half of the fatalities and operating smoke alarms were absent in 26 fires. In the two fires where alarms were present they were not effective, due to being poorly situated in one case, and in the other case closed doors contained the fire to an area where there was no smoke alarm.

⁴ O'Hagan, Robinson and Whiteside (1993) p.22

SECTION E

INFORMATION FROM INTERVIEWS AND FOCUS GROUPS

Methodology

Insights gained from the literature review, key stakeholders interviews and the analysis of coroners' reports were used to inform this aspect of the study.

Two groups of participants were confirmed for the interviews and focus groups—low-income parents of pre-school children and older people—either people aged 65 or older living in non-residential care, or their carers. Attempts were made to include participants of both genders. It was thought important that significant proportions of both groups were Maori, and the aim was for a third each of the older people and parent samples to be Maori. The reasons for this were that Maori are over-represented in low-income groups and appear to be over-represented in fire fatalities. For similar reasons, it would have been valuable to have included samples of Pacific people in the study so that resources which met their specific needs could have been developed. This was not possible in this first stage of the study. However, it is an aspect which should be researched in the future, with the involvement of Pacific researchers.

To obtain information about each participant's current fire safety knowledge, participants were interviewed individually face-to-face. Focus groups were used to obtain ideas about the best formats and ways to reach people similar to the participants so that fire safety information would be used in the future.

The Samples

As per the original research proposal, 180 individual interviews were conducted. The same people were also brought together as a focus group of six to eight people. Ninety interviews with low-income parents of pre-school children, and 90 interviews with older people or their carers, were undertaken. Two-thirds of the 180 participants were non-Maori and one third were Maori. The samples were obtained by working with co-ordinators from social service support agencies. (The social service/family support agencies used are listed in Appendix 5). In some cases, relationships with social service support agencies established for the earlier key stakeholder interviews were used for this new purpose. In one other case a school principal in a low-income rural area (who was a known member of the study team) was asked to identify and approach families with pre-school children from his school community. This was effective in providing an alternative method of gaining access to people for the parent sample. For Maori samples, the Maori researchers on the team used their personal networks to facilitate access. Participants were located in 14 rural, provincial, and urban centers in the North and South Islands. (The locations are listed in Appendix 6).

Information about the samples achieved is provided below:

Samples of Older People (n=90)

Older people		
Maori	27	
Non Maori	33	
Total	60	
Carers of older people		
Maori	4	
Non Maori	26	
Total	30	
Total Maori	31	
Total non-Maori	59	
Grand Total		90

Samples of Parents of Pre-school Children (n=90)

Maori	26
Non-Maori	64
Total	90

Overall, just under a third of participants (32 percent) were in the Maori samples and just over two-thirds were in the non-Maori samples (68 percent). It should be noted that the actual number of Maori in the parents sample is higher than the 26 included in the Maori sample because the parents using the social services/family support agencies and forming what was known as the “non-Maori sample” in fact contained some Maori people. This is because we specified low-income as the key determinant here, rather than ethnicity. It was our view that it was neither necessary nor appropriate to include ethnicity as a factor for agencies to take into account when inviting their clients to participate in the study.

With regard to gender, a little over two-thirds of older people and the carers of older people were female (n=63; 70 percent) and a little under one-third were male (n=27; 30 percent). Gender was much less balanced in the parent sample with only five male participants. This can be partly explained by the fact that many low-income families are sole parent families headed by the female parent. Sixty-two percent of parent participants in the study selected income support/benefit receipt as their main source of family income. In most cases this was probably the domestic purposes benefit—a benefit whose recipients are overwhelmingly female. Moreover, it was female parents who were in contact with the social service/family support agencies and were therefore contacted by the agencies to invite them to participate in the study. It seems likely that this gender imbalance in the parent sample reflects, at least to some extent, the general situation in New Zealand with regard to low-income families with pre-school children.

Data Collection

The letter provided to participants set out the ethical responsibilities of the researchers and of NZCER (Appendix 7). To thank people for their time in participating in the interviews and focus groups, participants were offered grocery vouchers for use in local supermarkets. Many people told us they appreciated this acknowledgement that their time and input was valuable. Morning or afternoon tea was provided, parents were encouraged to bring their young children, and in one setting where it was needed, assistance with transport was provided by the interviewers. It is hoped that these efforts will encourage participants to continue their involvement during the second year of the study.

Structured questionnaires were developed for interviewers to administer individually to parents, older people and the carers of older people. Interview schedules were produced for use with the focus groups. The questionnaires and schedules were piloted with a small number of people from each of the three groups and adapted very slightly for the main study. Because only a few minor alterations (such as combining first and second level prompts on an issue) were made to the questionnaires after the pilots, data from the pilot studies has been incorporated in the analysis and is included in the findings reported below. (Questionnaires and interview schedules are provided as Appendix 8). The data was collected between November 1999 and March 2000.

The Questionnaires and the Data Analysis

In the individual interviews, participants were asked questions or given prompts to ascertain their level of knowledge of various fire risks and safe practices for preventing fires from occurring and escaping safely from house fires. Apart from demographic questions and questions about the presence or absence of smoke alarms in participants' homes, which were closed questions, the emphasis was on open questions to ascertain what was known by the participants. Their responses were transcribed by the interviewer using the participants' own words. Codes were subsequently developed for organising this information and the coded data was entered using Excel. This information was then analysed for each question, for each of the three groups—parents, older people and carers. As intended, cross tabulations were not undertaken because the group sizes were not large enough for this to be viable.

As with any research study, decisions had to be made about design in relation to the type of data required. In this case the emphasis was on a qualitative approach – that is, an in-depth examination of the “off-the-top-of-their-head” knowledge and practices of relatively small numbers of people likely to be typical of the groups from which they were drawn. A sample survey of large numbers of people from the target groups would, by its nature, have yielded less in-depth information.

Ethical Responsibilities

Ethical responsibilities were outlined in the letters to participants, and follow NZCER's Ethical Statement (1998 revision). To meet the ethical requirements to “take all possible steps to protect participants from...harm or danger”, at the end of each interview participants were provided with a New Zealand Fire Service brochure on general fire safety. In addition, any misinformation participants gave in responding to three scenarios (namely: escaping from a smoke-filled house; responding to clothes on fire; and contacting the Fire

Service) were corrected during the interview immediately after the actual responses of participants were recorded.

Reporting

The study findings are reported in separate sections for parents, older people and carers of older people. Within each section, information from the individual interviews is reported first, followed by information from the focus groups. Characteristics of respondents are provided at the end of each section. It should be noted that in the case of carers, the “focus groups” were usually conducted individually because of difficulties of bringing these people together.

Because the purpose of this study is a practical one—to inform the development of information resources (content and format) as well as dissemination, findings have been reported in the text where they inform this purpose. This means it is main trends and notable exceptions that are, for the most part, reported in the text. Notable differences in the response of the Maori and non-Maori samples are reported. Tables are provided in Appendix 9.

Findings

Parents

Parents’ Knowledge of Fire Risks and Fire Prevention where Young Children Are Involved: Information from Individual Interviews

Keeping young children safe from house fires

As the first question, parents were asked what they think of when they hear the phrase “keeping young children safe from house fires”? Half the parents mentioned keeping lighters and matches away from children, followed by a little under a third mentioning supervision of young children. Just over a quarter mentioned open fires and kent fires, including the need for fire guards and a little under a quarter mentioned heaters, including guards. Twenty percent mentioned smoke alarms and the same percentage mentioned stoves and cooking, including children not being allowed in the kitchen during cooking. Fewer (14 percent) mentioned the need to teach children fire safety, including staying away from the open fire and an escape plan. The same percentage mentioned aspects of escape generally, such as difficulties in escaping, having an escape plan and getting children out first.

Causes of house fires

Involvement of lighters and matches, cigarettes, cooking, fires and heaters, clothes dryers, alcohol, electric blankets, wiring, and heater cords

In response to a question about the main causes of house fires for families with young children, over three-quarters of parents identified the involvement of lighters and matches. This included lighters and matches left lying around, children playing with lighters and matches, and adults putting lighters and matches out of children’s reach. A little over a quarter mentioned cooking as a main cause of house fires, including cooking being left unattended/adults being distracted, tea towels on the element, and children cooking. Around

a fifth regarded heaters as a main cause, including drying clothes on or near heaters, children playing with heaters or being too close to heaters. The same proportion identified open flames, including children around open fires, candles or kerosene/enclosed fires, as a main cause.

An additional prompt about fire dangers and heaters or open fires with children provided further responses, namely: a little over half the parents mentioned the need for screens around fires or heaters and 40 percent identified the need to supervise young children near a heat source. With further prompting about things being on or near heaters, two-thirds mentioned the fire risk of having things, including drying clothes, too close to a fire or heater. In response to a specific prompt about clothes dryers, a little over a third responded, covering such aspects as the need to clean the lint from the filter, turn off when not using, and not putting clothes that are not properly spun in the dryer.

In response to a specific prompt about fire risk when cooking with gas or electricity, half the respondents identified a risk involving children in the kitchen. Comments included “children must stay out of the kitchen while I cook”, while a quarter mentioned unattended cooking as a fire risk. When specifically asked about cooking with fat or oil, over half identified risks such as overheating fat or oil, or strategies such as keeping the oven and elements free of fat or oil, using only small amounts of fat or oil, or suggesting alternative cooking methods which were regarded as safer, including boiling or grilling. A little over a quarter mentioned the danger of unattended cooking when using fat or oil.

Parents were prompted about cigarettes and fire risks, including extinguishing cigarettes and “anything about matches and lighters”. Three-quarters mentioned the need to completely extinguish cigarettes, and the same proportion identified the need to keep matches, lighters or lit cigarettes away from children. A quarter mentioned that smoking only took place outside the house or didn’t take place at all.

Participants were asked their thoughts on the childproof lighters now on sale. Half felt these lighters were not necessarily safe, with comments including “children can learn how to work them”, “children can remove the safety device”, “it is harder for children to use them but they can do it”. A third thought these lighters were generally childproof.

In response to a prompt asking for any thoughts about alcohol and house fires, just under a third mentioned risks when alcohol is associated with cooking, including falling asleep when cooking, while a little over a quarter mentioned the risks with smoking, including falling asleep when smoking, and the same proportion mentioned general carelessness associated with drinking. Twelve percent identified carelessness with children, including “drinking makes you less vigilant with children”.

In thinking about electric blankets, a little over half the parents overall (three-quarters of the Maori sample) reported they didn’t use electric blankets, including because of fire risks. Just over half mentioned the need for regular checks, and a little over a third identified a fire risk if electric blankets overheat.

With regard to wiring and heater cords, a little over half the respondents identified damaged cords as a possible fire risk, and a little over a third mentioned the need for checking and maintenance of house wiring, and overloading plugs.

Fire prevention

Parents were asked their responses to the phrase “keeping an eye on young children”. Nearly half included the idea of watch them all the time, or keep them in view in their

response, while just over a quarter said you can't watch all the time, including, "I like to be in earshot", "I like to be able to locate them", "I don't watch them in the bedroom".

Nearly a quarter mentioned watching children near heaters and 15 percent mentioned keeping lighters and matches away from children.

Respondents were asked about the main things they did to make sure they didn't have a fire in their home. A third (including half the Maori respondents) mentioned care with lighters and matches, including keeping them out of the reach of children. A quarter (including nearly half the Maori respondents) said they checked the house before going to bed. Smaller numbers mentioned taking care with combustibles near a fire or heater, and care with the stove and other appliances. Nearly a third mentioned aspects of fire escape or control, as opposed to prevention.

Responses to fires

Exits, exiting, responding to smoke, responding to clothes on fire, calling the fire brigade, and smoke alarms.

Exits

Participants were asked for any thoughts they might have about locked doors. Just over 40 percent said their doors were locked but were easy to open, including key is kept in the door, key is nearby, and "I don't leave chain on the door when we are in the house". Just under a quarter said their doors were locked but were not easy to open, including key hidden, intentional that children cannot unlock the door because they might get out on the street, and burglary risk out-weighs fire risk; while four people said they recognised the problem but didn't see any solution.

With regard to knowing alternative ways out of the house if the front and back doors were blocked by smoke or flames, a little over two-thirds said they could use windows, including breaking the window. An additional 17 percent had some other doors which could be used. Four respondents said they had no other way out if the front and back doors were inaccessible.

Exiting

Parents were asked what they would do first if there was a major fire in the house when they were at home with their children. A little over 90 percent said they would get out with their children. The following question asked what they would do next (second and third). A little over half would call the fire brigade, smaller numbers would take possessions (18 people), prevent the spread (12), and get animals out (10).

Responding to smoke

In response to a question asking them what they would do to get themselves and their children out supposing the house was filled with smoke, over 80 percent said they would crawl through the smoke.

Responding to clothes on fire

The scenario of asking parents to suppose their clothes or their children's clothes were on fire produced a range of responses, with the majority knowing to roll. Just under three-quarters mentioned "roll" including roll or drop and roll (a little under half), or wrap in blanket/towels and roll (a little over a quarter). Smaller numbers mentioned using water (15 people); wrap in blankets (15); and take clothes off (8).

Calling the fire brigade.

Ninety percent reported they would phone 111. It is likely the actual number who knew this phone number is higher than reported, but some parents interpreted the question differently from what was intended and gave responses such as "on my cell phone" or "from a neighbour." The question was worded "how would you contact the Fire Service if there was a fire?" With hindsight, this question was poorly worded and would have been better phrased as "on what number would you phone the fire brigade?" or words to that effect. Unfortunately, this ambiguity did not show up in the pilot.

Smoke alarms

Parents were asked if they currently had a smoke alarm in their house or flat.

A little over two-thirds had at least one alarm which had been installed. A little over a quarter didn't have an alarm, and two people had an alarm which hadn't been installed. Those without an alarm were asked the reasons for this. Nearly half the people who answered this question said they meant to get one but hadn't got around to it/forgot about it. Eighty percent of the sixty-two parents who reported having a smoke alarm installed said they had more than one alarm. Fifty people provided information about the location of their smoke alarms. Nearly all these had an alarm situated in the hall of their house, over half had an alarm installed in the lounge, and a little under half had an alarm in a bedroom. Fifty people reported the alarm was currently working, and three-quarters said the alarm/s were checked regularly to see if it/they were working. Just under a third said the alarm/s was/were cleaned.

Parents' Responses for Future Fire Safety Information: Information from Focus Groups

Fire safety as a priority in people's lives, formats for fire safety information, channels for dissemination, and fire safety issues needing policy intervention.

Fire safety as a priority in people's lives

To gain an understanding of the priority of fire prevention and escape in relation to other priorities in their lives, parents were asked to consider a number of issues (including fire prevention and escape), which might concern them as parents of pre-school children. They were then asked to select up to four issues which best represented their main concerns. Fourteen items were ranked, with the top ranking issue being "having enough money". This was identified by a little over two-thirds of all parents, followed by "children's health" again, with two-thirds of respondents including this in their top four. The next issue was "children's education", identified by a little more than a third of parents, with "parents'

health” ranked in the top by just over a quarter of parents. Fire prevention and escape was selected in the top four by just under a quarter of parents making it the fifth most popular choice. One participant suggested that fire safety wouldn’t rank so highly if the parents weren’t at the focus group.

Formats for fire safety information and channels for dissemination

Parents at the focus groups were asked to consider both possible formats for presenting fire safety information which targeted parents, and avenues for dissemination, and then select their top four choices. Television advertising was the most popular being suggested by a little over half the participants. The timeslots suggested included before, after or during “Shortland Street”, the news, prime time programming generally and during children’s afternoon television programmes. Posters with leaflets in doctors’ waiting rooms, selected by a third of participants, were the next most popular item, followed by articles in community newspapers selected by nearly a quarter of parents. Community radio stations were also selected by a little over a quarter of people. Pre-school organisations, including information on Plunket publications and Maori equivalents were popular as were as were kindergartens, kohanga reo, playgroups and childcare. Community groups, newspapers that are purchased and churches were the least popular items.

Fire safety issues needing policy intervention

In thinking about urgent issues and measures to address them, participants were asked for suggestions to encourage more people in rental accommodation to install smoke alarms. In answering, participants focused on the desirability of making smoke alarms available free to people on low incomes, and on mandatory requirements to install smoke alarms in all houses or in all rental accommodation. They expressed the view that Housing New Zealand has installed multiple alarms in its rental properties, so why shouldn’t local authorities and private landlords be required to do the same?

Characteristics of Parent Participants

Ninety percent of parents had one or two children under the age of five living with them at least some of the time. Income support/benefit was the main source of income for nearly two-thirds of the families, followed by paid employment for a third. Nearly two-thirds of the families lived in rental accommodation with nearly all of these living in a stand-alone house or flat. Thirty-four people living in rental accommodation reported they had a private landlord, followed by 10 people, whose landlord was Housing New Zealand.

Overall, a little over half the parents reported that they smoked. Nearly three-quarters of the Maori sample, and just over half of the non-Maori sample reported that they smoked.

Older People

Older People’s Knowledge of Fire Risks and Fire Prevention: Information from Individual Interviews

Causes of house fires

Heaters or fires being left on, combustibles too close to a heat source, not extinguishing

cigarettes properly, unattended cooking and general forgetfulness

In response to a question about the main causes of house fires, particularly for older people, nearly half the participants identified a heat source being left on, including electric blankets, stoves and heaters. Combustibles too close to a heat source, including drying clothes too close, and sitting too close to a heater, were mentioned by just under a third of respondents.

A little over a quarter mentioned not extinguishing cigarettes properly, including falling asleep while smoking, smoking in bed, or being distracted while smoking. Unattended cooking was also mentioned by a little over a quarter of participants (11 percent of the Maori sample and 42 percent of the non-Maori sample), while a quarter overall mentioned general forgetfulness or absent-mindedness.

An additional prompt about fire dangers and heaters or open fires provided further responses, namely: half mentioned distrust of, or caution with, open fires, including the need for a fire guard, and a quarter mentioned combustibles too close to a heat source. With further prompting about things being on or near heaters, just under two-thirds mentioned the fire risk of people or things being too close to a heat source, including drying clothes too close to a heater or fire.

In response to a specific prompt about fire risk when cooking with gas or electricity, over a third of respondents mentioned dangers when distracted from cooking. One solution suggested was the use of timers. Again in response to a specific prompt, this time about cooking with fat or oil, over three-quarters mentioned caution when cooking with fat or oil, including using a very small amount, not allowing it to overheat, not leaving it unattended, and keeping a lid handy in case it overheats. Six people mentioned appropriate strategies to use if cooking does catch fire, such as putting a lid on it, and not using water.

Older people were prompted on two occasions about cigarettes and fire risks including extinguishing cigarettes, and matches, lighters and children. Over three-quarters mentioned the need to properly extinguish cigarettes and nearly two-thirds discussed the need to keep matches and lighters away from children. A little under a third mentioned the dangers associated with falling asleep while smoking.

In response to a prompt asking for thoughts about alcohol and house fires, a little under a third (40 percent of the Maori sample, and 20 percent of the non-Maori sample) identified that alcohol can be a fire risk when combined with smoking, including dropping cigarettes, falling asleep, and smoking more when drinking. A little under a third also identified that alcohol can make you less able to cope, including alcohol makes you over-confident or careless, less able to deal with a crisis situation and more likely to go to sleep. A smaller number identified that alcohol can be a problem when combined with cooking, including falling asleep and leaving cooking unattended, forgetting to turn cooking off, and a mention that cooking in these circumstances is particularly dangerous if using fat. Suggestions were made that if you are drinking alcohol you should eat cold things out of the fridge or buy takeaways on the way home.

In thinking about electric blankets, three-quarters mentioned the need for regular checks/maintenance. Nearly half identified a fire risk if electric blankets are overheated, including the need to switch off when getting into bed, and checking they are turned off (greater proportions of the non-Maori sample identified these issues).

In response to a question about clutter and fire exits and clutter near heaters or open fires, two-thirds identified the need to keep exits clear of clutter for ease of access, while a little under half mentioned clutter near a heat source as a fire risk.

With regard to wiring and heater cords, a little over half the respondents said house wiring should be checked/maintained, and a little over a third said damaged cords are a fire risk.

Fire prevention

Respondents were asked the main things they did to prevent a fire in their home. A little over half said they checked appliances were off, including checking before going to bed.

Responses to fire

Exits, exiting, responding to smoke, responding to clothes on fire, calling the fire brigade, and smoke alarms.

Exits

Participants were asked for any thoughts they might have about locked doors. A little over a third were concerned about being rescued in the event of a fire or about escaping, while just under half said exiting would be straightforward. There were differences between the Maori and non-Maori samples on both these matters. Just under a fifth of Maori and a little over half of non-Maori were concerned about rescue or escape. Correspondingly, nearly two-thirds of Maori, and a little over one-third of non-Maori reported exiting would be straightforward.

With regard to knowing alternative ways out of the house if the front and back doors were blocked by flames or smoke, two-thirds said they would use windows, including breaking the window. Twelve participants reported they would be able to use other doors, while 11 had no alternative exit, or no easy alternative exit, available.

Exiting

Older people were asked what they would do first if there was a major fire in the house when they were at home. A third said they would get out, while a quarter said they would phone the fire brigade first. Twelve people said they would try and extinguish or contain the fire first. The next question asked what they would do next (second and third). These responses have been combined to provide the following information. A little over a third said they would call the fire brigade, including from a neighbour's house, while slightly fewer said they would get out. Thirteen people reported they would try and extinguish or contain the fire, and 11 people said they would get others out.

Responding to smoke

In response to a question asking what they would do to get out supposing the house was filled with smoke, over three-quarters said they would crawl or get down low and move, while eight people just said they would get out.

Responding to clothes on fire

The scenario of asking participants to suppose their clothes were on fire produced a range of responses, with the majority knowing to roll. A little under two-thirds mentioned “roll” including roll, or drop and roll (a little under half) or wrap in blankets or towels and roll. Smaller numbers mentioned wrap in blankets (8 people), using water (7) and removing clothes (6).

Calling the fire brigade

Most reported they would dial 111. Other responses were ring from a neighbour's, have no phone and got the number by the phone.

Smoke alarms

Older people were asked if they currently had a smoke alarm. Nearly two-thirds had at least one alarm that had been installed. Maori were much less likely to have an alarm, with 37 percent of the Maori sample and 86 percent of the non-Maori sample reporting they had at least one alarm installed. In addition, five Maori and one non-Maori reported they had an alarm that had not been installed. Of those without an alarm, nine Maori and one non-Maori participant reported that they meant to get one but they hadn't got around to it or had forgotten about it. Thirteen people reported they had more than one alarm. A little under a third of people with at least one alarm installed had an alarm in the hall. Nearly all reported the alarm was currently working. Two didn't know. A little over a third said the alarm was checked regularly to see if it was working. Just under a quarter said the alarm was cleaned.

Older People's Responses for Future Fire Safety Information: Information from Focus Groups

Fire safety as a priority in people's lives: formats for fire safety information, channels for dissemination, and fire safety issues needing policy intervention.

As an introductory question, older people were asked if they felt there were any health issues for them as far as fire prevention and escape were concerned. People tended to agree with all the items listed in the questionnaire (Appendix 8BII). In particular there was discussion about the effects of medication slowing responses and making people sleepy. Following this “warm-up” question, participants were asked to select their top four concerns from a list of 11 items. “Health” was selected by over two-thirds followed by “home invasion/burglary”, which was selected by nearly half. Both “mobility” and “fire prevention” followed next with slightly fewer responses than “home invasion/burglary”.

Participants were asked to consider both possible formats for presenting fire safety information which targeted people like them, and avenues for dissemination. A number of items were discussed and some consensus reached within groups. (It depended on the nature of the group, but usually participants were not asked to select their top four items). The most popular suggestions were television advertising around the news and around Coronation Street, radio, including Radio Pacific talkbacks, doctors' waiting rooms where colour posters were favoured, Marae, including gatherings of kaumatua, daytime visits from the Fire Service to community groups, community newspapers, leaflets in mailboxes, and churches.

In thinking about urgent issues that should be addressed to lessen the chances of older people being involved in a house fire, the most popular suggestions were making smoke alarms mandatory in all homes, smoke alarms issued free or subsidised to all or all ratepayers or community groups, and New Zealand Fire Service education programmes for the elderly, including demonstrations of escaping safely from fires.

Characteristics of Older People Participants

Overall, two-thirds of respondents (85 percent of Maori) were aged 74 or younger, with a quarter of these (mainly Maori) under 65 years. Overall, just over half lived on their own, and 20 percent lived with a spouse. For Maori, 18 percent lived on their own and a little under two-thirds lived with a spouse. Compared with non-Maori (8 percent) Maori were more likely to live with people other than their spouse (44 percent).

Overall, nearly two-thirds lived in their own house or flat, with this being the case for three-quarters of the Maori sample and half the non-Maori sample. Maori respondents (81 percent) were more likely than non-Maori (45 percent) to report that children visited the house often or sometimes. Overall, nearly two-thirds reported that children visited often or sometimes.

Over three-quarters of older people reported that they did not smoke.

Carers

Carers' Knowledge of Fire Risks and Fire Prevention for Older People: Information from Individual Interviews

Causes of house fires

People being cared for unaware of what they are doing, unattended cooking, not extinguishing cigarettes properly, heaters or fires left on, and combustibles too close to a heat source.

In response to a question about the main causes of house fires particularly for older people, a little under two-thirds mentioned older people being unaware of what they are doing and inappropriate use of appliances including, turning stove elements on but not cooking, putting things on heaters, cords or cloths across elements, and leaving heating sources switched on, including electric blankets. A third mentioned unattended cooking, including falling asleep while cooking and being distracted from cooking.

An additional prompt about fire dangers and heaters or open fires provided further responses, namely: just under half mentioned problems with open fires, including the need for a fire guard, forgetting to use the fire guard, and sparks falling out and not being noticed. Just over a quarter mentioned combustibles too close to a heat source, including sitting too close, and draping things over a heat source to dry. Just over a quarter also mentioned falling over, including a person falling over a heater, or a heater falling over. With further prompting about things being on or near heaters/fires, nearly three-quarters mentioned the fire risk of things being on or too close to a heat source, including drying clothes too close to a heater or fire, and standing or sitting too close.

In response to a specific prompt about fire risk when cooking with gas or electricity, a little over a third mentioned unattended cooking and just over a quarter mentioned

inappropriate behaviour in the kitchen. This included not turning off the stove, turning on an element and not using it, and turning all elements on high and leaving the kitchen. In response to a specific prompt about fire risks when cooking with gas or electricity, nearly two-thirds mentioned not allowing oil or fat to overheat.

Carers were prompted about cigarettes and fire risks, including extinguishing cigarettes, and matches and lighters and children. Nearly three-quarters mentioned the need to extinguish cigarettes properly, including always using ashtrays, putting butts in water, and the risks associated with falling asleep while smoking. Most mentioned the need to keep matches and lighters away from children.

In response to a prompt asking for thoughts about alcohol and house fires, half mentioned that alcohol makes you less able to cope. Just under a quarter identified that alcohol can be a problem when combined with cooking, including the likelihood of falling asleep while cooking, or forgetting to turn the stove off.

In thinking about electric blankets, nearly three-quarters mentioned the need for regular checks/maintenance and a little over half identified a fire risk if electric blankets overheat, including switching off before getting into bed.

In response to a question about clutter and fire exits and clutter near fire exits or open fires, nearly two-thirds identified the need to keep exits clear of clutter for ease of access, while just under a quarter mentioned clutter near a heat source as a fire risk. Six carers discussed the problem that clutter can be for older people, including that they may not be able to look after this aspect themselves.

With regard to wiring and heater cords, nearly three-quarters said house wiring and cords should be maintained regularly and a third pointed out that extension cords are a risk, including across elements, and that older people can trip over them and fall on heaters.

Fire Prevention

Respondents were asked the main things they did to prevent a fire in the house/flat of the person/s they cared for. Two-thirds said they checked that appliances were turned off.

Responses to fire

Exits, exiting, responding to smoke, responding to clothes on fire, and smoke alarms.

Exits

Participants were asked for any thoughts they might have about locked doors. Three-quarters were concerned about rescue and/or escape in the event of a fire, while a third said there were no problems with doors as exits. Nearly two-thirds would use a window to get out if necessary. Eight carers said there was no alternative exit, or no easy alternative exit to get the person they cared for out.

Exiting

Carers were asked what they would do first if there was a major fire in the house where the person/s they care for lives and the carer was in the house at the time.

Three-quarters said they would get others out, including the person cared for. Four people said they would call the fire brigade and four said they would get themselves out. None said they would try and contain or extinguish the fire first.

When asked what they would do second and third, nearly three-quarters said they would call the fire brigade, including from a neighbour's house. A little over a third said they would get themselves out. Five people said they would attempt to contain or extinguish the fire.

Responding to Smoke

In response to a question asking what they would do if the house was filled with smoke, nearly three-quarters said they would crawl or get down low and move, while seven people just said they would get out.

Responding to Clothes on Fire

The scenario of asking respondents to suppose their clothes or the clothes of the person/s they cared for were on fire produced a range of responses with the majority knowing to roll. In total, just over three-quarters mentioned "roll", "including roll" or drop and roll (a little under a third) or wrap in blankets or towels and roll (a little under half). Smaller numbers mentioned wrap in blankets (6 people) and use water (3).

Calling the fire brigade

All 30 carers said they would dial 111.

Smoke alarms

Carers were asked if there was a smoke alarm in the house of the person they cared for. Twenty-five carers said there was a smoke alarm installed. Of the four who knew there was no smoke alarm, two had meant to get one but had not got around to it/forgot about it. One hadn't thought about getting one. Fourteen reported that there was more than one alarm in the house. In 19 cases there was an alarm in the hall, in 12 there was an alarm in the lounge, and in seven cases there was one in the bedroom. Two people reported an alarm in the kitchen. Twenty one respondents reported that the alarm was working at present. In one case the battery had been taken out as it went off at the wrong time and in one case the battery was flat.

Eighteen people said the smoke alarm was checked regularly. Nine carers said the alarm was cleaned.

Carers' Responses for Future Fire Safety Information

Fire safety as a priority in people's lives; formats for fire safety information, channels for dissemination and fire safety issues needing attention.

Participants were asked to select their top four concerns from a list of possible concerns. "Fire prevention and/or escape" was the most popular item. Just over half the carers selected this item. This was followed by "health of the person cared for" which was selected by just over half the carers. "Social networks and support" and "mobility of the person cared for" were both selected by a third of carers.

Carers made suggestions as to the best ways of disseminating fire safety information. The most popular choices were television advertising around the news, radio, including Radio

Pacific talkback and the National programme, as well as community radio. Community newspaper articles, visits from the New Zealand Fire Service to carer or community groups and posters in doctors' waiting rooms also received support.

The main suggestion to lessen the risk of older people being involved in house fires was to provide education for carers, some of whom had real concerns as to how they would be able to assist the person they cared for to escape in the event of a fire.

Characteristics of Carer Participants

Nineteen carers provided care for one person, seven provided care for two people and two provided care for more than two. Two carers did not provide responses.

Carers were asked about their primary relationship to the person they cared for. In 14 cases the carer was the spouse or partner, six carers were professional carers, five were the child of the person cared for and one was another relative.

Sixteen carers were less than 65 years old, seven were 65 to 74 years, five were 75-84 and one was 85 or older. Twelve of the people cared for were aged between 75 and 84, 11 were 65-74, four were 85 or older, and three were less than 65 years. In 16 cases the carer lived with the person cared for. In 19 cases the house where the person cared for lived was owned by that person or the carer, and in nine cases the person cared for lived in rental accommodation. In 26 situations neither the person cared for nor the carers smoked, and in 24 cases pre-school children often or sometimes visited the house.

SECTION F

THE DEVELOPMENT OF DRAFT RESOURCES

Two communication companies were engaged to develop concepts for draft resources for parents of pre-school children; older people and the carers of older people.

They were provided with copies of two interim reports for this study and were briefed on the study, ideas for concepts, and appropriate messages. A copy of the design brief is provided as Appendix 10. Following this, draft concepts for resources were developed.

APPENDIX 1

THE LITERATURE REVIEW

1. Introduction

This review looks at the current state of knowledge and best practice regarding public fire safety education programmes. It aims to isolate the factors involved in designing an effective public fire safety education programme, as applied to the New Zealand context. To begin this task, one must consider what information is necessary in designing public fire safety information programmes, and what the historical background to current practice in fire safety education is. These two issues are considered in this introductory section; the layout of the rest of the review is also outlined.

(i) The Recent Development of Fire Safety Research

There are three main strategies available to prevent fire injuries:

- educate, and hopefully persuade, people to change unsafe behaviours;
- enforce safe behaviours through law;
- provide automatic protection by product or environmental design (Powell and Appy, 1997).

Each of these strategies can be sub-divided into either aiming to prevent fire or aiming to protect people once a fire has started; both preventative and protective strategies can operate through changing behaviour or the environment (Home Office, 1980).

The study of humans and fires was, until the late 1970s, strongly focused on the technical aspects of fire engineering and fire fighting. Thus, it used the third strategy given above: providing automatic prevention and protection through environmental factors. Discussion revolved around how to make buildings as fire safe as possible, resulting in most countries developing prescriptive building codes that specified the proper width of doorways, number of fire exits, and the like. These building codes largely focused on public buildings, due to the twin political imperatives of, firstly, preventing large-scale disasters that had the strongest impact on public opinion (Canter, 1980) and, secondly, allowing “a man’s home to be his castle”, to do with as he will. The prescriptive building codes were backed by educational efforts that sought to scare people into fire-safe behaviours. There was also concern with ensuring the fire service reached fire scenes as rapidly as possible.

This traditional approach began to alter during the 1970s. Firstly, public education began to change. The 1974 report commissioned by the National Fire Protection Association (cited in Strother and Buchbinder, 1980; see also Powell and Appy, 1997) found that fire education with positive messages, that reinforced appropriate behaviours, was far more effective than fire education with negative messages that emphasised what not to do, or tried to frighten people into changing behaviour by emphasising the horrors of fire disasters.

Secondly, and at the same time, fire engineering began to consider the psychological aspects of human behaviour in fires. This led to the realisation that human safety in fires depended as much on human behaviour during the fire as it did on technical aspects of fire engineering and fire fighting, and the further realisation that human behaviour was far more

complex than had been assumed. Thus, an increased interest developed in the behaviour of humans in fires, and in changing that behaviour through public education.

The focus on human behaviour and education became more pronounced in the 1990s, due to three factors. Firstly, prescriptive building codes began to give way to performance-based codes, as in New Zealand in 1991 (Lucht, 1999; Hunt, 1996). Such codes allowed a much wider variety of building design, as long as the objective of fire safe buildings was met. As a result there was an increasing emphasis on behavioural analysis to improve fire safety (Benthorn and Frantzich, 1996; Buchanan, 1996).

Secondly, there began to be a sense that fire engineering had made most of the major gains in fire safety that it could, and therefore any further reduction in fire losses needed to come through changes in human behaviour. This belief was reinforced by statistics that showed the vast majority of fire fatalities occurred in residential fires, where building codes made fewer fire safety demands, and that the main causes of fatal fires were not mechanical or system faults, but human error.

Thirdly, in recent times fires have begun to burn at a speed that limits the possible effectiveness of fire-fighters. Flashover points in domestic fires (where an entire room spontaneously ignites due to the level of heat of the fire) are occurring much sooner than in the past, due to good housing insulation and the high amounts of easily combustible materials, such as synthetic fabrics, present in modern homes. In New Zealand, the typical flashover point in a fire is around three minutes, leaving very little time for fire fighting to prevent deaths (McAra and Hay, 1998; Guy, 1998; Sampson, 1998).

American research studying the national factors that affect fire deaths, backs up the need for an increased focus on public fire safety education. The Federal Emergency Management Agency (1997a) found that the level of fire fighting resources, and the level of resources spent on providing fire protection to buildings, had little effect on the national level of fire deaths. This leaves factors such as the amount of fire prevention activity undertaken, the societal “acceptability” of fire, and the fire safety behaviour of the population, as crucial factors influencing international variations in fire death rates (Federal Emergency Management Agency, 1997a).

Due to these developments over the past 20 years, public fire education is a growing field. Research in the area is increasing, and is moving away from just assuming a positive effect of programmes as was common in the past, to becoming increasingly rigorous in evaluating fire education programme effects. However, it is still a relatively emerging field, as is pointed out by Powell and Appy (1997), who stated that the fire and life safety educator’s body of knowledge is progressing from oral history and programme descriptions to the stage of adapting relevant knowledge from other disciplines.

While the professional literature reflects an increasing body of knowledge in fire and life safety education, there is still room for growth. For example, there is very little credible research in fire and life safety education. Peer-reviewed articles on fire and life safety education research are extremely rare and appear in publications, such as NFPA’s *Fire Technology*, that fire and life safety educators typically do not read.

(ii) How to Design a Public Fire Safety Education Programme: What to Consider

The basic question to be addressed in designing public fire safety education programmes is: “What strategies and actions would best reduce the fire risk of vulnerable groups and the

consequences of fire?” It requires decisions on: who is vulnerable; why they are vulnerable; what changes need to occur—for example, should one aim to prevent fires or improve responses to fires when they occur?; and how these changes might take place for the group in question.

A classic text on how to design a public fire safety education programme was produced in 1980 by the United States Fire Administration: *Public Fire Education Planning: A Five Step Process* (Stamps et al. 1980). The approach is as follows:

1. Establish who is responsible for decision making and supervising, regarding administration, policy, and staff.
2. Design an appropriate programme, following these five steps:
 - (a) Identification of major local fire problems:
 - (i) what are the fire hazards?
 - (ii) what are the high risk locations, times, victims and behaviours?
 - (iii) create scenarios of the typical combinations of location, times, victims and behaviours.
 - (b) Select programme objectives that meet the needs and resources of the community:
 - (i) find the target audience
 - (ii) find out what community resources are available
 - (iii) conduct a cost-benefit analysis
 - (iv) establish objectives
 - (c) Design the education programme package
 - (i) determine message content, format, time and place of delivery
 - (d) Implement the programme
 - (i) produce and distribute the programme
 - (ii) teach the educators
 - (iii) obtain audience participation and co-operation
 - (e) Evaluate the programme

Clearly, this approach is strongly rooted in the need for data on major local fire problems, with attendant objectives and programme designs. However, the use of data to develop objectives and attendant designs is not a simple process. It requires consideration of what data to use; further, a particular piece of data could give rise to a range of objectives.

Hall (1997d) discusses the issues one needs to consider in designing a fire safety programme, while thinking through the problems of using data to guide decisions. He suggests questions to be considered are: *what is the problem to be addressed; what is the strategy to address the problem; and who is the target audience?*

When looking at *the problem to be addressed*, he suggests first considering which measure to use. Fatal fires tend to come disproportionately from a few causes of fires; is the problem fires in general, or those causing death? Further, targeting based on fire data is complex. Hall (1997d), says that targeting the highest-risk places and people may mean giving up in advance any chance of reducing the large share of the fire problem cumulatively accounted for by places and people having less than the highest risk. It may be that 1 percent of the community accounts for 20 percent of fire deaths, for example, but if that

group is targeted exclusively, then 80 percent of fire deaths will be left untouched, even if the programme works perfectly on its targeted group.

There are also practical problems with targeting. On the one hand, closely targeted programmes can be relatively inexpensive compared with a programme with multiple parts to deal with various groups. On the other hand, public support will be lower for programmes that target a small high-risk group; people tend to worry more about risks to people like themselves. Further, public perception of risks can be incorrect: for example, people often worry about risks to school-aged children, when data analysis shows that it is children under the age of five who suffer the greatest fire risk.

Thus, even when drawing on data, the question of which problem to address can be complex. “Should the educator target properties with a history of fire deaths? Or places with unusually vulnerable populations (e.g., schools, nursing homes, hospitals), even if their actual fire history has been low? Or places with high occupancy (e.g., arenas, high-rise buildings), just because of the number of people potentially exposed to fire? Or places with unusual hazards, because the complex knowledge and behaviours required for their fire safety are the furthest from simple common sense?” (Hall, 1997d).

Another data issue is whether to look at trends or current size of the given cause of fire. For example, drawing on the American data that Hall (1997d) presents, should smoking be targeted, as it is the main cause of fire deaths? Or arson, which, based on trends, is likely soon to become the main cause? Or heating, which involves easily changeable behaviours and thus offers potentially the most life saving value for effort?

In practical terms, Hall (1997d) advises that we should concentrate on the risk of fire death. He argues that a five-year baseline is required for data to be meaningfully analysable, with more years needed for communities with less than 100,000 people. He comments that if the target population is less than 10,000, no meaningful data are possible, and it is best to look at data from beyond the community itself.

Hall then looks at the second question, *what is the strategy?* He begins by commenting that “many programmes already exist; so don’t reinvent the wheel”; and argues that analysis “is most useful if it identifies patterns in the fire problem that some strategies and programmes or help to set specifications for the selected strategies and programmes” (Hall, 1997d). For example, fire cause data usually links to specific fire prevention behaviours that can be emphasised in education programmes. However, Hall argues that one should not commit oneself to an approach too soon; for example, he comments that analysing fire data by cause can lead to an emphasis on fire prevention, at the cost of education that teaches strategies of coping with fires once they occur.

The key to programme success, Hall (1997d) argues, is its reach and its effectiveness. An effective programme has to affect enough people to produce an effect on fire problems.

Hall (1997d) emphasises that education programmes can have a wide variety of approaches. A programme can seek to prevent the main causes of fire deaths, for example by changing smoking habits; however, there is little evidence for the success of such programmes. Programmes can attempt to slow the rate of growth of the initial fire, by trying to limit the use of materials that are highly flammable. Another approach can encourage early detection, through the use of smoke alarms. Fourthly, early suppression techniques, and techniques for preventing rapid spread of fire, such as shutting doors, could be taught. Fifthly, programmes could teach evacuation techniques.

In summary, it is necessary, when considering the strategy to be used, to juggle a number of factors. Hall recommends setting up a flow chart which traces how specific actions will affect actions by other parties, and so will affect the target audience, and how changes in target audiences will lead to reductions in fire deaths (Hall, 1997d). Then effects of changes and their likely effectiveness can be anticipated. At this stage, an estimation can be made of how large a version of the programme could be run, allowing an estimate of reach. It is important to focus on the big picture, the overall effect, and to pay attention to weak links in the flow chart.

Finally, there is the question: *who is the target audience?* (Hall, 1997d). As previously discussed, there is a trade-off here. It may be difficult to design programmes that are of use to large target audiences; ensuring that all of a target audience is reached also becomes more difficult the larger the audience is. Further, cost will be a factor. Door-to-door programmes may be effective, but are also very resource intensive. At the other end of the continuum, mailing or dropping off materials is cheaper but unlikely to change behaviour. However, the larger the target audience and the more resource-intensive the programme, the higher the chances are of making a significant impact on the fire problem. Creative ways must be found to reach target audiences. For example, if smoking habits are the target, perhaps an education programme that focuses on the point of sale of cigarettes is called for.

(iii) The Lay-out of this Review

The lay-out of this review broadly follows the five-step planning process described above: it begins with identification of major fire problems, and moves on to specific design details for education programmes and advice on how to implement the programmes. A section on evaluation is also included.

More specifically, this review assumes the “common sense” approach that public fire safety education programmes will have the strongest positive impact if they fill gaps in people’s knowledge, rather than telling or teaching people something they already know. This requires an awareness of what people already know and what it is they need to know. To achieve this awareness, one can examine what people claim to know; and one can examine people’s actual involvement in fires. Actual fire involvement can be sub-divided into two areas: people’s behaviour in fires; and statistical analysis of the main areas of weakness in fire safety practices, or in other words, of the circumstances in which fire fatalities occur. These questions are variously addressed in Sections 2 and 3 of this review; Section 2 looks at fire data, while Section 3 looks at what people claim to know, and the human behaviour that typically occurs in fires.

Once the people and knowledge that need to be taught to improve fire safety have been identified, the next question for consideration becomes how to teach them. This question is addressed in Sections 4 and 5. Evaluations of fire safety programmes are also considered in Section 5.

Within each of the sections of this review, information relating to fire safety could be split into three main categories: fire prevention (for instance: safe appliances; safe disposal of cigarettes; safe storage of matches, lighters and flammable materials; safe electrical wiring; and the use of fire resistant fabrics and furnishings); fire management (the knowledge and practice of attacking fires when they are small, for instance how to deal with fat fires); and fire safe practices (the knowledge and practice of protecting self, property and dependants if

a fire breaks out, for instance by installing smoke detectors, having an escape plan, practising safe escape techniques).

However, while these are potentially useful analytic categories, very little of the fire safety literature uses them to distinguish public fire safety education programmes, public knowledge, or even fire data. For example, fire statistics will typically record the cause of a fire, and whether a smoke detector was present and working, but only rarely record how fire victims attempted to deal with the fire, whether fire risks such as flammable furnishing were present if they were not the cause of the fire, and whether the fire victims used or attempted to use safe fire practices in escaping from the fire. As a second example, most public fire safety education programmes teach a variety of techniques for minimising fire risk, ranging across all three categories, but do not seek to distinguish in evaluations, which of the techniques taught had a positive effect. The analytic categories of fire prevention, fire management and fire safe practices are probably used infrequently due to the difficulty of doing otherwise; for example, isolating which technique of a range of techniques taught in a single programme was the most effective would be a near-impossible task; similarly, not all data relating to fires is available even to those at the fire scene.

A categorisation system much more frequently used in the fire safety literature is one based on consideration of vulnerable groups. Fire data usually analyses which groups, under which circumstances, are most at risk of fire injury or death. Most public fire safety education programmes are aimed at specific vulnerable groups. Thus, this review follows that categorisation system, aiming to determine which groups are at risk from fires, and how these groups can be most effectively helped through public fire safety education. Where possible, the type of fire safety referred to is also specified.

2. Fire Data: Who are the Vulnerable Groups?

(i) Fire Data: Need-to-know Caveats

To begin with, it is important to be aware of how to assess the importance of various pieces of literature relating to fire safety education. The key issue here is the difference between what people claim to know, and what they actually do in a fire; and between the knowledge people gain from fire safety education programmes and the effects this knowledge gain has on fire statistics.

Data on actual behaviour in fires, and on the effects of education on fire statistics, is arguably more important because what matters in the end is what is people do in fires, and to what effect. On the other hand, data on what people claim to know about fires, and how that knowledge changes as a result of education, is important in isolating which areas of knowledge need to be targeted, and how best to do so.

It is important, also, to be aware of the fact that apparent knowledge does not necessarily lead to safe behaviour. One can look, for example, to the case of another safety behaviour: approaches to HIV infection. There are continuing studies conducted regarding the knowledge, attitudes and behaviour of family planning clinic attendees towards HIV. The latest of these studies was published in 1999 (Elliot, Crump, McGuire, Bagshaw, and Chambers, 1999). This study found that while knowledge of HIV infection was high and stable since the last study, behaviour was not becoming safer. Unsafe behaviour arose from a number of misconceptions, such as that if a partner tests HIV negative, condoms need no

longer be used. Further, there was a decrease in the belief that New Zealanders were at risk of catching HIV within New Zealand. The authors conclude: “health promotion messages need to be urgently reviewed. It is important that individuals realise that a test is not protective, may be negative during the “window” period and that use of condoms is still necessary to protect against other sexually transmitted diseases” (Elliot et al., 1999).

This case illustrates that knowledge does not necessarily lead to safe behaviour. If behaviour is not safe, despite apparently high levels of knowledge, then consideration needs to be given to the possibility of information gaps leading to misconceptions.

Another main issue in handling fire data is the need to be aware of the limitations of such data. Many countries have experienced difficulties in collecting useful data on fire incidents, and the data collection systems in various countries are not always compatible.

A British report (Reynolds, 1997) on the causes of fire deaths found that national statistics were compiled using standard fire report forms that lacked relevant information. This information was only accessible via the fire investigation reports that were kept by individual fire brigades and not readily available at a national level; however, even these reports were not standardised and thus contained variable data. Canter (1980) comments that even countries such as Britain, which has a legal requirement for the filing of reports of every fire attended by the fire brigades, have incomplete and inaccurate information in their frequency counts, both because of the number of fires which are not reported to the brigades, and because of human errors in recording those fires which are reported. Various informal checks and one or two studies... indicate that at least four out of every five fires which occur are not reported and probably as many as nine out of ten go unnoticed in the official statistics.

It is important to be clear about which type of fire data is under consideration. Information is available on the patterns of all fires; the patterns of fires which result in fatalities; and the patterns of fires that result in injuries. Data on fire causes may give the total percentage of fires linked to that cause, or the relative fire risk of a particular cause—the number of fatalities that occur for every 1000 fires caused by a specific factor. Data on fire victims may look at total numbers, or relative risk. As discussed by Hall (1997a), vulnerable groups may be at proportionately greater risk, but still not account for the majority of fire deaths.

(ii) International Trends

There are a number of ways in which fire data can be grouped. This section takes two main approaches: part (a) looks at patterns in fire data at a broad level, while parts (b) to (h) look at the reasons and patterns behind the high risk status of vulnerable groups.

(a) International patterns

Most fatal fires occur in residences—for example, eight out of ten American fire deaths are residential (Federal Emergency Management Agency, 1997b). Non-standard residences, such as garages converted to dwellings, have been found by American data to be disproportionately at risk (Hall, 1998d).

The majority of residential fires, including fatal residential fires, are caused by human behaviour, including cooking, heating, smoking, and arson (Federal Emergency Management Agency, 1997b).

The main cause of fatal fires in almost all countries surveyed is smoking materials (Reynolds, 1996, 1997; Hall, 1997, 1998a, 1998d). The term “smoking materials” refers to fires which start when cigarettes or the like are dropped, due to a person falling asleep, being affected by alcohol consumption, or being physically or mentally impaired; the cigarette, still lit or inadequately extinguished, smoulders and finally catches alight, usually on furnishing or clothing.

Other main causes vary in significance by country. They include: cooking fires and electrical appliance fires, particularly electric blankets (more significant in the UK); fires caused by children playing with fire (more significant in the USA); and fires caused by arson, or problems with heating (roughly equally significant in the UK and the USA) (Reynolds, 1996, 1997; Hall, 1997c, 1998b, 1998d; Federal Emergency Management Agency, 1997b; United States Fire Administration, 1998). Data from the UK, USA and Australia is considered in more detail below.

Particular causes of fires are far more deadly than others. For example, cooking fires are very common but lead to a relatively low level of fire death, while fires caused by smoking materials cause relatively many deaths compared with their incidence as a cause of fire. As Moyse (1983) points out, this is probably due to the common-sense reason that during cooking fires most occupants are active, probably preparing a meal, and thus will notice and respond rapidly to the fire. In contrast, smoking fires often occur when people are not active—when they drop a cigarette while falling asleep—and are very slow to react—a smouldering cigarette accidentally dropped down the side of a couch at a party, which ignites hours later when people have gone to bed or are too inebriated to respond effectively.

Ahrens (1999) analyses fire risks from the perspective of the ignition sources that are most high-risk; that is to say, she considers the number of deaths caused by a particular type of fire per 1000 occurrences of such a fire. By this method, she arrives at the following list, based on American data:

- High-risk ignition sources:
 - Being unconscious / impaired / affected by drugs or alcohol at the time of the fire (89.7 deaths per 1000 fires)
 - Falling asleep when a fire starts (28.5 deaths per 1000 fires)
 - Using a flammable liquid to kindle a fire (26.8 deaths per 1000 fires)
 - Using improper fuelling technique (22.6 deaths per 1000 fires)
 - Fires caused by abandoned or discarded materials (22.4 deaths per 1000 fires)
- Moderate ignition sources include:
 - Collision / overturn / knockdown (14.6 deaths per 1000 fires)
 - Having combustibles too close to a heat source (10.3 deaths per 1000 fires)
 - Overloading electrical points (9.8 deaths per 1000 fires)
- Low ignition sources include:
 - Thawing (4.1 deaths per 1000 fires)
 - Accidentally turning an appliance on / not turning an appliance off (3.2 deaths per 1000)
 - Lack of maintenance (1.2 deaths per 1000 fires).

In broad terms, the three most vulnerable groups, based on relative fire risk, are children under the age of five, adults over 65 (even more so adults over 75), and people with low-incomes in urban and rural settings (Gamache, 1997; Home Office, 1980). The older people at risk are often alone and physically or mentally impaired, while the children at risk are often unattended (Home Office, 1980). Another major fire risk group are adults who are under the influence of alcohol or drugs; they are not a relatively vulnerable group, but they do account for a large percentage of fire fatalities.

Hall (1998b) constructs an overall picture of the various “impairments” that affect fire victims in America. Around one-third of pre-schoolers who die in fires are recorded as being “too young to act”, while three out of ten of those over the age of 65 are either recorded as “too old to act” or suffer from specific physical or mental disabilities. Drug and alcohol impairments are found in around one-sixth of adults between the ages of 20 and 65; Hall considers that this figure is probably under stated due to the erratic recording of such factors, and he comments that the rate of alcohol or drug impairment may be as high as 50 percent of all fire deaths between the ages of 20 and 65. Fifty-two percent of people are asleep at the time of the fire, with no other impairments. Hall concludes by saying that, when all impairments—sleeping, alcohol or drugs, youth, old age, physical or mental disability—are accounted for, only 16.3 percent or one-sixth of fire victims are awake or unimpaired when fatal fires begin (Hall, 1998b).

A more precise picture of fire victim profiles—the age, context and behaviours of fire victims—can be found in the demographics and source of fire material in the following analyses of British, American and Australian fire data. This profile varies between countries; for example, America has a larger problem with children playing with fire while the UK has a larger problem with elderly fire victims. Fire victim profiles are further detailed in sections 2(b) to 2(h), below.

Analysis of British fire data has found the following general trends:

- Time:

The most common time of day for fatal fires to be reported was between 6 a.m. and midday; however, a significant proportion were reported between midnight and 6 a.m. (Reynolds, 1996, 1997).

- Demographics:

Between the ages of 31 and 65 the majority of fatalities were male, resulting in males in general having twice the fire death rate per million population as women (Goddard and Poole, 1996; Hall, 1997c).

The highest death rate per million population occurs in the 80 plus age group—46 deaths per million population. The second highest rate was for those aged 65–79, at 17 deaths per million population. The third highest rate was for those aged 1–4, at 13 deaths per million population. The lowest death rate is for children aged 5–16. (Goddard and Poole, 1996).

The results for injuries, rather than fatalities, show that the fire injury rate is highest among those aged 80 and over, and second highest among males aged 17–29. All other groups fall below the average for injuries. (Goddard and Poole, 1996).

Children and the elderly are proportionately more likely to die of smoke or gas inhalation alone, while those between the ages of 17 and 59 are more likely to die from burns alone (Goddard and Poole, 1996).

- **Impairment:**

Ten percent of the fatalities in the samples used by Reynolds (1996, 1997) were under the influence of alcohol; other British data has found that 16 percent of victims were impaired by drugs or alcohol (Home Office, 1980). Data from the British Crime Survey, 1995, found that fire risks were higher in homes where the person said they drank heavily (Community Fire Safety Task Force, 1997).

Eight percent of fatalities were in some way physically disabled in the sample used by Reynolds (1996, 1997); however, other samples such as that used by the Home Office (1980) found that up to 43 percent of victims were impaired by age or illness.

The Home Office (1980) comments that a large proportion of victims were alone at the time of death, meaning that if they are impaired in some way there was no assistance available to help them escape.

- **Location:**

The bedroom was the most common room of origin of fire, closely followed by the living room. The living room was the most common location of the fatality, closely followed by the bedroom.

- **Discovery/Detection:**

Over half of the fatal fires were discovered by neighbours, with almost a third discovered by other family members.

Thirty two percent of the households experiencing fatal fires had smoke alarms. Of these only 30 percent of alarms were known to have alerted people to a fire in the first instance; of the non-functional alarms, 64 percent were found to have no batteries, while 17 percent were not working due to a flat or faulty battery. (Home Office, 1980). An analysis of British data from 1994, by Goddard and Poole (1996) found another cause of alarms failing to operate was poor siting of detectors (6 percent). They also detail instances where the alarms did work but people did not respond, usually because a person had raised the alarm before the alarm system operated, or occasionally due to occupants ignoring the alarm.

- **Cause of fire:**

Forty-one percent of fatal fires were started by smoking materials igniting upholstery, bedding, paper or clothing. Such fires were particularly likely to be started by the elderly, those influenced by alcohol, and those suffering from mental or physical disabilities. Usually, the fires occurred when the person fell asleep or collapsed, while smoking, so that the cigarette fell and ignited furnishing or clothing (Home Office, 1980).

Thirteen percent of fatal fires were started by cookers—75 percent of these due to cooking being left unattended, 25 percent due to the ignition of clothing, usually when a burning pan was moved in order to extinguish the fire. Cooking being left unattended was a cause of fatal fire among various age groups, but the ignition of clothing predominantly occurred with older people. Most of the casualties resulted from not knowing how to deal with such a fire once it started

(Community Fire Safety Task Force, 1997). Smith (1990) comments that cooker fires were over four times more likely to involve electrical rather than gas fires. He postulates that this could be due to the greater visibility and audibility of gas flames, causing a higher conscious awareness of the fire risk of the cooker. Further, gas cookers are generally believed to give a greater control of cooking rates. Smith's point is backed up by three studies cited by Whittington and Wilson (1980) that found that around two-thirds of fat pan fires occur when the person has forgotten that the cooker is on, or when they mistakenly believe the cooker is off. Twelve percent of fatal fires were caused by heaters, usually because ignitable material (furnishings, clothing, paper, bedding) was left too close to the heating source. These fatalities were predominantly elderly people who often impaired in some way.

Eight percent of fatal fires were caused by electrical faults, half of which were due to electrical blankets. Almost all the electrical blanket fatalities were over 65, and some were mentally or physically disabled; many fatalities due to electric blanket fires are people who are bedridden due to illness (Home Office, 1980).

Five percent of fatal fires were caused by children playing with fire; the majority of fatalities were children under the age of 16. These fires usually occurred when children were alone and were experimenting with fire. (Home Office, 1980).

Fatal fires were disproportionately caused by certain sources: the main cause of all fires was cooking (41 percent) followed by smoking materials (13 percent). However, the main cause of fatal fires was smoking materials; cooking fires were less likely to involve a fatality.

Another main causes of fires in general, rather than fatal fires in particular, was electrical appliance faults (13 percent).

Injuries from fires followed general fire trends more closely: the main cause of fires that resulted in injuries but not fatalities were cooking, followed by smoking materials and then electrical appliances and space heaters (Goddard and Poole, 1996).

- Trends in statistics:

The number of fire related deaths, and fire related injuries, increased from 1995 to 1997 (Collier, 1998; Community Fire Safety Task Force, 1997). However, the number of accidental fires in dwellings decreased in the 1990s (Goddard and Poole, 1996).

An analysis of American fire data found the following general trends:

- Time:

Fatal fires were most likely to occur between midnight and 6 a.m. (41 percent); the next most common time was between 9 a.m. and 9 p.m. (34 percent), followed by between 9 p.m. and midnight and between 6 a.m. and 9 a.m. (25 percent) (Hall, 1998b).

- Demographics:

Fire deaths were 35 percent higher in rural areas as compared with non-rural areas (United States Fire Administration, 1998); the next highest fire risk was in large cities (Klem, 1984).

Children aged 1–4 were 2.3 times more likely to die in a fire than the general population (Hall, 1998b); this risk level is unusually high compared with other societies such as Britain, where young children have only a slightly higher fire risk than does the general population (Hall, 1997c).

Those over 65 were at twice the risk of fire death than the general population; the risk increased with increasing age to three times the risk at 75, and four times the risk at 85 (Hall, 1998b).

Males had a 51 percent higher fire death risk than females, except for people aged 20–29 killed by children playing with fire, and people aged 65 or above killed by cooking fires, both of whom were more likely to be women (Hall, 1998b).

The main cause of fire death varied with age. Among children aged nine or under, children playing with fire was the leading cause of fire deaths. From ages 10–19, incendiary or suspicious fires were the main cause. Smoking related fires were the main cause of fire deaths for ages 20–84; from age 85 fires related to heating equipment were the main cause of fire deaths.

- **Impairments:**

A review of the literature on the role of alcohol in fatal fires found that different studies recorded a percentage of fatalities exposed to alcohol ranging from nine percent to 86 percent, with a median of 46.5 percent (Howland and Hingston, 1987, cited in Boot and Treep, 1990).

One in every three pre-schoolers who died in fires was recorded as “too young to act”, while three out of every ten elderly victims of fire were recorded as either “too old to act” or suffering from physical or mental disabilities (Hall, 1998b).

Fifty-two percent of fire fatalities were asleep at the time of the fire with no other impairments and 57 percent of fire victims were outside the room of origin at the time the fire started (Hall, 1998b).

- **Discovery/Detection:**

Sixty-five percent of fires attended by the Fire Service occurred in households that do not have a smoke detector (Federal Emergency Management Agency, 1997b). Only 19.2 percent of fire deaths occurred in homes known to have an operational smoke detector (Federal Emergency Management Agency, 1997b). Around one-third of smoke alarms were not working at the time of a fire (Ahrens, 1998b).

- **Cause of fire:**

Twenty-four percent of fatal residential fires were started by smoking materials (Federal Emergency Management Agency, 1997b). The importance of smoking as a fire risk factor increases with age (Hall, 1998b). Across all ages, 20 percent of fire deaths were caused by people who were smoking falling asleep with a still-lit cigarette (Hall, 1998b). Older adults are proportionately more likely to set their clothing on fire in an accident involving smoking materials (Hall, 1998b).

Fifteen percent of fatal residential fires were started by arson. In metropolitan areas, it was the leading cause of fire deaths, accounting for over 25 percent of fire deaths.

Twelve percent of fatal fires in non-rural areas were started by heating (United States Fire Administration, 1998). In rural areas, this figure rose to 26 percent,

making it the most common source of rural fire fatalities, followed by careless smoking (23 percent) and electrical distribution (17 percent).

The fourth main cause of fatal fires was children playing with fire. The fifth main cause of fatal fires was electrical distribution systems. The sixth main cause of fatal fires was cooking (Hall, 1998d). Older people were more likely to ignite clothing, while younger people were more likely to ignite cooking materials (Hall, 1998b).

Fatal fires were disproportionately caused by certain sources. For example, while arson was the third most common cause of all fires in the USA, accounting for 14 percent of fires, it was the leading cause of fire deaths in metropolitan areas and the second most common cause of fire deaths in residential fires. Smoking materials and children playing with fire were also disproportionately high-risk fire causes; they were the seventh and eighth causes of fires respectively, but the first and fourth cause of fatal fires (Hall, 1998d). Cooking, on the other hand, was the main cause of fires, but only the sixth most common cause of fatal fires (Hall, 1998d). Both arson and heating fires were both very common and also main causes of fire fatalities (Hall, 1998d).

The lounge was the most common room of origin (Hall, 1998d). In rural areas, given that many fires were caused by heating, chimneys were the most common place of fire origin, followed by cooking and lounge areas (United States Fire Administration, 1998).

Fire injuries were most common in cooking fires, followed by children playing with fire, smoking materials, and heating and incendiary/suspicious fires were fourth equal (Hall, 1998d). People who were injured in fires tended to be awake and unimpaired; they were usually trying to fight the fire, trying to rescue people, or trying to escape (Hall, 1998b). The age pattern is slightly different for injuries compared to fatalities; those aged over 85 and those aged between 20 and 29 were at proportionately higher risk (Hall, 1998b). These people also were usually men, except for people aged 20–29 injured by children playing with fire, who were more likely to be women. Over the age of 65, women were also more likely than men to be injured in cooking fires (Hall, 1998b).

The Queensland Department of Emergency Services (1998) produced a comprehensive analysis of the Australian fire problem. It found the following trends:

- **Time:**

Fatal fires were most common between midnight and 8 a.m. and during winter

- **Demographics:**

Groups particularly at risk of fires were:

Elderly over the age of 65—particularly from fires caused by heaters and smoking materials. Figures from 1989–1993 show that people aged over 75 had three to four times the death rate from fires than the national average (Thompson, Somers, and Wilson, 1997).

Children aged under five—particularly in situations where parents miscalculate the development of a fire and think they can complete several evacuations of their home when they cannot, so that the child is not rescued.

Adults affected by alcohol; 21 percent of victims over the age of 18 have been affected by alcohol, usually in fires involving smoking or heaters and falling asleep.

Adults not in the workforce: those receiving pensions, house-parents and the unemployed.

Males (62 percent of fire victims were male).

Those in rental accommodation, particularly private, are at higher risk than homeowners.

- **Causes of fires:**

Causes are only recorded in about half the fires attended by the Australian Fire Service. Of these, the most common cause is discarded smoking materials, either if a person falls asleep, or if a child plays with the discarded materials.

The presence or absence of smoke alarms is rarely recorded; however, where it is recorded, almost no fatal fire cases had a smoke alarm present.

A risk factor not considered in much of the literature is the presence of flammable fabrics, particularly in the form of furniture upholstery. The main data found on this issue came from Canada. Canadian data shows that upholstered furniture fires account for five percent of all fires, 14 percent of all fire deaths, and 10 percent of all fire injuries (Chandler, Crown, and Brown, 1991). This indicates the level of relative danger linked to fires that start in upholstered furniture, indeed “Upholstered furniture fires cause more deaths than any other category of material first ignited” (Ibid.). The Canadian upholstery industry has established a voluntary system of labelling products according to industry standards. Other countries have used alternate approaches to ensure that upholstered furniture that is a fire risk is identifiable—Great Britain, for example, has regulations that require all products meet specified safety standards or be labelled as having failed those standards.

(b) Children

A detailed analysis of American data found that younger children, under four years old, were two times more likely than the general population to die in a fire, while older children, aged five to nine, in fact had a lower risk of dying in a fire than the general population (Federal Emergency Management Agency, n.d.). However, it must be kept in mind that the extent of fire-fatalities among very young children seems to be unusually large in America; young children in other countries such as the UK, Japan and Sweden have only a slightly higher fire risk than the general population (Hall, 1997b, 1997c, 1998a). Hall suggests this may be due to the high level of sole parenthood in the USA, as well as the possibility that children in other countries are typically better supervised (Hall, 1997b).

The most detailed analysis found of the fire safety risk of children is an undated report by the Federal Emergency Management Agency of the USA. The report appears to be current as it refers to sources as recent as 1996. It finds that, aside from the age distinctions explained above, the children most at risk from fires are African American children, particularly boys. Native American children also have high fire death rate. In general, boys are at a higher fire risk than girls. The Federal Emergency Management Agency (n.d.) documents the context of child fire deaths:

- Eighty five percent of fires that killed children were residential fires.

- Fatal fires for children were most likely to originate in the lounge or sleeping areas. In particular, the proportion of fatal fires originating in sleeping areas was higher for children than for the general population, as children often chose to play with matches or a lighter in a bedroom; 62 percent of fatal fires were caused by children playing with fire originated in the sleeping area.
- Approximately 66 percent of fires causing child injury or fatality occurred in homes where there was no operable smoke detector—just over half of these cases had no smoke detector; in the other half the smoke detector did not sound the alarm.
- A disproportionate number of fires that resulted in child casualties (death or injury) were caused by children playing with fire; children playing with fire accounted for only 11 percent of all residential fires with casualties, but accounted for 32 percent of fires that result in child casualties. “The increased risk of child fire deaths or injuries associated with children playing with fire is attributable to the proximity of the child to the area where the fire originates and the inability of children, especially very young children, to effectively escape from a fire because of limited physical capabilities and limited life experience”.
- Almost 90 percent of all child deaths associated with children playing with fire in 1993 were children aged four and under. A similar result was found in a Scottish analysis of house fires that killed children (Squires and Busuttill, 1995), with around a third of these fires caused by children, and with children five years old or younger much more likely to die in a fire started by other children than were 6–16 year old children. Eighty-five percent of the victims of children playing with fires were children; however, over one-third of people injured in children playing with fires were between the ages of 20 and 39, presumably caregivers. The time of day, location and presence of others during fire play varied with a child’s age; for example, older children were more likely to have others with them, and engage in fire play outside of the home (Porth, 1999).
- Other main causes of fires involving child casualties were, in order of frequency, cooking, heating and incendiary/suspicious, careless smoking and electrical distribution.
- Child fire deaths follow the same seasonal patterns as all fire deaths; they also follow the same patterns as regards the day of the week, with fatal fires more common in the weekend. This is particularly so for fires caused by children playing with fire.
- The time of day that fatal fires occur varies with the child’s age: children aged under four are as likely to experience a fatal fire during the day as at night, while the majority (76 percent) of fires which are fatal for five to nine year olds occur at night. If a fire occurs during the day while these children are awake, they have a better chance of being alerted of the fire or noticing it themselves and escaping. Younger children have less understanding of fire and less mobility, especially infants and toddlers, making escape less likely than for older children regardless of the time of day unless an adult or older child assists them”. Fires caused by children playing with fire occurred mostly during daytime.
- Fires resulting from children playing with fire were most commonly caused by matches (58 percent) and lighters (22 percent). However, of these fires, fires caused by lighters were more likely to cause an injury to a child (52 percent). The materials

ignited included: forest, bush and grass; and rubbish, trash and waste. Fires set indoors tended to involve mattresses, pillows and bedding.

Leaving children unattended increases their risk of fire injury or death, both because many young children are unable to cope with fires without adult help, and because it provides an opportunity for fire play. As discussed in the “lower socio-economic groups” section below, leaving children unattended can be linked to level of income. However, most researchers argue that a greater factor than poverty in explaining child fire play is that many parents fail to recognise when they are leaving their child unsupervised, believing for example that running out to do a quick errand is not “leaving a child unattended” (Fahy, 1993; Kraizer et al., cited in Federal Emergency Management Agency, 1997b). Fahy (1993) has tested this argument by analysing data kept by the National Fire Protection Association; she finds that “unsupervised” has in practice meant a wide range of things, from parents doing a quick errand, to inadequate child care arrangements, to the child being awake before the parents wake up, or parents being in another part of the home when children start a fire. Fahy (1993) comments that

[a previous] NFPA study noted that poverty and single parenthood can limit the options of parents. ... This is still true. It has become increasingly clear, however, that the principal problem is with people who do not understand the potential danger from fire that their children face.... These are not parents who leave their children alone because they don't care or because they have to. They do so because they don't realise the dangers in what they are doing.

A study conducted by the Child Welfare League of America a few years ago reported disturbing findings on the inability of many parents to recognise the frequency with which they leave their children unattended, and their tendency to overestimate their children's ability to handle common occurrences such as a telephone call or a package delivered when left alone. [In interviews] Most [parents] said that they did not leave their children home alone, but as the interviews progressed, they reported behaviour that actually did leave their children alone... many parents don't realise that leaving children alone occasionally for ‘a few minutes’ is a risk just like leaving them to care for themselves on a regular basis.

The Federal Emergency Management Agency (n.d.) postulates that there are three categories of child fire setters: those too young to understand the dangerous implications; those who do understand the implications and are experimenting with fire; and children who deliberately set fires.

Fineman explains that about 60 percent of fires started by children in the USA are due to children playing with fire out of curiosity, rather than due to pathological fire setting. Fineman recommends curing curious fire setters by actively teaching the child about fire and its dangers, while pathological fire setters need professional mental health counselling. (Fire Protection Association, 1992b).

Kafry (1980) found that, in a study of boys aged 5–10, fire interest was almost universal, and fire play was performed by 45 percent of the boys studied. Much of this fire play (33 percent) had at some point resulted in fires. Fires were typically the result of a child playing with matches and accidentally starting a fire, rather than a child actually intending to start a fire. Only 9 percent of these boys had been reported to the fire service.

Fire interest usually started at an early age, with 18 percent of the fires set before age 3; there was a decreasing number of fires set from age 7 onwards. While fire interest and

attraction was stable over ages 5–10, fire competence and use increases with age; this accounts for the fact that older children set fewer fires—it is not that they do not play with matches and the like, but their level of fire competence means that this play does not result in a fire being accidentally started.

Children generally had an understanding of some of the possible consequences of fires. However, their level of knowledge in this regard was not at all related to the amount of fire play they engaged in. Thus, the behaviour of fire play is linked to something other than fire knowledge.

Kafry (1980) suggests that fire play, and more particularly actually setting fires, is linked to fire competence. Many of the children in Kafry's study had limited knowledge about practical aspects of fires; approximately half could not determine whether various substances were combustible, and only 42 percent were reasonably competent in dealing with matches. Competence increased with age, and was higher in children who were allowed to light matches under supervision. Fire competence was also higher in the group of children who did play with fire but had never started an actual fire. Alternatively, the children who were not allowed to use matches at all either had never played with fire, or were fire setters engaged in fire play that resulted in actual fires. A clear dichotomy thus emerges, between children who are taught how to handle fire competently—these children may play with matches and the like, but this play does not result in fires—and children who were taught not to touch matches at all—these children, if they disobeyed their teaching, would play with matches in a way that resulted in fires being set.

In general terms, children who played with matches—whether they were competent or not—were more likely to be children who lacked impulse control, and who came from more deprived families. Their parents were more likely to set few limits and use punitive punishments, were less likely to report good family relations, and were less likely to support their child in a “starting fire to boil water” experiment carried out as part of the study.

While Kafry (1980), as well as Fineman (Fire Protection Association, 1992b), emphasise the need to teach fire competence, others such as Porth (1999) argue that “the availability of matches and lighters may be the single most significant factor in child fire setting, particularly among many pre-school children whose knowledge is limited and whose desire to explore and learn is intense”. This perspective argues for an emphasis on teaching children not to touch matches or lighters, rather than teaching them to use lighting materials competently in supervised surroundings. Of course, these two approaches are not exclusive: one can both teach children to use lighting materials, under supervised conditions, and keep lighting materials away from children at other times.

Kolko and Kazdin (1986) discuss factors that seem to be linked to a child becoming a fire setter rather than just playing with fire. They isolate factors such as: early interest and direct experience; availability of incendiary materials; limited cognitive competence; inter personal ineffectiveness/skill deficits; covert antisocial behaviour; emotional loss, anxiety or aggression; limited supervision and monitoring; parental distance and uninvolvement; parental pathology and limitations; and stressful external events.

- **Key Points**

- Pre-schoolers have a higher fire risk than the general population.

- A disproportionate number of fires that kill pre-school children are caused by children playing with fire.
- Child fire play is usually motivated by curiosity, with the setting of actual fires an accident rather than the intent.
- The likelihood of child fire play resulting in actual fires decreases as a child's fire competence increases. Thus, one main way to address the issue of child fire play is to teach children competence with lighting materials; it is also important to keep lighting materials away from children in unsupervised contexts.
- The key factor in protecting pre-school children is constant supervision; many parents do not realise that even leaving a young child alone for a few minutes can be highly dangerous.

(c) Elderly

The elderly face a two-fold fire risk: they are exposed to greater risks of fire, and they are often less capable of escaping a fire due to physical or mental limitations (Federal Emergency Management Agency, 1997b; Hall, 1989, cited in Walker, Beck, Walker, and Shemanski, 1992; Pearson and Joost, 1983, cited in Walker, et al, 1992; Gamache, 1997).

Generally, while nursing home fires are the ones that reach the attention of the media, elderly in care institutions are at a lower fire risk than those living independently or with family in residential settings (Walker, et al. 1992). It is suggested that this is because those elderly who live in care institutions are likely to be relatively wealthy, while those outside care institutions may suffer from the double risk of being elderly and poor (Gamache, 1997). Thus, the elderly who are self-housed should be the main target for education programmes (Ibid.). Elderly who live alone at home are particularly at risk, as there is no-one to assist them if they are unable to escape a fire due to physical or mental limitations (Home Office, 1980).

The elderly are particularly at risk of death in fires started by smoking materials and combustibles placed too close to a heat source, including heating and cooking (Gamache, 1997). A larger percentage of fire victims in the elderly group were "intimately involved" with the ignition of the fire than is the case for other groups. This may in part reflect the lower ability of elderly to get away from fires they have started or witnessed starting (Gamache, 1997; Hall, 1998b).

- **Key Points**

- Elderly face a higher fire risk, and elderly fire victims are more likely to have been involved in the cause of the fire that kills them.
- Elderly are often less capable of escaping a fire due to physical or mental impairments.
- The highest risk elderly are those who are poor and live alone.
- The main fire causes for the elderly are smoking materials, and combustibles placed too close to cooking or heating.

(d) Lower Socio-economic Groups

The Federal Emergency Management Agency (1997b) has reviewed what is known about socio-economic factors and fire risks, focusing on American literature. They comment that work in this field is restricted, since "Most of the seminal studies relating socio-economic characteristics to fire rates were conducted and published in the late 1970s. Since that time, the limited amount of research that has been conducted is contained mostly in unpublished doctoral dissertations and master's theses, restricting its availability to other researchers and policy makers" (Federal Emergency Management Agency, 1997b).

The first study considered by the Federal Emergency Management Agency (1997b) is that by Schaenman, Hall, Schainblatt, Swartz, and Karter, published in 1977. This work found that variations over time in the fire rate in a US city were most effectively explained by:

- parental presence (percent of children under 18 still living with parents);
- poverty (percent of people whose income fell below the poverty line);
- and under-education (percent of people over 25 who had fewer than eight years schooling).

When tested, each of these variables alone explained an average of 39 percent of the variation in fire rates. Seven other variables also provided some explanation, including:

- good education (percent of people over 25 who had at least a high school education);
- race (percent black);
- home ownership (percent owner-occupied housing units);
- adequate income (percent families with annual income over \$15,000);
- housing crowdedness (percent of housing units with more than one person per room);
- and two variables which considered interaction between education and race, and race and poverty.

When tested, each of these variables alone accounted for at least 20 percent of the variation in fire rates. Two other variables were significant for only some cities; these were housing vacancy (percent of housing units vacant) and age of housing structure (percent of housing units built prior to 1940). Of all the variables, only parental presence, good education, adequate income, and home ownership were negatively correlated with the fire rates—that is, if they increased, fire rates decreased. Of course, most of the variables are interrelated, leading Schaenman et al. to note the ranking given here was only tentative. Schaenman et al. also pointed out these variables are only shown by such an analysis to be predictive of fire risk, and are not the causes of higher fire rates.

A second study considered by the Federal Emergency Management Agency (1997b) was published in 1978, by Karter and Donner. It considered which socio-economic and building characteristics were most highly related to increased fire rates. They found that the most important socio-economic characteristics were family stability (percentage of persons under 18 living with both parents; i.e. Schaenman et al.'s "parental presence" variable) and poverty (percentage of persons below the poverty level). The most important building characteristics were crowdedness (percentage of housing units with at least one person per room), ownership (percentage of housing units that are owner-occupied) and vacancy (percentage of housing units that are vacant).

A third study considered by the Federal Emergency Management Agency (1997b) was that of Gunther, published in 1981. Gunther found there was a strong negative relationship

between income and fire rates. Further, he found there was a strong negative relationship between income and several specific fire causes, in particular smoking, cooking, children playing with fire, and incendiary/suspicious. The strongest relationship was between income and arson (incendiary/suspicious) fires. Given that each of these causes are typically due to human actions rather than mechanical malfunctions, the Federal Emergency Management Agency concludes that “This suggests that public education is the tool most readily available to help reduce the occurrence of these types of fires”. Gunther did not find a strong relationship between income and appliance fires, electrical distribution fires, and heating fires.

A more recent study considered by the Federal Emergency Management Agency (1997b) is that by Jennings, published in 1996. Jennings argues socio-economic and environmental factors have become much more important in understanding fire risk and determining loss from fire, since technological changes such as the common installation of smoke detectors have reduced fire risks for the general population. Jennings creates a conceptual model of fire initiation and fire loss, which predicts that interactions between building stock, social/household system, demographics and economics can lead to indirect fire ignition, or direct fire ignition through human behaviour. Each of these concepts was linked to a specific variable: building stock was denoted by percent of vacant dwelling units, social/household system by percent of single female parent households, demographics by percent of population under 17 or over 65, and economics by median household income. Other variables, such as educational level, were dropped from the analysis as they were highly correlated with the variables given here. Through multiple regression, Jennings showed that these variables combined accounted for 63 percent of the variance in fire rates in an area over time.

Jennings (1999) has published his own literature review of socio-economic characteristics related to fire incidence. It contains references to a large number of studies, and a great deal of detail. In broad terms, Jennings is arguing in this literature review for a view of fire risks as being linked to a wide range of characteristics of both communities and individuals; this range of characteristics can be grouped under the title socio-economic, but may include, for example, demographic, environmental, technological, or social-psychological factors. His interest appears to lie in showing a cluster of socio-economic characteristics that are linked to fire risk, rather than isolating any one variable or “cause”.

In order to make more sense of these various studies, the Federal Emergency Management Agency (1997b) offers a discussion of the reasons why socio-economic factors might affect fire risks, at neighbourhood, household, and individual levels.

At the neighbourhood level, several factors may be operating.

- Poorer neighbourhoods tend to have more vacant housing, which is a fire hazard as vacant housing is more likely to experience severe fires, often due to arson. Vacant housing also attracts the homeless, who are more likely to start fires for heat, and due to careless use of smoking materials under the influence of alcohol and drugs.
- Building abandonment causes a general neighbourhood decline, with less investment in routine maintenance, increasing the risk of heating or electrical fires.

- Arson is more likely in poorer neighbourhoods. Also, higher crime rates are common in poorer neighbourhoods, causing householders to bar access to their houses by means which may trap them if a fire occurs, such as bars across windows.

At the household level, another set of factors operate:

- Poorer households usually live in lower quality housing, which is typically poorly maintained. This will increase fire risks through the risk of mechanical malfunction, dangerous electrical wiring, and the use of space heaters to compensate for faulty central heating and poor insulation. Households in public housing are at a lower risk of these problems, as public housing is typically well-maintained.
- There is less likely to be an operational smoke detector in lower income households. While there are no direct U.S. data showing this link, circumstantial data points to the likelihood that lower income households are less likely to have smoke detectors. In Britain, there is further evidence of this probable link. Families without a car are also unlikely to have a smoke alarm, suggesting a link between poverty and owning smoke detectors (Roberts Institute of Child Health, London; cited by Fire Protection Association, 1996). A survey conducted at a UK hospital backs up this suggestion, finding the most common reason cited for not having a smoke detector was cost. This finding applied to 85 percent of those surveyed who did not own a smoke detector (McCabe and Moore, 1990).
- Poorer families are less likely to be able to afford basic needs aside from shelter. This means such households are less likely to be able to afford fire protection devices, are more likely to have a utility shut off, resulting in the use of less safe heating methods, and are more at risk of becoming homeless, with its attendant fire risks.
- Household structure can affect fire risk. Single parent families are likely to be poorer, and are less able to deal with child care contingencies, resulting in a higher chance of children being left at home alone, or unsupervised.
- Poorer households are more likely to be over crowded, which is linked to an increased fire risk. Possible reasons for this are the greater wear and tear on mechanical systems, and increasing difficulty in evacuating all residents from a unit in the case of a fire.

A final set of factors operate at the individual level:

- Careless smoking leading to fires is more likely among individuals in lower socio-economic groups. This is because cigarette smoking is inversely related to income.
- Alcohol and drug abuse are possibly more common among lower socio-economic groups. These behaviours increase fire risks as intoxicated persons are at greater risk of falling asleep while smoking, dropping the cigarette, and starting a fire. Further, intoxicated persons may be less capable of escaping a fire.
- Low socio-economic status is linked to lower education levels. This increases fire risk as fire education programmes may be less easily grasped, and low literacy levels inhibit the reading of instruction manuals and warning labels.
- Low socio-economic status is linked to lower rates of owner-occupation. This may increase fire risk as renters have less of an incentive to maintain their homes.

Other American articles published on the topic of socio-economic factors and fire risk concur with the analysis offered by the Federal Emergency Management Agency (1997b) (see the collection of articles in Ahrens, 1998a, including: *Burning Issues*, 1996; Conley and Fahy, 1994; Norton, 1989. See also Fahy and Norton, 1985).

British data on the links between fire risks and socio-economic factors also shows that housing and social factors have a strong impact on fire risk (Smith, 1990). In particular, unemployment, shared and crowded accommodation, socio-economic status, occupation level, and renter status have all been found to affect fire risk significantly (Chandler, 1979; *Fire Prevention*, 1984; both cited in Smith, 1990).

- **Key Points**

- Variations in fire rates over time are best explained by factors related to socio-economic status such as income, education, the state of housing, and the number of sole parents. Such factors have been found by various studies to explain between 20 percent and 40 percent of variations in fire rates each, and to all together account for up to two-thirds of variations in fire rates.
- Specific high-risk fire causes, such as smoking, children playing with fire, and arson fires, are negatively related to income levels.
- The reasons for why lower socio-economic status leads to a higher fire risk can be explained at the neighbourhood, household and individual levels. At the neighbourhood level, vacant housing and arson are more common, as well as security devices which trap occupants. At the household level, houses are likely to be less well maintained, with fewer fire safety devices, more overcrowding, and possibly less child supervision. At the individual level, less education increases fire risk, and risky behaviours such as smoking and alcohol consumption are more common.
- Jennings (1999) argues for a view of fire risk that sees fires as linked to a cluster of, broadly speaking, socio-economic factors. This is as opposed to a view which attempts to isolate single “causes” of fire risks.

(e) Rural population

Rural areas have a higher fire death rate than non-rural areas; in the USA this rate is 35 percent higher (United States Fire Administration, 1998). This may be due to a number of factors. Firstly, the lack of a working smoke detector is more common in rural areas than non-rural areas; only 27 percent of rural residential fires have an operational smoke detector, compared 35 percent of non-rural fires (Ibid.). This may be linked to lower socio-economic levels. Secondly, a study by Gunther (1982, cited in Federal Emergency Management Agency, 1997b) argues that high rates of rural fire deaths are due to variations in income and climate.

Gunther’s climate argument is more complex. In the USA, the colder climate northern states, usually have central heating, which is relatively safe. But southern states, particularly

rural areas, are more likely to rely on alternative forms of heating, which increase their fire risk. Thirdly, the geographical distance of rural areas means a slower response from fire departments.

In rural areas in the USA, heating is the leading cause of residential structure fires, accounting for 34 percent of rural residential fires. This is frequently (78 percent) linked to poor maintenance of heating devices, particularly stationary heating units and chimneys, vents and flues (United States Fire Administration, 1998). Cooking is the next main source of rural residential structure fires, at 13 percent (Ibid.). It is usually argued that heating fires are relatively more common in rural areas in the U.S. because rural housing is less likely to have central heating than urban housing, and thus is more likely to use less safe means of heating, such as space heaters and open fires (Gomberg, 1982). Heating is also the main cause of fatal rural fires, at 26 percent, followed by careless smoking (23 percent) and electrical distribution (17 percent) (United States Fire Administration, 1998). American data show that the proportion of fire deaths that occur in a residential structure is lower in rural areas than in the USA as a whole; conversely, rural areas experience a slightly higher proportion of outside and vehicle fires (United States Fire Administration, 1998).

- **Key Points**

- Fire deaths are higher in rural than non-rural areas. This appears to be largely due to lower incomes in rural areas, leading to a greater use of unsafe heating, a lack of smoke detectors, and geographical distance from the fire service.
- The American rural fire risk is strongly linked to a higher level of use of less safe forms of heating in rural areas.
- Other main causes of rural fire deaths in America are smoking materials and electrical distribution systems.

(f) Ethnicity

Gunther (1981, cited in Federal Emergency Management Agency, 1997b) considered the relationship between race and the risk of fire. He found that, once income was accounted for, there were no significant links between race and fire risk. For individual causes of fires, the data was less clear; no definite evidence could be provided to show a link between race and specific causes of fires.

- **Key Points**

- The evidence on the relationship between race and fire risks is unclear. It appears that any link between the two can be accounted for by other socio-economic factors, notably income.

(g) Alcohol and drug use

Alcohol is a risk factor for fires. Boot and Treep (1990) look at a range of studies that have varying estimates of the percentage of fire fatalities that involve alcohol. They estimate that

alcohol contributes to as much as half of all fatalities. A New Zealand study on alcoholism and mortality found that, of the 342 unnatural deaths in Otago from 1971 to 1979, 18 were caused by fires, of which intoxication was found in nine, or 50 percent (Gwynne, 1980, cited in Boot and Treep, 1990). Recent American data found drug and alcohol impairments in around one-sixth of adult fire victims between the ages of 20 and 65; Hall considers that this figure is probably understated due to the erratic recording of such factors, and comments that the rate of alcohol or drug impairment may be as high as 50 percent of all fire deaths between the ages of 20 and 65 (Hall, 1998b).

Data on the link between alcohol and fires is derived from blood tests on fire fatalities; it indicates that a considerable percentage of fire fatalities have consumed alcohol but does not necessarily show that those fatalities are in some sense caused by the alcohol consumption. However, Boot and Treep (1990) report a range of studies have found that fatal fires involving alcohol often occur when a drunk person drops a cigarette or falls asleep with a lit cigarette. This is supported by Hall (1998c), who comments that people who die in smoking-related fires are more likely to have been affected by alcohol. While he finds that 10 percent of American residential fire victims are affected by alcohol, this figure rises to 18 percent when only smoking-related fires are considered.

Another possible link between alcohol impairment and fires is cooking. Scottish data reports that alcohol-related fires were often chip pan fires. “Eighty-four percent of people killed by, and responsible for starting “chip pan” fires were over the legally prescribed limit [of alcohol] for driving” (Squires and Busuttil, 1995). Alternatively, a fire may have been started by other causes and the person’s judgement or physical abilities impaired by alcohol to a point of ineffective response to the fire. Brennan (1998) found that alcohol was linked to behaviours other than evacuation, such as attempting to fight the fire or rescue valuables.

The occurrence of alcohol-related fires is particularly linked to middle-aged people, often men. American data found that alcohol or drug impairment is particularly common between the ages of 30 and 49, and more likely in males (7.5 percent of women fire victims aged 20–65 are found to be alcohol impaired, compared with 18.4 percent of men (Hall, 1998b). Brennan (1998) found that nearly half of a sample of fire fatalities aged 18–75 were under the influence of alcohol; this was particularly common among males aged in their early 20s, or aged 40–50 years.

The victims of alcohol-related fires may also be people who share a home with an intoxicated person who starts a fire. Scottish data shows that “approximately 30 percent of all child fire deaths occur in fires that are alcohol—related events. In the majority of such cases the “alcohol positive” adult was a parent of the child” (Squires and Busuttil, 1995).

A sample of fire fatalities aged 18–75 found that a high proportion of alcohol-linked fire fatalities were people who had caused a previous fire incident in similar circumstances (Brennan, 1998). Alcohol abuse is also a statistically significant predisposing factor for burn injuries (Boot and Treep, 1990).

- **Key Points**

- The exact level of involvement of alcohol impairment in fatal fires is unknown, but around 50 percent of fatal fires are estimated to be affected by alcohol impairment.

- The most common cause of alcohol-related fires is the dropping of cigarettes by alcohol-impaired persons. Another main cause is cooking by alcohol-impaired persons. Evacuation behaviours may be negatively affected also by alcohol impairment.
- Fire victims impaired by alcohol tend to be in their middle age, and male.
- Fires started by alcohol-impaired adults often kill children living in the same household.
- Alcohol impairment leading to fire risks appears to be a behaviour pattern for certain individuals, rather than a one-off occurrence; Brennan (1998) finds that a large proportion of alcohol-related fire fatalities are people who have caused a previous fire incident in similar circumstances.

(h) Smoke Detectors

In the early 1980s, there were a number of reports produced in the UK that questioned the usefulness of smoke detectors (Moyses, 1983; Home Office, 1980). While allowing that smoke detectors would undoubtedly save some lives, Moyses (1983) argued that many fire deaths are characterised by an incapacity to respond, such as the person who is drunk, handicapped in some manner, or too young or too old, or even a heavy sleeper, and that in such cases, smoke detectors may be ignored or not responded to effectively. Further, it was argued that many smoke detectors are non-operational due to missing batteries and the like, and that households are apathetic towards smoke detectors and necessary further fire safety measures such as having and practising an escape plan, giving further cause for doubt as to the extent of the positive effect of smoke detectors.

The Home Office Report (1980) commented that in many cases of fire fatalities, people were directly involved in the fire, and thus would not need a smoke detector to alert them to the fire. This argument does not stand up when one considers that many of these cases involve people who may be responsible for the fire—they dropped the cigarette—but who are not aware of the fire, for example, due to falling asleep. Another example is children playing with fire, where the child will realise there is a fire but will probably not respond effectively, while a parent would be alerted to the fire by a smoke detector.

Another reason given to doubt the effectiveness of smoke detectors is the evidence on people's responses to fire alarms. As discussed in the "human behaviour in fires" section below, people tend to disregard fire alarms as false, or tests, rather than seeing them as a warning of a genuine emergency. However, this result does not translate to the residential setting—in the only piece of research on domestic fires, Wood (1972) found that people in their home environment are far more likely to rate a fire situation as "serious". On the other hand, people will not rely solely on a smoke detector but will check to see what the cause of the smoke detector activation is. A survey by the National Fire Protection Association found that only 7 percent of people, when they hear their smoke detector go off, think first that it is a fire and that they should get out (Ahrens, 1998b).

A high number of fatal fires occur at night, when residents are asleep. In such circumstances, smoke detectors are particularly effective in saving lives as smoke is likely

to kill occupants prior to them hearing the noise of the fire (Moyses, 1983). A smoke detector gives much higher chances of waking up in time, though there is a need to ensure that the sound level of the smoke detector is sufficiently high, through tests in the home and putting smoke detectors near the heaviest sleepers. Recent research has found definite proof of the life-saving potential of smoke detectors. Much of this research comes from America. A good summary of the American data is given by Ahrens (1998b).

In general, fires discovered by automatic fire alarms, including smoke detectors, are discovered sooner after ignition, and are thus associated with lower casualty rates and less property damage (Goddard and Poole, 1996). Specifically, fatalities in fires discovered by smoke detectors were three per every 1000 fires, compared with 10 fatalities for every 1000 fires (Fire Protection Association, 1991). Where smoke detectors were operating, 70 percent of fires were discovered in under five minutes, compared with 50 percent of fires where smoke detectors were not operating (Fire Protection Association, 1991). American data from 1990 found only 19.2 percent of fire deaths occurred in homes known to have operational smoke detectors (Federal Emergency Management Agency, 1997b).

Smoke detectors also appear to reduce the number of fires requiring fire department assistance to suppress them. American data showed that 65 percent of residential fires attended by the fire service were to households that did not have an operational smoke detector (Federal Emergency Management Agency, 1997b). This is despite the fact that around three-quarters of American homes have a working smoke detector (Ahrens, 1998b). This suggests either that households with operational smoke detectors are more safety conscious, or that such households are able to detect and extinguish small fires more effectively (Federal Emergency Management Agency, 1997b).

Smoke detectors are most commonly owned by those who own their own home, and least commonly owned by private renters (McCabe and Moore, 1990). Households without smoke alarms are also slightly more likely to be poor, non-white or headed by an adult over the age of 65. However, the link between smoke detectors and socio-economic status is not as well-proven as the link between socio-economic status and fire risk (Ahrens, 1998b).

In a survey conducted at a hospital, the common reason cited for not having a smoke detector, was "cost" in 85 percent of cases, and "not worthwhile" in 15 percent of cases (McCabe and Moore, 1990).

The level of smoke detector use is high both in the United States and the UK. In 1995, 93 percent of American homes had at least one smoke detector. However, not all these smoke detectors were operational (Ahrens, 1998b). Hall (1997c) reported that around 70 percent of UK households had a smoke detector.

American data has shown that around one-third of smoke alarms are not working at the time of a fire, usually because batteries are dead or have been removed, or occasionally because the smoke detector has been incorrectly installed, or installed in the incorrect place (Schuchard, 1997; Ahrens, 1998b). The US Consumer Safety Commission carried out a general survey on the status of smoke alarms, and found that 20 percent of the smoke detectors in the survey did not work, while 46 percent of the owners of non-operational smoke detectors did not realise that they did not work (Ahrens, 1998b). Where batteries had been deliberately removed, this was usually due to either the alarm activating during cooking (one-third of these detectors were incorrectly sited, leading to the inappropriate activation),

or due to the chirping of the alarm that occurs in many smoke detectors when the batteries are low (Ahrens, 1998b); this chirping is often misinterpreted as the alarm being faulty.

It is true that the effectiveness of smoke detectors is limited by human error in maintaining the smoke detectors. However, this does not mean that the use of smoke detectors should be dismissed; rather, it means that education on smoke detector maintenance and the importance of smoke detectors is needed. A possible technical solution to the issue of people removing batteries from smoke alarms is to encourage the use of smoke alarms hard-wired into the electricity circuitry of the household. Statistically such alarms are less likely to fail (Ahrens, 1998b).

The case study of Norway (Hansen and Hovden, 1998) highlights many of the issues associated with smoke detectors. In 1991, Norway made working smoke detectors and extinguishing equipment compulsory for all residences. This did not lead to a significant decrease in overall fire deaths. This is thought to be because of the high level of smoke detector use prior to the law change, and because of the relatively high level of people who did not know about (14 percent) or chose to ignore (23 percent) the regulation—there are no penalties for householders not acting on the regulation. However, the number of child deaths, and deaths of able-bodied people, was reduced, suggesting that smoke detectors did have a positive effect for those who were able to respond effectively to them. Hansen and Hovden (1998) concluded that people who chose to ignore the regulation, by keeping non-operational smoke detectors, need to be encouraged to maintain their smoke detectors. They also concluded that among those who did not respond effectively to smoke detectors—particularly the elderly, people affected by alcohol, and people living alone—fire prevention behaviours must be improved.

- **Key Points**

- Smoke detectors reduce fire fatalities from 10 in every 1000 fires where there is no operational smoke detector present to three in every 1000 fires where there is an operational smoke detector present.
- Smoke detectors are least commonly owned by renters, those over 65, those in lower socio-economic groups, and the non-white.
- The level of smoke detector use is high in both the USA and the UK.
- Around 20–30 percent of smoke detectors are non-operational, usually due to dead or removed batteries.
- Smoke detectors will not directly help those who are unable to escape a fire due to physical or mental impairments. However, smoke detectors will alert others in the same household to the fire, and thus create the possibility of assistance for those who are impaired in some way.

(iii) Fire Incidents Attended by The New Zealand Fire Service in the Past Decade: General Trends

The New Zealand classification system of the causes of fires is somewhat different from overseas classifications. For example, there is no specific category for children playing with fire; nor is there any indication of what specific objects are being referred to in the cases of

New Zealand classifications such as “abandoned/discarded heat source”, or “collision/overturn/knockdown”, or “equipment unattended”. Thus, it is difficult to distinguish specific factors, such as smoking materials, or cooking, or space heaters. Similarly, with a New Zealand classification such as “falling asleep”, it is not specified what occurred while the person fell asleep that caused the fire: did the person drop a cigarette they had been holding? Did they forget about cooking on the stove?

At the same time, the New Zealand data and classification systems give no reason to suppose that patterns commonly found overseas would not be relevant here also. The analysis of fatal fires in New Zealand by Cropp (1991) below indicates a pattern of fire risks that is similar to that seen overseas.

The most recent comprehensive analysis of fatal fires in New Zealand was completed in 1991 (Cropp, 1991). It arrived at the following conclusions:

- The New Zealand death rate from fire is low compared with the USA, Canada, England, Norway, Ireland and France
- Fatal fires are:
 - 90 percent residential
 - Disproportionately in non-conventional dwellings such as caravans or sleep-outs—these dwellings account for 1.5 percent of the dwellings in New Zealand, but 8 percent of fatal dwelling fires
 - Disproportionately in rented dwellings
 - Disproportionately in sole person households, flatting households and boarding or rest homes.
- Fatal fires are more likely to be:
 - In houses with no detection equipment
 - Late at night
 - In autumn
 - Involving only one death
 - Similar in various communities, due to the fact that New Zealand has little major rural poverty, and most housing has electricity.
- Victims of fatal fires are:
 - Twice as likely to be male
 - Elderly—those aged 75 and over have the highest proportionate fire risk
 - Very young—those aged under five have the second highest proportionate fire risk
 - Usually (two-thirds) asleep at the time of the fire
 - Least likely to be children aged 10–14, or males aged 50–54, or females aged 40–45.

- House fire contexts with at least two times the death risk compared to other fire causes are:
 - Falling asleep while ignition source is on
 - Fires where the victim is unconscious or suffering mental impairment
 - Careless disposal of smoking materials
 - Ignition source accidentally turned on
 - Children playing with ignition sources
 - Combustibles placed too close to heat
 - Ignition source left unattended
- Fires with a low death risk in New Zealand include suspicious fires, and fires involving electrical systems
- Alcohol is estimated to be involved in around half the fire deaths listed from 1986–1990; almost 25 percent of adult victims had been drinking alcohol, and around 10 percent had been taking drugs.

Another way of examining the fire problem in New Zealand is to look at the annual reports and tables of figures produced by the New Zealand Fire Service in the past decade.

The number of fire incidents attended by the New Zealand Fire Service has dropped over the past decade, from a rate of 6 per 1000 people in 1989 to 4.7 per 1000 in 1997 (New Zealand Fire Service, 1998c). The level of fire fatalities has been more variable: there were around 14.2 deaths per million population in 1989; this dropped to 6.8 per million in 1992, rose again to 12.4 per million in 1995, dropped again to 8.8 per million in 1996, and rose again to 13.9 per million in 1997 (New Zealand Fire Service, 1998c). This translates to 32 fire deaths in 1995/6, 50 fire deaths in 1996/7, and 48 fire deaths in 1997/8 (New Zealand Fire Service Commission, 1997; New Zealand Fire Service Commission, 1998).

During this time period, children have been the largest casualty group (New Zealand Fire Service, 1998c).

Over the 1995–1997 time period, an increase in multiple death incidents was recorded; in 1995/6 there were three residential fires with more than one fatality; in 1996/7 there were eight. Of the eight multiple death fires in 1996/7, a number were linked to the use of alcohol or drugs, especially by young men. Also, seven of the deaths occurred among Maori in Bay of Plenty, prompting a fire awareness campaign in that area. Finally, there was an increase in multiple-death fires in rest homes. (New Zealand Fire Service Commission, 1997). However, in 1997/8 the number of residential fires with multiple fatalities was significantly down on the previous year, with only two occurrences (New Zealand Fire Service, 1998).

Of all fire incidents attended by the Fire Service in 1996/7, 71 percent were urban fires, 13 percent rural, and 16 percent involved motor vehicles. A majority of both urban and rural fires were non-structure fires (only 37 percent of urban fires were fires in structures, such as dwellings or buildings, while only 28 percent of rural fires were structure fires).

While a majority of fires were non-structure fires, the majority of fatalities and injuries typically occur in structure fires, particularly in residential structures. In the 1997/8 year, the New Zealand Fire Service Commission (1998) pointed out that fires in domestic residences accounted for more than 90 percent of fire deaths in structures. While most fire incidents attended by the Fire Service occurred in the daytime, peaking from 5 a.m. till 6 p.m., the highest number of structure fire fatalities occurred between 10 p.m. and 6 a.m., when

typically people are asleep (New Zealand Fire Service, 1998c; New Zealand Fire Service Commission, 1997).

The New Zealand Fire Service Commission (1998) commented that the risk of domestic fire fatalities has increased with the increasing use of highly combustible furnishings (those of polyurethane or other synthetic materials), which burn quickly with toxic smoke. This has meant that rapid response times have not been able to prevent fatalities; past education strategies also appear to have been less successful than hoped. It was decided in 1998 that there was a need for “more culturally sensitive approaches, more effective forms of message, and a better use of community partnerships to disseminate the message” (New Zealand Fire Service Commission, 1998). The “Home Safe Home” campaign aimed to meet this need.

Other main trends evident from 1995–1997, were an increase in fires in non-urban fire districts, and an increase in incidents which led to death, both for vehicle and structure fires. These trends may be linked—fire-fighters cannot reach non-urban fires as quickly, leading to more deaths (New Zealand Fire Service Commission, 1997). This is a further reason for focusing on fire prevention and fire safety, as again, rapid response times by the Fire Service have not been able to deal with the problem fully.

The most common known causes of fires that resulted in fatalities between 1992–1997, were an abandoned/discarded heat source; collision/overturn/knockdown (of material which started the fire); and falling asleep (New Zealand Fire Service, 1998c). Other main causes that were less common were: person playing with heat source; equipment unattended; heat source too close to combustibles; part failure/break/leak; person impaired by drug/alcohol; and suspicious or unlawful incendiary (New Zealand Fire Service, 1998c).

An analysis of New Zealand data showed that upholstered furniture and bedding were implicated in 28 percent of all burn related deaths (Brereton and Laing, 1992). Bedding and mattresses were the first textile items to be ignited in 25 percent of bedroom fire deaths, while furniture is the first textile item ignited in only 7 percent of lounge fire deaths. Thus, the death rate attributable to upholstery is not especially high. Typically, “The mix of alcohol consumption, smoking, then falling asleep created a situation of risk”. Cigarettes were the most commonly identified source of ignition of fabrics. The most common place of death was bedrooms, presumably because people were sleeping and overcome by smoke; the most common place of injury was the lounge where people were typically awake and may have attempted to fight the fire.

- **Key Points**

- New Zealand fire risks appear to be broadly similar to those found overseas.
- The elderly and the very young are at a disproportionate risk of fire fatalities, as are males.
- Many of those killed in fires are asleep or impaired by alcohol at the time of the fire.
- Fatal fires occur almost exclusively in homes with no fire detection equipment, and disproportionately in non-conventional dwellings.

- The main causes of fatal fires include smoking materials, children playing with fire, unattended ignition sources, and combustibles placed too close to a heat source.
- The main differences found from overseas trends are that rural communities are at less of a risk than in the USA, that arson is a low-risk fire cause in terms of fire fatalities, and that New Zealand's overall death rate from fire is low compared to many other Western nations.

(iv) Common Fire Safety Advice

This section gives a summary of the most common fire safety advice offered in the fire safety literature. It draws specifically on articles in the popular media (Turner, 1998; Wakelin, 1990; Stop the home fires burning, 1995; McAra and Hay, 1998; Baskett, 1994).

Advice regarding fire detection:

- Put smoke detectors in hall/lounge, and every sleeping area
- Clean smoke detectors once a month with vacuum cleaner
- Replace batteries every year.

Advice regarding electrical appliances:

- Check electrical and gas heaters for faults regularly
- Check computers, televisions, videos for electrical problems
- Turn electric appliances off at the wall when you go to sleep or if they are not in use
- Get electric blankets checked annually; keep them smooth and tied down; switch them off when you get into bed or if you are not in the house; keep clothes, cushions and pets off them as they can cause "hot spots".

Advice regarding heating:

- Keep clothing and furnishings away from heaters/fires.

Advice regarding open fires:

- Use a fireguard
- Sweep chimneys regularly
- Dispose of ash from fireplace sensibly.

Advice regarding smoking materials:

- Make sure cigarettes are stubbed out properly
- Provide deep stable ashtrays
- Do not smoke in bed.

Advice regarding electrical systems:

- Don't overload power points
- Don't run wires under rugs
- Check electrical wiring every 10 years
- Check power points, plugs, extension cords.

Advice regarding cooking:

- Check that pot handles are turned to the rear of the stove; and cords are out of children's reach
- Do not wear clothes with long/drooping sleeves
- Have a fitted lid for any pot in which you cook oil, in case it catches alight
- Empty crumbs from inside the toaster
- Don't leave fat/oil pan unattended—turn the heat off if you have to leave to get the phone or door
- Use stove guards
- Think about kitchen design (accessibility to toddlers/young children).

Advice regarding children:

- Supervise children, especially near heaters, kitchen, etc.
- Do not leave children at home alone
- Teach children to use appliances safely
- Buy nightwear that fits closely and is made from polyester, nylon or wool, or is treated for fire resistance.
- Keep lighters and matches away from children.

Advice regarding alcohol:

- Encourage safe practices with alcohol, smoking and cooking.

Advice regarding escape behaviour:

- Have an escape plan and practice it: two exits from each room.

Advice regarding safe practices during a fire:

- Stop, drop and roll if clothing is on fire
- Check doors for heat before opening
- Close doors on the fire, gently.
- Put towels under doors
- Crawl in smoke
- Fire fighting should not be a priority; raise alarm and escape, then call the fire service
- Stay alert and assist the elderly, young and disabled.

Advice regarding fire fighting:

- For fat, oil and solvent fires, smother or use a dry powder extinguisher—don't use water which will spread the flames
- For all other fires, water is fine; if a fire is electrical, switch off the source of the electricity (at mains is safest) and then use water.
- Shut the door on a fire in the oven; put a lid on a fire in a pot.
- If you can't get a fire under control within 30 seconds using a fire extinguisher, get out.

3. What is Known by the Public About Fire Safety?

As a starting point for consideration of public fire safety knowledge, it should be noted that “almost all data [on fires] is quantitative in nature and little is regularly available on attitudes, awareness and behaviour” (Community Fire Safety Task Force, 1997).

Data from various countries consistently suggests that the number of fires notified to the fire brigade constitutes only a small percentage of all fires. For example, Britain, it is estimated that only 8–16 percent of fires are reported (Goddard and Poole, 1996). This suggests most fires are minor and are successfully extinguished without the help of the Fire Service. The fires discussed in this review are those which have come to the attention of the Fire Service and as such will generally be major rather than minor fires.

(i) What is Known by the Public About Fire Safety, and How has it Been Learnt?

People tend to have an unrealistically low perception of the hazard that fire may pose to them. Only 4 percent of the public surveyed in Britain, 1995, considered they were likely to have a fire in the home, while 44 percent considered themselves likely to experience a burglary and 35 percent, a car accident (Community Fire Safety Task Force, 1997). Data on the fire safety knowledge of Americans found that Americans under-estimated the risk they faced from fires, with 92 percent being very or somewhat confident about their own safety from fire, despite 24 percent having experienced an unintentional fire (Grisanzio, 1996). The survey found that older people and men, in particular under-estimated their fire risk. Perhaps due to the media emphasis on large fire disasters, people typically felt safest from fire at home, and least safe in hotels, again despite the vast majority of fire deaths occurring in the home (Grisanzio, 1996).

People tend to have a low level of awareness of how a fire progresses, and thus propose or practice attendant unsafe fire escape practices.

Research by Canter, Powell and Booker (1987) found that, shown a series of photos of a growing fire, people will consistently over-estimate the time between photos; their over-estimation becomes exponentially worse as time progresses.

In 1998, the NFPA published the results of a survey they had conducted regarding the fire safety knowledge and behaviour of Americans (Wolfe, 1998). The survey showed what had been suspected: that people over-estimate the time they have to escape from a fire. While research shows that fires can kill within two minutes of starting, 58 percent of those surveyed thought they had more than two minutes before they needed to escape, and 24 percent thought they had more than 10 minutes.

A New Zealand survey of fire safety knowledge in 1997 found that knowledge and behaviour were worst regarding the overloading of power points (50 percent) and the rescuing of valuables from the home (52 percent), as well as the fact that there is little time to escape during a fire (69 percent), that the home could become unsafe within three minutes (73 percent), that smoke would not wake a person up during a fire (73 percent), that fire is in fact likely to produce poisonous gasses (70 percent) and that one should wait for the Fire Service rather than attempting to fight a fire alone (75 percent) (Decision Research Ltd, 1997).

In Britain a survey showed smoke was recognised as the major cause of death in fires by 95 percent of those interviewed (McCabe and Moore, 1990).

The NFPA U.S. survey of 1998 (Wolfe, 1998) found 53 percent of respondents had a fire escape plan, while 31 percent of these people had practised it. When asked what they would do if the smoke detector sounded during the night and they could smell smoke, 63 percent said they would leave the house immediately, 34 percent said they would investigate and / or fight the fire, 32 percent would wake others in the household, 22 percent would call the fire service, and 3 percent would gather their belongings.

Williams and Hopkinson (1985) found that in a large proportion of fires, fire growth and spread is due to doors or windows being left open or opened at a crucial stage in the fire's development, often during escapes, rescues, or fire-fighting. Malaysian research in a school found that a large proportion of staff and students believed that, in the case of fire, opening doors and windows to let out smoke was a positive behaviour (Marchant and Idris, 1998).

Other aspects of fire safety knowledge show mixed results.

The New Zealand Fire Service Commission (1998) reports on the results of a CM Research Limited random national phone survey, conducted in 1998, on the subject of public knowledge of fire risks and fire safety skills. Around half the respondents remembered hearing or seeing a fire safety or prevention message. Further, nearly all respondents knew where the nearest fire station was, and two-thirds knew how to contact the Fire Service for information and advice. Two-thirds said they had smoke alarms in their house; around half of these had only one alarm. Seventy percent checked their alarms at least once every six months. Levels of fire equipment kept in the home varied, from almost all having a garden hose and 80 percent a first aid kit, to only seven percent having a fire blanket. The main variations in this data were people who did not own their own homes and minority ethnic groups.

A 1997 report of a random mail survey (Decision Research Ltd, 1997) discusses in more detail the state of public fire safety education in New Zealand.

Over half the respondents had a smoke detector. Only 7 percent reported having a non-working smoke detector. Homes with children under 15 years were more likely to have a smoke detector than those without (60 percent compared with 47 percent). This is presumably linked to a finding from a 1996 survey, that fire-fighter visits to the child's school were the strongest influence on the installation of smoke alarms. While such a link was not directly found in the 1997 survey, the 1997 survey did find that smoke detector usage levels were higher in households that recalled a firefighter school visit occurring.

Awareness of the public education efforts of the Fire Service was found to be reasonably high, with 40 percent of the respondents having read a Fire Service brochure. Those who had read the brochure were more likely to have a smoke detector and an escape plan than those who had not read the brochure.

In some areas, fire safety knowledge was very high. For example, 99 percent of those surveyed knew to call 111 to reach the Fire Service, 96 percent knew to keep low in smoke, 95 percent knew to keep furniture and children away from heaters, and that it is dangerous to put hot ashes with other rubbish, 89 percent reported that no-one in the household smoked in bed, and 88 percent knew to close doors in a fire.

A British survey found that 55 percent of smokers smoke in bed, and 25 percent of households with window locks could not open them if a fire occurred (McCabe and Moore, 1990). On the other hand, 80 percent of all households closed doors at night; 62 percent

unplugged all plugs at night, and 60 percent of households with smokers emptied ashtrays each night (McCabe and Moore, 1990).

Grisanzio (1996) found that certain fire safety practices were relatively well known, such as “stop, drop and roll” (79 percent), but that incorrect practices still influenced a large number of people. For example, 20 percent of respondents said that they would smother a cooking fire with salt or baking soda.

British fire data (Reynolds, 1997) has shown that smoke alarms were usually positioned where official advice suggests they are of most use: in hallways and landings. A survey of parents attending the paediatric department of Cardiff Royal Infirmary backs up this result, with the majority of those surveyed picking the appropriate optimum sites for positioning smoke detectors (McCabe and Moore, 1990).

(ii) The Fire Safety Knowledge of Specific Groups

A survey of a sample group of elderly, conducted as part of a fire safety education pilot programme, found that only 11 percent conducted a fire drill even once a year. However, 75 percent reported testing their smoke detectors at least once a year, and 55 percent said they checked their homes for fire hazards at least yearly (Walker, Beck, Walker and Shemanski, 1992). Smoke detectors were generally placed in suitable places.

Research regarding levels of fire safety knowledge amongst New Zealand school children was published by the New Zealand Council for Educational Research in 1993 and 1995. Constable and Renwick (1993) aimed to establish the pre-intervention level of children’s knowledge, and Dunn and Renwick (1995) looked at changes resulting from a new school fire safety education programme introduced after the 1993 study.

Constable and Renwick (1993) found a high level of baseline knowledge of fire safety among standard two children. Ninety-three percent knew that the emergency telephone number is 111; ninety-one percent knew to stop, drop and roll if their clothes were on fire; 81 percent knew that the Fire Service should be the first people called; 71 percent knew to first call for help if they saw a fire; and 70 percent knew to crawl to a window or door if there was smoke in the room. This information was most commonly gained at home or from a fire fighter; Television, teachers, and “just know” were also common answers. Interestingly, there was a significant gender difference in where children reported getting their fire safety knowledge. Girls were more likely to cite home and teachers as a source of knowledge, while boys were more likely to cite fire-fighters, television, or say that they “just know” (Constable and Renwick, 1993; Dunn and Renwick, 1995). Generally children also knew what things could start fire, what a smoke detector is for, and what to do if they found matches.

When asked to demonstrate the correct behaviours, results were also generally positive. Forty-seven percent of children showed complete mastery of “stop, drop and roll”, while a further 14 percent showed partial mastery, needing some clues as to the correct response. Of the children who showed no mastery, the majority demonstrated an alternative behaviour such as getting water to put out clothes which were on fire or taking off clothes. The behaviour of crawling to the door had 56.5 percent total mastery; common mistakes included not knowing the exit, running, or dragging the body. Making a phone call to the fire service had 84 percent mastery, with 94 percent knowing the correct number but not knowing to ask

for the fire service; and some children did not know their house address (Constable and Renwick, 1993).

A large majority of schools taught fire safety, particularly at the lower age levels in the school. Seventy-nine percent of schools had conducted a fire drill in the past year. (Constable and Renwick, 1993).

Canter, Powell, and Booker (1987) found a high level of fire safety awareness and knowledge in a group of care and office professionals in the United Kingdom. The areas in which they were most frequently incorrect included what to do if fighting a small fire, and knowing what causes most fires. The professionals were generally positive in their approach to fire safety, in particular regarding the value of drills, the importance of preparedness for fire prevention, the consciousness of others regarding fire safety, and their own concern with fire safety. They attributed less importance to the strictness or enforcement of fire safety rules, ensuring people received sufficient training, individual ability to help prevent fires, and others' concern with fire safety.

- **Key Points**

- Data on the level of fire safety knowledge of individuals is limited and often gives highly variant results.
- In broad terms, it can be said that the greatest gaps in fire safety knowledge are: firstly, people under estimating their risk from fire; and secondly, people not understanding fire growth and the speed at which it occurs.
- Presumably as a result of people not realising how quickly a fire progresses, the worst areas of fire safety behaviour are in regard to escaping fires. These include a lack of awareness, in New Zealand, that smoke will kill rather than wake up a person; an overconfidence in the ability of an individual to fight a fire unaided; an attendant failure to realise one should evacuate immediately and call the Fire Service, rather than fight a fire; and a relatively low level of escape plans, with an even lower level of practised escape plans.
- The one escape behaviour widely known is the need to crawl low in fires.
- In terms of fire prevention behaviours, the results of the surveys are mixed. Knowing how to call the Fire Service has high levels of awareness. Knowing not to smoke in bed, not to leave heaters too close to furnishings, to close doors at night, not to overload electrical points, and to switch electrical points off at night, are all behaviours that have mixed results depending on the survey in question.
- Awareness of smoke detectors is also mixed. It appears to be relatively high, with around two-thirds of New Zealanders claiming to own smoke detectors, and two-thirds of the owners claiming to check the smoke detector(s) regularly. There was a high level of knowledge on the correct positioning of smoke detectors. New Zealand homes with children were more likely to have smoke detectors.

- A link was found in New Zealand evidence between people recalling fire safety education efforts and the levels of fire safety practices engaged in, particularly in terms of smoke detectors and escape plans.
- Elderly as a separate group found that they have a low level of escape plans, but a high level of smoke detector maintenance.
- New Zealand children had a high level of fire safety knowledge, and a lower level of ability to perform fire safe behaviours such as crawling low in smoke.

(iii) Human Behaviour in Fires

There are two main approaches in the literature on human behaviour in fires: one approach is to survey people who have experienced a fire to find out common actions; and the other approach is to concentrate on specific aspects of the evacuation procedure to understand how and why people behave as they do during fire evacuations.

(a) Common actions in fires

To set the scene on how people behave in fires, one can begin by looking at those who die in fires. This has been covered largely earlier in this review, and the broad results found there are mirrored in New Zealand data which shows that fire victims, prior to the fire fatality, were usually sleeping, unable to act in some manner, or attempting escape (New Zealand Fire Service, 1998c). However, it is important to be aware that large numbers of fires do not have such data classified (Ibid).

American data (Hall, 1998b) found that at the time of the fatal injury, people are most likely to be asleep (43 percent) or attempting escape (25 percent). Other common actions are being unable to act (14 percent), being irrational (6 percent), making a rescue attempt (3 percent) and attempting fire control (3 percent). Notable variations in this pattern are age-based: pre-schoolers are more likely to be unable to act than to be attempting escape; those aged 20–29 are more likely to be attempting a rescue than to be unable to act or irrational; and those aged over 50 are more likely to be trying to control the fire than to be making a rescue attempt.

Leaving aside the fire victims, British data (Reynolds, 1997) found that, in fatal fires, over half of the fires were discovered by neighbours and almost one-third were discovered by members of the family. Over 40 percent of those who discovered a fire tried to enter the property and rescue the fatality, usually unsuccessfully due to flames or smoke, while 10 percent tried to rescue other family members. Only 25 percent of those who discovered a fire called the fire brigade first. Fourteen percent tried to fight the fire.

Studies of fires tend to find that the first behaviours engaged in are searching for the fire, evacuating the building, fighting or containing the fire, and alerting the fire brigade or other people in the building (Bryan, 1997). These behaviours vary according to the stage of the fire: notifying others, searching for the fire, and getting family become less common as the fire proceeds, while evacuating, fighting the fire, and calling the fire brigade become more common (Bryan, 1997). There are some small differences between US and British study populations (Bryan, 1997).

There are apparently some small differences in the first behaviours of those in public building fires and those in domestic fires (Canter, Breaux, and Sime, 1980; Wood, 1972; Bryan, 1997, all cited in Bryan, 1997). People in public buildings are less likely to notify others immediately (Fahy and Proulx, 1997); people in their own homes are more likely to search for family. Interestingly, people in domestic fires are more likely to check if there is indeed a fire if informed so by someone else; this “is apparently related to the role of the individual in his or her own home as well as the proximity of a fire” (Canter, 1985). People are more likely to rate a fire as “extremely serious” if it occurs in the home environment (Wood, 1972).

There are gender differences in behaviours. Men are more likely to investigate the fire and attempt to fight the fire, while women are more likely to warn others, including family and fire departments, as well as being more likely to leave the building (Bryan, 1997; Canter, 1985; Wood, 1972).

After evacuation, a number of fire victims will re-enter a fire. The main reason given for this by US subjects is to fight the fire, followed by retrieval of personal property, checking on the fire, notifying others, assisting the fire department, and retrieving pets (Bryan, 1997). Such behaviour is typically engaged in by males. It involves, usually, around one-third of those who were in the fire (Bryan, 1997). In Britain, other reasons given for re-entering a fire were to shut doors, the fire was not severe, and to wait for the fire department. Notifying others and assisting the fire department were not given as reasons in the UK material (Bryan, 1997).

- **Key Points**

- In fatal fires, victims are likely to be asleep, unable to act, or attempting escape. These behaviour patterns vary by age. Others in fatal fires often try to rescue the fatality or other family members.
- Fire behaviours vary depending on the stage of the fire. They chiefly involve finding the fire, fighting it, notifying others, and evacuating.
- People in domestic fires are more likely to attempt to find the fire, rate it as serious, and notify others in the house.
- There are gender differences in common actions in fire, with men more likely to fight the fire, and women more likely to warn others.
- Fire re-entry is common especially by men

(b) Evacuation behaviour

A body of literature on evacuation behaviour in fires, usually focused on public building evacuations, has developed since the late 1970s. Prior to this point, fire engineering of public buildings was seen as a technical matter, concerning calculations of how many people could fit through a doorway at once, and how far people would have to move to get to the nearest exit, with no consideration of psychological aspects. Incorrect assumptions were made about human behaviour in fires. As outlined by Sime (1992), these included:

- people “panic” in fires, meaning that their safety cannot be guaranteed
- people will start to move as soon as an alarm sounds
- “the time taken for people to evacuate a floor is primarily dependent on the time it takes them to physically move to and through an exit”

- “movement in fire is characterised by the aim of escaping”
- people are more likely to move towards their nearest exit
- people move independently of each other
- fire exit signs help people to find a safe escape route
- “people are unlikely to use a smoke filled escape route”, and
- all people in a fire are equally capable of moving towards an exit.

The burgeoning interest in the psychological aspects of fires was linked to a realisation that fire evacuation was not as simple a matter as had been assumed. Key to this realisation was the discovery that evacuation time hinged not on the time it would take to physically move from inside a building to outside it, but rather, on how long it would take for people to begin to evacuate. The “start up time” (Sime, 1992), including various typical human behaviours in fires, such as investigating and seeking more information before deciding to evacuate, disregarding fire alarms, and seeking out family members or friends, mitigates against a rapid start to the evacuation process.

Studies prior to this had often assumed that human behaviour in fires could be characterised as “panic”, since the behaviour did not seem objectively optimal. However, a shift in thinking occurred. Drawing on models of human behaviour that suggest humans do the best they can with limited information, an awareness grew that human behaviour in fires was optimal, given the information on which actions were based (Sime, 1980). Further, it was realised that many of the early stages of human behaviour in fire were concerned with seeking more information about the fire if informed about the fire by someone else, the tendency is to check this information for oneself, and fire cues such as noise or smoke typically resulting in investigation rather than evacuation (Canter, 1985). Bryan (1997) reports that detailed interview and questionnaire studies over 30 years have established that instances of non-adaptive, panic-type behaviour are rare events. Most behaviour in fires is determined by information analysis, resulting in co-operative and altruistic actions (Bryan, 1997). Particularly in domestic fires, panic behaviour such as competition rather than co-operation among those attempting to evacuate is almost unheard of (Keating, 1982, cited in Bryan, 1997).

A model of human behaviour in fires developed, which looked at the most common behaviours people engaged in from the time that they began to notice something was wrong. The psychological process model that emerged was described by Benthorn and Frantzich (1996). The person will first receive some sensory information about the change in situation. If this information is unclear to them—which it usually is—they will seek out more information by talking to others, or physically going to investigate. The early stages in the process are thus often characterised by uncertainty, misunderstanding and inefficiency. Having discovered that there is a fire, two main options emerge: fight or run. However, both of these main behaviours will be interrupted by other actions, such as warning or rescuing others, saving material objects, and calling the fire brigade.

This model gives rise to a main tactic in improving fire evacuation: increase the amount of information available to people in order to move them more quickly to a stage where they will decide what to do (Benthorn and Frantzich, 1996). This can be done, for example, by giving verbal warnings of dangers rather than relying on fire alarms, or putting directional exit signs in place (Benthorn and Frantzich, 1996; Building Research Establishment, 1993).

Bryan (1997) outlines two models similar to Benthorn and Frantzich. The first model he outlines contains six stages:

- recognition (cues are perceived);
- validation (cues are confirmed);
- definition (the situation is defined);
- evaluation (options are considered);
- commitment (behaviour suiting the decision arrived at in evaluation is undertaken); and
- reassessment (if initial behaviour is not successful in removing the threat).

The second model scales this down to three stages:

- recognition/interpretation;
- behaviour (action or inaction); and
- the outcome of action.

Meacham (1998) discusses a model for human decision making in fires that is based on psychological concepts. It holds that a person's actions are affected by four main psychological drives: avoidance (psychological protection from acknowledging an unpleasant situation); commitment (people wish to complete the task they are engaged in before they embark on another task such as responding to a fire); role (people will act in a manner they consider to be in accordance with their role at the time of the fire); and affiliation (people will seek to carry out actions in groups, particularly family groups). This model offers some explanation for the delays in responding to fires that are often noted in studies of human behaviour, and also some explanation for different behaviours during a fire.

Generally, empirical studies of human behaviour in fires have shown consistency of results. The first main source of these studies is the collected articles in *Fires and Human Behaviour*, edited by Canter (1980), that resulted in a body of work developing in the 1980s at the University of Surrey Fire Research Unit, where Canter was employed. There was a second edition published in 1990. Other important works include Canter (1985); Proulx and Sime (1991); Sime (1992); Fahy and Proulx (1997); Canter (1980/81); Bryan (1983); Yoshida (1996), Wood (1972). Summaries of this material are given by Bryan (1997) and the Building Research Establishment (1993). The main findings of the studies are:

- People will favour using a familiar exit door, or route, over using a "fire exit", even if the familiar exit door is further away or the route is longer than the emergency exit. This phenomenon has been noted in a large number of case studies (Benthorn and Frantzich, 1996; Building Research Establishment, 1993; Sime, 1992).
- This instinct is only reduced if an emergency exit door is open, and the outside can be seen through it (Benthorn and Frantzich, 1996), or if the emergency exit is also used in day-to-day movements in the building (Sime, 1992). The instinct to not use emergency exits is increased if the emergency exit doors are never used, or not allowed to be used, for general use (Sime, 1992). This points to the importance of exit drills, as they will make a fire exit or non-familiar exit door or route more familiar.
- People tend to mistrust fire alarms, perceiving them as a general warning (Benthorn and Frantzich, 1996) or even disregarding them, taking their sounding to be a false

alarm or a test (Proulx and Sime, 1991; Building Research Establishment, 1993; Sime, 1992).

- Spoken messages, particularly those containing directives, will have a stronger impact on the chances of rapid evacuation and on the exits chosen (Bryan, 1997).
- Research from 1985 (Building Research Establishment, 1993) found that over 70 percent of people will opt for immediate escape in response to computer-generated voice or picture alarms, while 45–55 percent will do so in response to text messages and 13 percent from alarms; the decision takes between 35 and 55 seconds. A research study carried out at a transport facility confirmed these results, with only evacuations where directive public announcements were used resulting in rapid and full evacuation (Proulx and Sime, 1991). Alarm bells and non-directive announcements were associated with delays of up to 8 minutes between the alarm being sounded and people beginning to evacuate. Even in the case of the successful evacuations, around half the subjects believed the warnings were a test, rather than genuine. Nonetheless, this interpretation was over-ridden by the instinct to obey direct instruction.
- Fire safety training does make a difference to behaviour; Wood (1972) found that people trained in fire safety are more likely to engage in raising the alarm or evacuating the building as a first action in a fire. Fires producing fire deaths are likely to involve a greater proportion of people who have never been trained in fire safety (Wood, 1972).
- People will often not recognise the warning signs of fire (smoke, heat, noise) as such, and will investigate what the source of the signs are; thus the early stages of a fire are often “characterised by ambiguity” (Canter, 1980; Bryan, 1997; Building Research Establishment, 1993; Bryan, 1983). Most people require at least two cues before they will perceive a problem (Brennan, 1996). This points to a possible need to teach people to interpret cues such as auditory cues correctly (Canter, 1985).
- People will act differently depending on the context. If evacuation concerns family groups, family members will act to be with other family members before they seek escape (Building Research Establishment, 1993).
- People will also modify their own interpretation of a situation as an emergency or non-emergency depending on the interpretations of those around them (Latane and Darley, 1968, cited in Bryan, 1997; Canter, 1985). People respond more quickly to fire cues if they are by themselves. If they are with others, they will delay assessing cues and rely on others, particularly those in a position of authority (Brennan, 1996). People familiar with a building are more likely to fight the fire and alert or assist other occupants, while those unfamiliar with a building will primarily engage in evacuation (Horiuchi, Murozaki, and Hokugo, 1986, cited in Bryan, 1997).
- People seem to have a “misleadingly optimistic view of the threat that fire presents to them *when they can actually see it developing*” [emphasis in original] (Building Research Establishment, 1993). Research by Canter, Powell, and Booker (1987) found that, shown a series of photos of a growing fire, people will consistently over-

estimate the time between photos; their over-estimation becomes exponentially worse as time progresses. This suggests that people do not realise how fast a fire can grow, particularly in its later stages. It raises the possible need for education on fire development so that a person watching a fire develop can correctly identify the level of risk to themselves, and will not disregard fire warning systems on the grounds that they do not judge the risk to be severe. Wood (1972) found that the chances of fire-fighting behaviour are inversely related to how serious the fire is judged to be.

- People are willing to move through smoke; visibility has to be reduced to a few metres before people begin to be strongly deterred (Sime, 1992).

Powell and Custer (1998) discuss how research on human behaviour in fires can be integrated with fire engineering. They argue that performance-based engineering can incorporate both design and human performance criteria. For example, the fire protection goal to “provide life safety” and its attendant loss objective of “no life lost outside of the room of fire origin” requires both an engineering condition—“maintain tenable egress conditions” and a human performance condition—“give a presentation on building evacuation, showing fire exit doors in such a way that people will use the nearest exit”. If specific, measurable human performance objectives are part of the performance criteria, it is more likely they will be explicitly considered by engineers.

- **Key Points**

- Fire engineering prior to the 1970s was focused on technical matters, with incorrect assumptions made about human behaviour in fires.
- A burgeoning psychological literature and interest in actual human behaviour in fires has corrected those assumptions.
- Much of human behaviour in fire is driven by a need for information and is informed by a number of factors such as self-perceived role, actions engaged in at the time of the fire, and group membership. For example, employees listen to bosses, while family members search for their families.
- Actual evacuation is not immediate. The time to decide to evacuate is usually the longest time period in the entire evacuation process, and people tend to under-estimate the risk of a fire to themselves. Evacuees usually do not use fire exits or routes unless these are commonly used, and often do not respond to traditional fire alarms.
- Before evacuation, people tend to either fight the fire or warn others.
- The literature on behaviour in fires indicates that a key task for education is to improve people’s understanding both of fire process and of safe behaviour during fires. During a fire the simplest way to encourage fast evacuation is to provide more information in the form of verbal directives.

4. General Features of Successful Public Fire Safety Education Programmes

Public fire safety education is one of three strategies aimed at reducing fire injuries; one can educate, enforce or provide automatic protection through the modification of products or the environment (Powell and Appy, 1997).

As limits have been reached on the effectiveness and viability of improving automatic protection or increasing enforcement, education has become more important. Further, education has a role in supporting legal enforcement or automatic environmental modification. Educational strategy may strengthen enforcements or environmental change strategies. For example, until an environmental change produces a maintenance-free residential smoke detector, educational messages on how to test and maintain smoke detectors will be needed (Powell and Appy, 1997).

- **Key Points**

- Education is less likely to produce change than legal enforcement of fire safe practices or automatic protection through environmental modification.
- Education is becoming more important as limits are reached in the viability of further modifying the environment or enforcing safe behaviour.
- Education has a crucial role in supporting both legal enforcement and environmental modification.

(i) International Approaches

Some detail is given here on overall approaches to fire safety education in the two main countries from which the information in this review is drawn, the United Kingdom and the USA.

(a) The United Kingdom

While some fire safety education has been delivered on a national level in the UK, such as the Home Office campaign for increased smoke detector use, most of the education efforts have been planned, designed and funded by local fire brigades with little co-ordination between them.

In the late 1990s, Britain began a review of its Fire Service. The review Task Force found a duplication of education materials and no national fire safety strategy. The review recommended a unified national approach to fire safety education be developed and made the principal focus of the fire service (Community Fire Safety Task Force , 1997).

The national education system is to be based around three core messages:

- fire prevention (fire safe behaviour, kitchen safety, bedtime routines, child fire play, etc.);
- fire detection (coverage and maintenance of smoke alarms); and
- escape behaviour (addressing misunderstandings about fire process and how quickly a fire develops, the danger of smoke, escape routines, calling the fire brigade, extinguishers).

The Task Force proposed these messages be targeted at high-risk times of the year, particularly autumn and winter and at “hot spots” areas with particular problems, through campaigns co-ordinated by local fire brigades, the local media, and local schools. The use of “quick strike” campaigns, to target neighbourhoods where there has recently been a fire were also proposed as being useful by capitalising on a likely temporary rise in local awareness of fire safety (Community Fire Safety Task Force, 1997).

(b) The USA

The public fire safety education effort in the USA is spearheaded by the National Fire Protection Association, a non-governmental body. It produces the child fire safety programme, “Learn Not To Burn”, which is taught by one out of every 20 United States schools (Hall, 1998a), and is also used overseas. Other main focuses of the NFPA have been the “Get Alarmed” smoke detector campaign, and a recent programme targeted at the elderly, called “Remembering When”.

The two main government agencies involved in fire safety education are the Federal Emergency Management Agency (FEMA), and the United States Fire Administration (USFA).

All three bodies are involved in Fire Safety Week, which in past years has focused on teaching safe escape behaviours.

- **Key Points**

- The UK has had a non-unified approach to public fire safety education, with each Brigade responsible for its own geographic area. This approach was recommended for change in 1997 by the Community Fire Safety Task Force, which proposed a nationally unified programme focused on fire prevention, detection and escape.
- The USA has had a more unified approach based around the NFPA, FEMA, and USFA; it has traditionally focused on child fire safety education, and smoke alarms, and more recently has begun work on programmes for the elderly, and improving escape behaviour.

(ii) Critical Success Factors in Public Fire Safety Education Programmes

This section gives a broad-brush discussion of the main features of successful public fire safety education programmes.

A 1975 study commissioned by the US Office of Planning and Education examined 15 fire education programmes and isolated two key features. These were targeting education at local fire problems, and involving the community in programme development and implementation. The study indicated that for an individual to change unsafe behaviour, the problem must be perceived as local, immediate, and personally relevant. In addition, delivery or reinforcement of the prevention message by a community leader increased the probability of acceptance (Strother, 1975 cited in Strother and Buchbinder, 1980).

A 1974 study funded by the NFPA determined that fire prevention messages must be explicit and positive, showing the desired behaviour in the context where the action should occur (Strother and Kahn, 1974, cited in Strother and Buchbinder, 1980; see also Powell and

Appy, 1997). Traditionally, it had been assumed that people needed to be scared into adopting fire safe practices. However, this study found that people already had a fear of or concern about fire and positive motives as regards fire safety. Thus, what was needed was an approach that gave specific actions the public could use. The public should not be overloaded with information, and they should not be scared into action: emphasising fear as a motivator can lead to an inability to cope and the blocking out of the threat, rather than positive action.

(a) Targeting programmes

The need to target programmes is a theme that recurs throughout the fire safety programme literature. For example, the FEMA, focusing on the needs of low-income groups, provides a persuasive rationale for targeting education programmes at income-based groups: "public education campaigns targeted to middle income groups should focus on the importance of maintaining operational smoke detectors in homes. In contrast, fire reduction efforts in central city areas need to recognise that low-income households are less likely to be willing to pay for smoke detectors and batteries on their limited budgets. Due to the elevated level of stress in their lives generally, they are also less likely to prioritise fire safety.... Similarly, to attenuate the rate of child playing fires, middle income groups need to be educated about the dangers in leaving children unattended, even for brief periods of time. But this strategy is not likely to be effective with low-income households who may leave their children alone due to a lack of childcare options" (1997b).

Generally speaking, broad-range programmes seem to result in less success. An example of this is the British National Fire Safety Week, which was found in 1989 to have a limited impact on the attitudes of the public (McCabe and Moore, 1990). A survey was conducted among the parents of children attending the Paediatric Department of Cardiff Royal Infirmary, which found that only a third of those surveyed had heard of the National Fire Safety Week. There was also no significant difference between groups interviewed before and after National Fire Safety Week concerned the last time they had noticed a smoke detector in a shop.

Programmes need to be not just targeted, but well funded, to have maximum impact. For example, in Britain the Community Fire Safety Task Force (1997) argues that "After a long period of decline, fire deaths are starting to increase once again and this has coincided with a large reduction in Home Office publicity expenditure". Some local fire services in the UK are spending a relatively substantial proportion of their budget on fire safety education with highly positive effects. For example, the West Midlands Fire Service has put approximately a million pounds each year into targeted programmes including increasing the awareness of cooking fires as the main cause of fires, publicising the importance of smoke alarms, particularly to the elderly, and using special campaigns to target the elderly, the disabled, and ethnic minorities. As a result fire deaths and injuries were cut by two-thirds from 1990 to 1993 (Fire Protection Association, 1995a).

Another example of the need for sufficient funding is the case of the British Fire Service strike of 1977. During the strike, a large publicity campaign was launched to ensure the public followed basic safety rules (Whitaker, 1983). The campaign focused on: the dangers of leaving children at home alone; looking after the elderly; dangers of smoking in bed; checking the house before going to bed; checking heaters; danger of fat pans; and what to do

in the event of fire. There was also constant news coverage of the strike, a fire safety booklet was distributed on demand, and a short film in Hindi screened in Asian cinemas. The number of fire calls dropped drastically, until the level of publicity was reduced; then the number of calls rose again. The publicity did not reduce the number of fires but the number of casualties decreased by 10 percent (Whitaker, 1983).

Finally, one can look to the example of Sweden (Hall, 1998a). Fire safety education in Sweden has been widespread and well funded. It is widely deemed to have been very successful, partly due to the sheer number of people reached. This was helped by one-third of the schools using the national fire safety curriculum, compared with one out of every 20 in America, and by the fact that there are only a few television channels (again, as compared with America), which allows fire safety publicity campaigns to reach more viewers.

Successful targeting is often helped by conducting market research that isolates not only who is at risk, but also how they perceive that risk, so that fire safety education can appeal to an existing concern in the community to be targeted. For example, a British programme sought to convince parents to purchase smoke detectors on the grounds that it is not possible to be vigilant about a child's safety while asleep. This approach pre-empted the instinctual response by a number of parents who tended to dismiss safety advertising on the grounds that they already took good care of their children (Seaton, 1996).

(b) Involving the community

Community involvement in public fire safety education has been found to be highly effective in regard to programmes for various target groups, such as the elderly, or those in lower socio-economic groups, as will be discussed in more detail in sections relating specifically to these groups, below. This is probably so for a number of reasons.

Firstly, community involvement allows a programme to be designed to respond to the specific needs of the community. Members of a community involved in designing a programme are likely to be able to provide invaluable information on how best to reach others of their community.

Secondly, community involvement creates a degree of ownership of the programme by the community, which is likely to lead to more effort being put into both running the programme and responding to the programme as a participant.

Thirdly, a high level of community involvement can lead to a programme containing more personal contact. Often this is an effective way to change behaviours. There are two examples of personal contact in programmes that helped to improve the programme results. In Edmonds, Washington, civilians were hired to conduct home inspections, with the result that home fires dropped 69 percent. In Louisiana, it was found that media contact increased fire safety knowledge but did not change fire safety behaviours, while using a face-to-face approach gave a 55 percent reduction in fires in one year (Stamps et al., 1980).

Fire safety education is becoming increasingly focused on the need to involve communities. For example, the NFPA, in the USA, has recently introduced a variation on their "Learn Not To Burn" programme, which is one of the main programmes aiming to teach children—and through the children, parents—fire safety education in a school setting (Powell and Appy, 1997). The variation involves appointing a "Champion" for the programme in the community where the programme is to be introduced. The Champion is in

charge of running the programme and has the specific job of motivating community support for, and involvement in, the programme.

New Zealand used the tactic of community involvement in the Home Safe Home fire safety education programme (New Zealand Fire Service, 1998b).

(c) Explicit and positive messages

Strother and Buchbinder (1980) and Powell and Appy (1997) report that fear, unless continually maintained, does not have a positive or long-term effect on behaviour. They also report that people were aware of the threat of fire and concerned about it, but just did not know what to do about it. Thus, it was realised there was a need for positive, concise, clear instructions on fire safe actions.

Powell and Appy (1997) report on a 1991 study by the American Red Cross. This study examined whether showing people slides of natural disasters encouraged people to take more or less action to prepare for disaster. This study found that graphic images of disaster in fact confused people, and discouraged them from taking action.

In recent times, fire safety education has become “less preachy”, focusing “more on teaching behaviours”. For example, providing diagrams of how and where to install home smoke detectors” (Powell and Appy, 1997).

Lopes (1997) details some specific message selection techniques in teaching safety education programmes which he has derived from a survey of research. These are:

- Choose and limit messages: the average person retains less than one-tenth of what they hear after one week, so it is important to choose the most important messages.
- Reinforce messages: messages can be repeated several times, in several ways, to increase recall. Learning activities can also increase recall.
- Use positive messages: “Negative messages like “Don’t Panic” do not tell people what to do. In fact, messages like this can actually cause people to think about panic, because the message plants a negative thought in their mind.”
- Avoid value-laden messages
- Correct myths and misinformation
- Begin with awareness-raising messages, informing people about the hazards, and then move to educational messages, informing people of how to deal with the hazards.
- Time the message: use “teachable moments”, when external events heighten interest or make the message particularly relevant.

Along with an emphasis on positive messages, there is still some role for images of burnt houses and the like. A number of fire departments in various countries use trailers which have been burnt on the inside or houses which have experienced a fire as a teaching tool, taking people through the structure and pointing out important features of the fire (Turner, 1998; Fire Prevention Association, 1994c). The key point to this approach is the use of burnt structures as an example of how severe a fire can be, and to illustrate the ways in which a fire can spread, rather than using such examples as scare tactics. They must be followed by positive messages on how to avoid or deal with a fire.

(d) Recent analyses of crucial features of fire safety programmes

More recent research on successful fire safety education has built on the three crucial factors discussed above. As Gamache (1997) recognises, two of the factors—targeting and community involvement—are closely linked; successful targeting requires the involvement of the community to be targeted, while community-based programmes are of necessity geographically targeted.

The NFPA of the USA gives a number of fundamental qualities needed for the Learn Not To Burn programme to be effective, called “Cs to Success”. Most of these qualities are centred around involving and motivating the community. They are (Powell and Appy, 1997):

- A committed fire chief: one who will support the programme, and supply resources for the efficient running of the programme.
- A dedicated Champion: the Champion is often the fire safety education officer in the local fire department; they need to effectively manage the programme and motivate others to support it.
- Collaboration: there is a need to ensure the collaboration of school boards, teachers, and the fire department.
- A compelling case: by targeting the highest-risk schools first, dramatic results can be achieved and used to expand support for the programme.
- Continuity: repeated, age-appropriate teaching is needed to ensure children maintain their learning.
- Coalition: sufficient human and financial resources are required; a team of community members can provide and raise such resources. Participating organisations will have their own priorities; thus, a community team needs to agree on a set of goals and priorities.
- Creativity: the programme should be supplemented with elements designed to address local needs. For example in Los Angeles an esteem-building component was added to the course. Creative use of enhancements to the course—such as clown and puppet shows, colouring-in books, or safety trailers—can also enhance knowledge gain and retention, as it customises the programme, giving the community a sense of ownership, and also makes the learning experience fun.

The list created by the NFPA is partially based on one of the few and comprehensive studies of successful fire safety education programmes—“Proving Public Fire Education Works”, by Schenman et al. (1990). This report isolated 10 features successful programmes had in common. These were:

- “Spark Plugs” or Champions: a person who will take the central role in implementing the programme and ensure its success.
- Magnanimous Chiefs: Fire Chiefs who will allow public educators to be innovative in their work, while supporting them where they can.
- All-Out Attack or Surgical Strike: programmes need to either attack a multitude of problems with force and repetition, or focus on a very carefully targeted problem.
- Market Research: this ought to determine what media people listen or respond to, who they will listen to, for example, certain groups may respond better to initiatives run by churches than by local government, what types of messages they will be responsive

to, and what they already know. Market research can take various forms, and need not involve actually employing a market research company; for example, consulting a teacher on what children's abilities are is market research.

- **Powerful Allies:** allies within the community, for example principals, local media, local businesses.
- **Good Materials:** adequate and accurate materials.
- **Significant Outreach:** a programme has to reach a large proportion of its target group to even begin to be able to have a significant impact.
- **Repeated Exposure:** repetition helps understanding and retention; but first it must be ensured that people are getting the *intended* message.
- **Adaptability to Change:** good programmes change with time as the fire problem change.
- **Testing Programmes in a Small Area First:** this will give information on how to improve the programme, as well as gaining support for the programme. It also avoids making mistakes on a large scale.

- **Key Points**

- Programmes should be targeted.
- Successful targeting requires market research and sufficient funding.
- Targeting is currently used as a strategy by most effective public fire education programmes.
- Programmes should involve the community.
- Community involvement improves a programme by encouraging effective targeting, support and interest from the community, and a high level of personal contact.
- Community involvement is particularly effective for programmes for elderly and lower socio-economic groups, as discussed in Sections 5(4) and 5(5) below.
- Community involvement is currently being used as a strategy in New Zealand and the USA.
- Programmes must teach positive actions people can take in response to fire risks and fires.
- Attempting to scare people into action can have a negative effect.
- Graphic images of fire damage have a possible role in awareness raising and as examples of fire growth, but must be supported by positive, constructive, action-orientated messages.
- Fire safety messages should be limited to key points, and repeated.
- Lists of crucial factors from the NFPA and researchers in the field expand upon the three key factors of targeting, community involvement and positive, constructive messages.

5. Dealing with Specific Target Groups: How Do You Run a Programme?

Research in the field of fire safety education programmes is of two main types. The first is small-scale experimental research, where a sample of the target group participate in an experimental programme. The programme is evaluated by comparing pre- and post-programme test results, or by comparing students in the programme with a control group. This type of research aims to isolate the specific teaching methods that are most successful in producing the desired changes in knowledge and behaviour.

The second type of research is evaluations of actual fire safety education programmes in use in the community. Because of the varying contexts, this type of research is not as useful for isolating the effects of specific teaching methods. However, evaluative data often includes effects on fire injury and death rates. Thus, this type of research can be used to evaluate not just changes in knowledge and behaviour in test situations, but also the effect on behaviour in a fire context.

The second type of research, evaluation of actual programmes, is possibly of more use to designers of programmes, because most programmes aim to reach a large population with a small amount of time and resources. Experimental research usually occurs under conditions of intensive training of individuals or small groups, with a large amount of time and resources available, and thus produce results which may not be mirrored in real life (McConnell, Dwyer, and Leeming, 1996).

However, much of the available literature on actual programmes fails to provide effective evaluation of the success or otherwise of these programmes. For example, FEMA (1990) produced a document detailing the operation of 80 different fire safety programmes run across America; however, details of evaluation of the programmes are few. The best collection of evaluated public fire safety education programmes is the work of Schaenman et al., (1990), entitled "Proving Public Fire Education Works".

Information on how to run a programme is covered in the *Fire Protection Handbook*, produced by the NFPA (Cote, 1997). It deals with public fire safety education specifically and contains articles on using available data to design programmes; education theory as it applies to different age groups; reaching hard-to-reach groups; dealing with the media; and evaluating programmes (Gamache, 1997; Hall, 1997d; Lopes, 1997; Powell, 1997; Schaenman and Gunther, 1997; Schumacher, 1997).

The *Fire and Life Safety Educator* (Powell, Sneed, and Hall, 1997) is intended as a hands-on guide for teaching public fire safety education. It contains much of the same material and advice as the *Fire Protection Handbook*. However, because it has been written as a guide, the information is often more accessible than that in the *Fire Protection Handbook*. Topics covered include: planning a programme; using data to plan; knowing your audience; funding programmes through outside sources; developing the programme curriculum; evaluating the programme; networking, forming coalitions and working co-operatively; educational theory and its application; selecting educational materials; and working with the media.

- **Key Points**

- Much of the fire safety education research is either small-scale and experimental, or considers evaluations of actual programmes.

- Experimental research is useful in isolating the effects of specific teaching methods.
- Evaluations of actual programmes are the most useful in showing the effects of education on actual behaviour in fires; however, many programmes are not effectively evaluated.
- The fullest set of evaluations is in Schaenman et al. (1990).
- The best guides to running a public fire safety education programme appear to be the Fire Protection Handbook (Cote, 1997) and the Fire and Life Safety Educator (Powell, Sneed, and Hall, 1997).

(i) General Education Theory as it Applies to Fire Safety Education

Powell (1997) lists a number of important points in learning theory that the fire safety educator's should keep in mind. These are:

- Learning is life-long;
- Learning can be stressful, as it involves a change in attitude or behaviour;
- People learn at different paces and in different ways;
- Effective learning has to be reinforced;
- Effective learning requires support from people who influence or control the student, such as parents or employers;
- Learning is improved when multiple senses are stimulated; and
- Learning is most effective when it is focused: first give an overview, then explain the individual components.

Motivation to learn is influenced by a number of factors (Powell, 1997). Motivation is considered within the context of Maslow's hierarchy of needs (Maslow, 1970); namely, people need to first fulfil the needs at the bottom of the hierarchy before they can consider their needs higher up. Conversely, once a need is met it no longer motivates action. Thus, education must be pitched at the correct need level. The hierarchy of needs begins with physiological needs at the bottom, then moves up to safety and security, then sense of belonging and social activity, then esteem and social status, and finally self-actualisation and fulfilment. Powell (1997) matches these needs to specific aspects of fire safety education. For example, a sense of belonging could be met by programmes encouraging group activities, while esteem could be met through a certificate of achievement.

Another way to consider motivation is to see it as driven by the learner's need to have various domains of learning met (Powell, 1997). These are: the affective domain—how people feel about a situation, values and opinions; the cognitive domain—what people understand; and the psychomotor domain—what people can do. Any education programme should aim to address all of these domains, teaching people why they should care about or what is important about fire risks, what they should know about fires and fire safe practices, and what they should be able to do in regard to fire safe behaviours.

(ii) Appropriate Learning Techniques for Adults

Powell (1997) argues that adults will appreciate the need for training and education for professional purposes, but that they invest a lot in leisure activities, meaning that fire safety

must compete for their time, attention and effort. She discusses a number of principles of how adults learn. Firstly, adults certainly can learn, particularly in informal settings where learning projects are undertaken in order to achieve a specific goal. Secondly, adults need to know why they are learning something; one must establish a need-to-know first. Thirdly, adults are active learners and need to be self-directing and participate in their learning. Fourthly, adults bring a total life experience to the learning environment. Fifthly, adults are task-centred learners. And finally, adults have both internal and external motivators to learn, so it is possible to appeal to either in motivating learning. An example of an internal motivator is the wish to keep one's children safe, while an external motivator might be that taking part in a fire safety education course could increase the possibility of a pay raise.

Powell (1997) gives a detailed discussion of education techniques, in particular on the topics of: curriculum development—objectives, course outline, lesson plans, instructional methods, and instructional materials; questioning techniques; and managing the physical learning environment.

Schumacher (1997) considers the use of media in educational outreach, from an American perspective, offering practical advice on dealing with the media. This advice centres on the need to understand the media and how it works in order to utilise it. The key to working with the media appears to be to ensure that fire incidents are reported in a positive light, by producing press releases that emphasise how the fire could have been prevented and offer fire safety information (Federal Emergency Management Agency, 1990). There are many examples of the use of media as a teaching tool in New Zealand, with major magazines and newspapers running occasional stories on fire incidents, accompanied by fire safety information (see, for example, Turner, 1998; Wakelin, 1990; Stop the home fires burning, 1995; Carrol, 1998; Baskett, 1994; Turner, 1990; Sampson, 1998; New Zealand Fire Service, 1998a). The media can also be used to remind people of fire safety behaviours they have learnt in other contexts; for example, in Chicago, the public radio station ends the nightly news bulletin with reminders such as "It's 10:30. Are your smoke detectors working?" (Federal Emergency Management Agency, 1990).

Specific learning techniques for children and the elderly are considered in the appropriate sections below.

- **Key Points**

- Fire safety education must draw on general educational theory, which states that any attempt at education must be focused, reinforced, appeal to multiple senses, and be supported by people close to the student.
- Learning can be motivated by addressing the needs, outlined in Maslow's hierarchy of needs, that are specific to the audience in question.
- Learning must address the various domains of learning—affective, cognitive and psychomotor.
- Adults will often learn best in a goal and task-directed manner, in a self-directed environment, once a need-to-know has been established.

- Using the media in education requires supplying positive, constructive materials to the media.
- Specific educational techniques are discussed in Powell (1997).

(iii) Children

(a) Age-specific educational needs

Powell (1997) discusses the difference in learning styles between children of different ages. It is important to present fire safety information to children in a way that they are able to understand. Powell uses developmental theory to characterise children's learning at three different stages.

Children at a pre-school level (ages three–five) learn by doing, not by seeing. But they also remember what they see more than what they hear. Thus, there is a need to be very careful. For example, the Children's Television Workshop (the producers of Sesame Street) studied how pre-schoolers would interpret fire safety and burn protection messages on television and found that showing a dangerous activity, even while warning against it, is dangerous, as the child is more apt to remember the image than the warning. Other risks arise from the limited and unpredictable way pre-schoolers view the world: children this age have difficulty relating one event to another, so that cause and effect reasoning, or making choices, is often beyond them. Therefore, they will not link the problem and the solution. Finally, it must be remembered that children of this age have a limited vocabulary. On a more positive note, any materials that can be developed within these guidelines can be used over and over again: pre-schoolers like repetition.

Children between the ages of five and 11 will be the easiest to reach by linking fire safety education to the wider developmental tasks of children of this age. These tasks include: developing physical skills; developing self-attitudes; developing social skills; understanding social roles; developing abstract learning skills; learning about living concepts; learning about values; developing feelings about society; and creating independence. Fire safety education programmes are more likely to be used by schools if they can be taught as part of a larger safety or health education programme, rather than as a stand-alone programme.

Adolescents learn in a wide variety of ways. In particular, adolescents will learn from: direct experience; hypothetical projection; role model emulation; instruction/demonstration; rehearsal; and teaching "best practice" to others. An example of a programme that draws on this last feature is the "Fire Breaks" programme used by the Leicestershire Fire and Rescue Service (Brown, 1999). In this programme, children aged 14–16 are put in charge of teaching younger students fire safety lessons, and carrying out fire drills. They are also taught how to extinguish a range of fires, with a certificate awarded when all these activities are successfully completed. As with elementary school children, teaching adolescents is likely to be most successful if programmes are linked to developmental tasks. The developmental tasks at adolescence include: developing conceptual thinking and problem-solving skills; forming more mature relationships; preparing for the future (for example, for family life, or career); developing ethics to guide behaviour; and developing civic competence and responsible community behaviour.

Gamache (1997) also looks at the most appropriate methods of teaching children, particularly children under the age of five, as this is the most vulnerable group. She begins

by outlining some general principles for young children: children need a variety of play environments; activities should allow interaction between the child and others, in a language-rich environment, using tools such as music, puppets, stories, and dramatic play; children like to create or recreate dramatic activities; and young children will not be suited to most games as they do not understand win and lose and do not wish to wait for turns.

Gamache then considers the work by the Children's Television Workshop, which found that children ages three to five will look to adults to interpret the world, as they do not yet recognise cause and effect. For this reason, programmes for young children ought to include an adult component. For example, the "Learn Not To Burn" pre-school programme sends a series of letters home with the child. Addressed to the parent, the letter reiterates the points the child is being taught, and reinforces the importance of keeping matches and lighters away from children, as well as the importance of installing smoke alarms.

Quoting a 1990 report from the Children's Television Workshop, Gamache makes the same point as Powell (1997): it is important to be very careful in designing fire safety education messages for children. Gamache says that "Children's Television Workshop, and the Learn Not To Burn" Foundation came to the conclusion that public service advertising to young children with messages on matches and lighters would most likely be ineffective. Gamache reports that for the Foundation report "Pre-Production Evaluation of the "Tell a Grown-up to Put It Away" Public Service Announcement (PSA) for 3-6 Year Olds," the Foundation tested 50 children in a day-care setting with a video prototype. They found that the three and four years olds did not understand the safety message well enough to risk putting the PSA on television; that is, mere exposure to the message and pictures of matches and lighters without comprehension can have the opposite effect on children, possibly causing them to have more of an interest in playing with or exploring matches and lighters.

Finally, Gamache goes on to look at specific content of programmes. She argues that lessons for young children should be varied, participatory, and draw on a range of senses. Children need repetition. They will often remember messages from songs. It is good to introduce new adults, such as fire-fighters, to a child; children need to know to go to a fire-fighter if trapped in a fire, and not to be scared of the protective clothing worn by fire-fighters. Thus, it is good if a child is shown images of a fire fighter in normal clothing, followed by the fire fighter dressing in protective clothing. Crucially, education programmes should allow the practising of different behaviour in different scenarios. If a child is only taught one behaviour, such as "stop, drop and roll", they will use that behaviour in every fire situation. This suggestion is supported by New Zealand research that found that, in the wake of a new school fire safety education programme in which "stop, drop and roll" was a main message, children would suggest this behaviour also for situations in which it was not appropriate, such as when they were asked what they would do in a smoky room (Dunn and Renwick, 1995).

Wolfe (1997) discusses how the American "Risk Watch" programme targets its lessons to different age groups. The activities for each age group in the *Risk Watch* Curriculum are created to fit a "character role" suited to the kids' developmental skills. ...the pre-school module casts kids as story tellers, developing their ability to describe situations. The first-to-second-grade kids use reporting skills that draw on their more advanced analytic capabilities. In the detective role, third-and-fourth-graders begin to apply their knowledge to group, as well as individual decision making that focuses more on working with others. Students in

fifth and sixth grades take on marketing roles to develop advanced research and communication skills that feature working collaboratively to convince others to adopt safe practices. Seventh and eighth graders... says Jacquelyn Sowers, a comprehensive health and safety educator,... don't think they need safety education. They think they know it all, they don't want to hear "don't do that" or "this might hurt you". To get around this attitude, *Risk Watch* uses a tried and true method of getting older kids to learn: Give them the responsibility of coaching younger children.

- **Key Points**

- Children's learning is age-specific.
- Pre-schoolers will not understand cause and effect reasoning, and are more likely to remember an image than its accompanying message. Thus, fire safety education for this age must be very carefully designed to avoid negative effects. For example, a pre-school child will remember a picture of a lighter and not the accompanying safety message.
- Children may not realise that different safety behaviours are needed for different fire scenarios unless each of these behaviours is taught separately.
- Including adult components in programmes for children is very important, particularly in programmes for pre-schoolers.
- Suitable teaching for primary school children links to their need to understand social roles and develop social skills, physical skills, and self-attitude.
- Adolescents respond to teaching that draws on the need to develop conceptual thinking, responsibility, ethics, and community involvement. They also respond to role models, or to becoming a role model by teaching others.

(b) Experimental research

The experimental literature focuses on school-aged children, particularly those at primary school.

The first piece of experimental research in child fire safety education programmes to have lasting effects on other researchers was the 1981 study by Jones, Kazdin and Haney. It sought to teach fire escape procedures to children between 8 and 9 years of age, through a multi-faceted behavioural programme. The appropriate fire escape procedures were chosen through a process of elimination: the researchers came up with a wide range of fire scenarios and suitable child behaviours, based on fire safety literature; these hypothetical scenarios and behaviours were then shown to fire-fighters, who rated their effectiveness in terms of fire safety. This process was iterated until there were nine fire emergency situations isolated which were deemed correct by approximately three-quarters of the fire-fighters. These were the scenarios used in teaching the children, and they have been used in most experimental studies of child fire safety programmes published since 1981.

The scenario was described to the children who were then asked to show the appropriate behaviour in the particular situation. Further cues were given as necessary. For example, the experimenter told the children that they were not coughing and their eyes were not burning and that the children could again leave through the window if needed. However, when the children touched the door, they were told that it was not hot. When the children opened the door, they were told that there was hot air rushing in. (Jones, Kazdin, and Haney, 1981). The demonstration of correct behaviour by the children, three times in a row, earned the child a star; filling in all the spaces for stars on a sheet led to a prize. Training also included questions, and feedback on verbal and behavioural answers. Each lesson began with a review of the past lesson.

The results of this training were positive: children significantly increased the percentage of correct responses, from 4.5 percent at the start of the programme to 74.4 percent by the end. This level of knowledge gain was maintained in a post-programme follow up test, two weeks later. This result was obtained through an average of nine twenty-minute training sessions.

The training done by Jones, Kazdin and Haney (1981) is described as “behavioural” training: it teaches by getting children to physically practise safe behaviours. While fire safety programmes for young children need to show, not just tell, what to do, an interactive approach that allows children to physically practise rules and behaviours is even more effective at aiding recall.

Research by Holmes and Jones (1996) indicates that approaches using moving pictures such as videos as the main teaching tool, with verbal practice of what is taught, are not as effective at teaching as approaches using behavioural practice. Holmes and Jones conducted an experiment where they compared three types of teaching—behavioural teaching, teaching via an animated computer programme, and teaching by a still-graphics computer programme—with a control group who were not taught. Both the behavioural group and the animated graphics group first watched a computer programme with animated characters modelling fire safety skills. The behavioural group then went on to physically practise these skills, such as “stop, drop and roll”. The animated graphics group went on to

repeat the computer programme, with interruptions where the children had to type in the correct multi-choice answer to what the animated child should do next. Finally, there was an elaborative question-and-answer phase, where children were given questions that pertained to the rationale for each fire safety skill, with possible responses suggested. Children then sat a multi-choice test, and later had a review session. Children in the still-graphics group went through essentially the same steps, except that all images used before-and-after images were still.

Holmes and Jones (1996) found all three groups that were taught had essentially the same level of knowledge gain in post-instructional testing, a level which was significantly higher than the control group. However, when the children were tested for improvements in their ability to actually perform the fire safety skills demonstrated, children in the behavioural group did better than those in the animated graphics group, who in turn out-performed the still-graphics group. All groups performed significantly better than did the control group. Thus, Holmes and Jones conclude that graphics are certainly useful in aiding learning, but that they are best used as a supplement to behavioural teaching. Overt practice of the skills results in the strongest improvement in the ability to perform the skills. On the other hand, knowledge gain was not affected by the instructional medium.

The work of Holmes and Jones (1996) highlights that the most important factor in learning fire safety skills is not the ability to recall appropriate fire safety skills in a written test, but the ability to perform those skills to a reasonable standard. They looked explicitly at the effect of different training methods and conclude that behavioural teaching, where the student has the chance to physically practice behaviours, has the strongest effect on a child's ability to perform fire safety behaviours.

This finding is supported Ribbe and Jones (1995). These authors compare the results of two types of peer modelling: active modelling, where children saw a video of peers modelling fire safety behaviours, and then physically rehearsed the behaviours; and passive modelling, where children saw the same tape, and then verbally rehearsed the behaviours. Not surprisingly, while both groups showed significant gains in fire safety behaviours, this improvement was largest for the active group.

It is common for school-based programmes to use both video and behavioural teaching. For example, the Cheshire Fire Brigade in the UK runs a programme that operates at different school levels. At age 10, the children are taught as follows: first, there is a short talk by fire-fighters at the school. This is followed by a video entitled "First Alert" that details three different fire plans to be adopted if involved in a fire in the home. The presentation is confirmed by filling an inflatable structure with synthetic smoke and an experienced fire fighter gives children instructions on how to behave in this environment. The session is summarised using pamphlets and posters that the children are encouraged to take home (Dowling, 1997). This particular programme has not been effectively evaluated. A New Zealand programme also uses behavioural teaching, with the correct behaviour taught by fire-fighters. Evaluation of this programme (Dunn and Renwick, 1995) found that it improved performance of behaviours in the areas it targeted, namely "stop, drop and roll" behaviour and knowing to call the fire service on 111 as a first action if fire is found.

A further step in the experimental research was to consider how elaborative approaches to fire safety education could improve upon the results from behavioural education. Elaborative teaching is where "children are taught specific skills and provided with a

coherent rationale as to why these strategies will work. Understanding the reasons behind the recommended actions makes them more sensible” (Jones et al, 1989). This is done by giving children reasons why correct behaviours are correct, and asking children to summarise how correct behaviour would aid evacuation. Elaborative teaching is used in combination with behavioural teaching.

Jones, Ollendick, McLaughlin, and Williams (1989) conducted a study comparing three groups of third-graders, in the USA: a control group, a behavioural group, and an elaborative group. The elaborative group received both behavioural and elaborative teaching. The researchers thought that elaborative rehearsal might lessen children’s fear of fire, and thus improve the chances of the child responding correctly in a fire emergency. They refer to research by Ollendick (1983) which found that 40 percent of children reported extreme fear about being in a fire and being burnt.

Both the elaborative and behavioural groups showed similar significant gain in fire safety skills. Only the elaborative group showed a significant drop in the self-reported level of fear of fire, as well as general fear. Further, only the elaborative group showed a significant gain in knowledge about the rationale for fire safety behaviours. Thus, elaborative teaching reduces fear and increases knowledge of rationales.

Jones et al. (1989) cite research on other ways to reduce fear in children. In particular, they cite work by Kanfer, Karoly, and Newman (1975) who taught kindergarteners fearful of the dark a set of self-statements that reduced self-reported fear of the dark. The statements aimed to either change perceptions of the dark—“the dark is a fun place to be”—or change self-evaluations about being in the dark—“I can take care of myself in the dark”.

Jones et al. (1989) also cite past work by Hillman, Jones, and Farmer (1986) who found that elaborative teaching leads to a higher level of learning recall two months after the training than does behavioural teaching on its own. This indicates that teaching the rationale for fire safety behaviours aids their recall over time.

Other studies have also looked at the effects of elaborative teaching. Ribbe and Jones (1995) showed two groups of children a videotape where peers modelled fire safety behaviours, including elaborative rehearsal. They then compared the learning results when children actively rehearsed what they had seen on the tape with children’s passive rehearsal, by discussing it. They found that both the passive and active children had a similar reduction in fear, while the active group had a higher level of rationale acquisition. In other words, the active group had absorbed a greater amount of the messages of the elaborative rehearsal shown. This showed that elaborative teaching is more effective in combination with behavioural (active) rehearsal, than without it.

Hillman, Jones, and Farmer (1986) found that teaching the rationale for fire safety behaviours improved recall of those behaviours over time, particularly when combined with behavioural training rather than training that was verbal only.

Another useful variation on the behavioural approach is to include some self-instruction strategies. While external instruction involves an instructor asking questions and telling children if they are performing correctly, self-instruction aims to train people to verbalise, monitor, evaluate and reinforce themselves as they are learning. A study designed to compare external and self-instruction, involved children repeating questions asked, verbalising the answers to these questions before demonstrating the behaviour they thought was appropriate, and then evaluating their own demonstration by pointing to “+” or “-”

signs. The study, by Jones and Haney (1983), found that children taught by self-instruction showed the same level of skill acquisition as those taught by external instruction, but had a slower rate of decline in those skills over the next eight months. Thus, self-instruction improves recall over time.

Jones and Randall (1994) designed an experiment to compare basic behavioural teaching with “rehearsal plus” teaching. “Rehearsal plus” teaching involved both self-instruction strategies and an attempt to reduce fear in children, on top of behavioural teaching. Children were given self-instruction statements paired with particular fire situations. They were told why those fire situations should not be a cause for fear, shown how to use the self-instructional statements, and finally encouraged to practise the strategy as a whole. A child would be told, for example, “you are in your room and the smoke detector goes off—what do you do?” and the child would respond by saying out loud what they should do, saying out loud why that situation should not be a cause for fear, and then performing the action in question. The experiment found that both the behavioural and “rehearsal plus” children gained the same amount of knowledge, but that knowledge retention was higher in the “rehearsal plus” group. This group was also the only one to experience a drop in fear. This experiment reinforces the results found earlier, that self-instruction improves recall, and illustrates another successful attempt at reducing children’s fear of fires.

Williams and Jones (1989) also consider the effects of combining self-instruction strategies with attempts to reduce fear in children. They find that groups taught using both these methods retain more fire safety behaviours at follow-up testing than groups taught only by self-instruction. They suggest this may be due to the fear reduction training resulting in more cognitive involvement by children in what they are being taught. They also comment that fear reduction training may, for fearful children, provide a rationale for fire safety behaviours. In this case, fear reduction strategies are acting in a manner similar to elaborative strategies discussed above. Oddly, while fear reduction training obviously does have an effect on children—improving their retention of fire safety behaviours—it did not, in this experiment, significantly reduce the level of fear of fires reported by the children.

There is some reason to question whether elaborative or self-instruction approaches really make as large a difference in learning recall as has been found in the studies cited so far. A study by Randall and Jones (1993) compared elaborative, (rehearsal plus) and behavioural groups, and found that, while initial knowledge gain was highest for the elaborative group, and knowledge retention was higher for elaborative and (rehearsal plus) groups than for the behavioural group, the retention of the *ability to actually perform the skills in question* was equal among all three groups. Randall and Jones put this down to the extra practice time given to the behavioural group, while the other groups were spending time on elaborative or (rehearsal plus) teaching. This finding points to the need to repeat lessons within programmes; if a programme begins with a behavioural component, this needs to be backed up either by complementary strategies—such as elaborative or (rehearsal plus) teaching—or by further behavioural practice.

Interestingly, the 1993 study by Randall and Jones found that elaborative and (rehearsal plus) teaching strategies made no difference to the level of fear expressed by the children involved. Randall and Jones comment that this is probably due to the small number of very fearful children in their sample. Other studies on techniques that sought to reduce fear in children, in particular Jones, Ollendick, McLaughlin and Williams (1989), chose their

sample from children who had expressed a high level of fear of fire. This suggests that fear-reduction strategies are only useful for reducing extreme fear. This is possibly a positive thing, because a moderate level of fear may be adaptive in a fire situation (Randall and Jones, 1993). However, the area of reducing fire-related fear in children is still rather inconsistent in its results: Williams and Jones (1989) found no fear reduction in a group of very fearful children taught fear-reduction strategies.

It is notable that even one of the most effective methods of teaching children that has been isolated so far - behavioural teaching backed up with self-instruction and fear-reducing strategies - only gave a 27 percent retention rate for knowledge taught, at post-testing in Jones and Randall (1994) and a 36 percent retention rate in Williams and Jones (1989). Clearly, even the best teaching methods will not cause a child to remember fire safety education long-term. This points to the need for teaching to be repeated and continuous, a fact that is emphasised by all fire safety educators (Powell and Appy, 1997; Schaenman et al., 1997; Powell, Sneed and Hall, 1997; Powell, 1997).

- **Key Points**

- Experimental research focuses on teaching techniques for primary-school-aged children.
- Much experimental research is based on teaching suitable behaviours in response to a series of hypothesised fire situations, as pioneered by Jones, Kazdin, and Haney (1981).
- Behavioural teaching, where children physically practice behaviours, is much more effective at improving children's ability to perform the behaviours in question than are verbal or visual teaching alone.
- Many school-based programmes use behavioural teaching.
- Behavioural teaching results can be improved by adding elaborative teaching or self-instruction strategies. These approaches improve children's understanding of the behaviours being taught, and promote retention of the behaviours.
- Both elaborative teaching and self-statements have been found to reduce excessive levels of fear of fire in children, in the hope that this will improve responses to actual fires. Fear reduction techniques also appear to improve knowledge retention.
- Given the low levels of skill retention over time, even for the most effective programmes, it is clear that repetition, both within programmes and of programmes over time, is crucial.

(c) Teaching pre-school children to make emergency phone calls

Two studies discussed how to teach pre-school children to make emergency phone calls. Both sources used an experimental approach to isolate effective teaching approaches.

The first study, by Jones and Kazdin (1980) found that pre-school children could be taught to identify emergency fire situations by instruction on what an emergency situation is - "When we see fires like this, we call the fire truck. The fire truck brings water and puts the fire out" (Jones and Kazdin, 1980) - and subsequent practice in identifying emergency fire situations from a number of picture cards. As a follow-up, pre-school children can also be taught the skills

required to make an emergency call, through a behavioural training program using modelling, practice, feedback, prompts, rehearsal and tangible reinforcement. Such a program significantly improves the ability to make an emergency call, unlike teacher-devised programmes and no training, both of which were used as controls in the experiment.

The second study, by Rosenbaum, Creedon, and Drabman (1981), followed on the work of Jones and Kazdin (1980) by seeking to teach pre-school children more subtle distinctions in types of emergencies. They sought to teach pre-school children to distinguish between fires that are emergencies and fires that are not, as well as teaching them to identify other emergencies, through the use of videotaped scenes and instructions. Then pre-school children were taught through a behavioural training programme to make an emergency call of a more complex variety, including identifying the number of people who appeared hurt, deciding whether an ambulance was needed, and reporting home number and address. The behaviours taught were found to generalise to four scenes that had not been used in training, and were maintained at follow-up testing three months later. This study by Rosenbaum et al. (1981) made two further discoveries. Firstly, the younger the pre-schoolers, the more steps needed in the training to ensure it had been understood, in particular to ensure the child could recall his or her home details. Secondly, only one training session was required to reach the positive results they describe.

- **Key Points**

- Pre-school children can be taught to discriminate between emergencies and non-emergencies using instruction on what is an emergency, visual cues such as pictures or videotaped scenes, and practice in choosing pictures or scenes that are emergencies.
- Pre-school children can be taught to make emergency phone calls using a short behavioural program. The effects of such a program appear to last over time.

(d) School-based programmes: “Learn Not To Burn”

Most child fire safety education programmes operate through schools. The most commonly used programme is “Learn Not To Burn”, a programme developed by America’s National Fire Protection Association (NFPA) in 1979, and since adopted by schools both in the USA and in the UK (Powell and Appy, 1997). The programme involves lesson plans and hands-on learning activities for children, presented by teachers who have a teacher’s resource book. The fire department visits the school regularly to answer questions and assess students’ understanding and performance. There is a pre-school programme, and a curriculum for schools that runs from kindergarten to Grade 3 (in the American school system).

“Learn Not To Burn” has been evaluated through the compilation of reports that credited life saving incidents to the “Learn Not To Burn” educational curriculum or media campaign. Over a 14 year period, 143 incidents were recorded where a total of 312 people were saved, with numbers fairly evenly split between the effects of the educational curriculum and the media campaign (Community Fire Safety Task Force, 1997).

However, it is not clear whether “Learn Not To Burn” is more effective than other programmes. A 1992 study of the effects of the programme in North Carolina found that improvements from pre-to post-programme test scores did not differ significantly between

children in the “Learn Not To Burn” programme, and those from schools that used other forms of fire safety education (Grant, Turner, Bartlett, Winbon, & Peterson, 1992). The same study found that improvements in test scores were more varied within the various school districts that used “Learn Not To Burn” than between those districts as a group and districts that used other programmes (Grant et al., 1992). This indicates the programme is not consistently administered between districts, and that the success of the programme depends strongly on how effectively it is administered (Grant et al., 1992).

In 1994, the NFPA launched the “Learn Not To Burn Champion Award Programme” (Powell and Appy, 1997). It aimed to improve community support for, and focus on, the programme, so it could be used more effectively. The Champion programme uses trained public education leaders—the “champion” of the programme—to go into communities and act as “spark plugs” to motivate a community-based strategy, involving the fire department, schools, private sector, and safety organisations. The NFPA programme is provided at no cost to the community and technical or material support is also available. The Champion is responsible for planning, managing and evaluating the programme.

The Champion programme appears to have had positive effects: the first group of students to go through the modified programme, in 1994, made an average knowledge gain from pre- to post-test scores of 12 percent (Powell and Appy, 1997). Further, within the first year of implementation, there were 10 documented cases of life saving incidents involving children who had been in the “Learn Not To Burn Champion” programme (Ibid.).

Other programmes tend to mirror the NFPA approach of using the classroom as the preferred venue for teaching children. While in some countries, such as the UK, school-based fire safety education is often less comprehensive, long-term, or co-ordinated than in the USA (Community Fire Safety Task Force, 1997), in other countries such as Sweden, it is in fact, more comprehensive (Hall, 1998a).

Most school-based programmes aim to reach adults as well as children through take-home materials. For example, in Northern Ireland a programme is run with the message “Get out, Get the Fire Brigade out, Stay out”. This programme uses fire-fighters, rather than teachers, to give a presentation in class, followed by a homework project. The homework project is intended to encourage family participation, requiring the design of a family escape plan and including a brochure and a parent’s package with general information on fire safety. A return visit is made by the fire fighter to go over the homework, consolidate the message, and emphasise the need for a smoke alarm. This programme is known to have been used by at least one child to help her family escape in a fire, a week after she had participated in the programme (Fire Protection Association, 1995b).

In order to have the strongest effect, limited resources can be concentrated on the schools in areas that have the worst fire-related problems. This approach was used by the Lothian and Borders Fire Brigade in the UK, where the number of fires fell in targeted areas by eight percent, while it rose in non-targeted areas by two percent (Community Fire Safety Task Force, 1997). This relatively small drop in the number of fires was linked with a large drop in fire deaths, 56 percent from 1986 to 1995 (Ibid.).

- **Key Points**

- Most programmes for school-aged children operate through schools.
- The most widely used programme is the NFPA's "Learn Not To Burn", which has had success in teaching fire safety skills.
- Grant et al. (1992) found no evidence that "Learn Not To Burn" is more effective than other programmes used in the USA, and found that its success strongly depends on its administration.
- In 1994 "Learn Not To Burn" was given a stronger community focus through the Champion Award Programme.
- School-based programmes often reach not only children but also their parents.
- Targeting high-risk schools can be an efficient strategy if funds are limited.

(e) Programmes for caregivers

Given the difficulties in teaching pre-school children fire safety education, a number of programmes take the approach that it is more effective to concentrate on teaching the child's caregiver. This is particularly necessary because "Children in this age group, even with some knowledge that playing with fire is wrong and fires are dangerous, are dependent in almost every case upon older members of the family for their safety" (Graham, 1998).

Fahy (1993) argues that the three most important lessons for caregivers to learn are: first, to always supervise a child; second, to realise how quickly a fire can be started and develop; and third, to keep matches and other fire lighting materials away from children. This is supported by statistics on the causes of fires that kill pre-schoolers, which are frequently linked to child fire play and/or a lack of full supervision of children.

An example of a programme that teaches caregivers is the pilot burn prevention programme described by Walker (1995). This programme focused on teaching injury prevention for children. Child-care providers in different environments—child care centres, family child care facilities, and parents who attended the programme in either of these settings—could all be successfully instructed using the one programme.

The programme was based on the rationale that injury prevention can be achieved by removing hazards from the environment, increasing supervision, or teaching children safety rules. For young children aged 0 to 4, teaching safe behaviour has its role, but is not reliable. Caregivers begin training infants by saying "no" when they see the child encounter danger. More important than training is continuous close supervision by an adult. This is necessary to prevent injuries to young children. In fact, supervision is frequently considered to be the major ingredient in injury prevention. Even with the maximum level of adult supervision, however, it is not possible to prevent children from becoming severely injured if hazards are readily at hand. A cup of hot liquid left on a table can spill and scald a child severely in an instant, even if an adult is close enough to witness the accident. ...the most effective precaution is removing as many hazards from the environment as possible in areas where children are being cared for. Experts recommend the three-pronged approach: remove the danger, provide close supervision, and train children in safe behaviour. (Walker, 1995).

The programme sought to teach a combination of environmentalist approaches, teaching caregivers to identify and remove hazards, and developmental approaches, teaching caregivers the risks attendant to each stage in a child's development. For example, infants are more likely to suffocate, toddlers are more likely to drown, and pre-schoolers are more likely to start a fire by playing with matches. These two approaches were each applied to a list of possible injury types. This material was taught through a standard programme format: there was a sourcebook, a short video, an instructor, and resource materials to be kept by the caregivers. The programme lasted an hour.

The participants in the programme started with very positive attitudes to reducing child injury risk, but with no more than 50 percent knowledge on most of the causes, characteristics, and prevention of child injuries. Knowledge was high on the risks of matches, presumably due to past education efforts that have emphasised this risk, but low on risks such as heaters, hot surfaces, scalding liquids including tap water, hot food, electricity, and sun exposure. The post-programme results were highly positive: all participants—centre staff, family day-care operators, and parents—improved their knowledge by up to 53 percent, and improved self-reported practices and intentions by up to 66 percent. Family day-care operators made particularly large gains regarding their practices; and both family day-care operators and centre staff improved their attitudes to the material taught. It was positive also that the programme, initially intended for staff of day-care institutions, attracted interested parents to participate. This indicates that parents are interested in, and can be reached by, out-of-home programmes on child injury prevention.

- **Key Points**

- Pre-school children cannot keep themselves safe; thus, children's caregivers need to be taught to keep them safe.
- There are three key messages for caregivers: supervise children; realise the risk to children from fire; and reduce environmental hazards, particularly the presence of matches and lighters.
- Even a one-hour programme, designed to teach injury prevention to a range of child carers, can have a strong positive effect on the knowledge of caregivers.

(f) Child fire setting

A range of experts advise that the best way of dealing with child fire setters is education in a controlled environment. It is argued that the majority of fires are set by curious children whose experimentation gets out of hand, and that this is best prevented by teaching children how to cope with lighters and matches, letting them help with fires such as barbecues, and teaching them the effects of fire (Fire Protection Association, 1992a, 1992b). Particularly with very young children, showing is more effective than telling, so it is advised, for example, that parents help their children light matches (Fire Protection Association, 1992b). This approach reduces the level of curiosity of children as regards fire, and reduces the chances of fires getting out of hand, as children have a greater mastery of fire (Fire Protection Association, 1992b).

This advice is supported by Kafry (1980), who studied children who engage in fire play. He argues that children should be taught to “use matches safely”, rather than “don’t play with matches”, especially since this latter message is liable to only increase the curiosity of those impulse-driven children who are more likely to play with fire in the first place. He argues that education must seek to sate a child’s fire interest, and teach appropriate fire-related behaviours, by engaging in constructive fire play, with adult supervision.

The advice is different for pathological fire setters. It is too late to prevent fire setting behaviour in such children. These children tend to have emotional difficulties, and thus need to be dealt with through professional mental health counselling (Fire Protection Association, 1992a). An assessment scheme can be used by the fire service to determine if children who come to their attention need an education programme or counselling; such a scheme has been used by the Fire Administration in the USA (Fire Protection Association, 1993a).

Another successful approach used by a number of fire brigades in the UK has been for a fire fighter to visit child fire setters at home on several occasions, talking with the child to determine the causes of the behaviour and advising parents on fire safety in the home (Fire Protection Association, 1992a). The child is given rewards at the end of each visit for tasks completed.

- **Key Points**

- Most child fire setters are curious and unable to handle fire; they are best helped by educational programmes that teach mastery of fire in supervised conditions.
- Pathological fire setters tend to have emotional difficulties and are usually helped through counselling.

(g) A cautionary example: What not to do

Finally, here is an example of a fire safety programme that, at least on its own, is unlikely to have any positive effect on a child’s fire safety behaviour. The Home Office in the UK was, in 1986, looking for a new television filler film to teach children not to play with matches; the programme was to be targeted at children aged 4–7. The Home Office concluded that a successful filler must use an authority figure who was liked and respected, must represent “realistically and blatantly the horror of the effect of playing with matches”, and must stimulate viewing in a way that did not lead to the filler being viewed as solely entertainment (Home Office, 1986). Such an approach is unlikely to be successful for a number of reasons. First, experts agree that education must teach positive behaviour, not seek to scare people into changing behaviour by showing “the horror” of acting incorrectly. Second, most experts agree that children must be taught competence with fire rather than relying on them following instructions not to touch matches, though this approach is not backed by all. Third, as children learn far better by doing than by seeing; a television filler is unlikely to have long-term impact. Finally, a filler such as this could be seen by younger children also, who possibly will not grasp the message, but will remember and become interested in the concept of matches. This example illustrates that fire safety education can, if it is carried out incorrectly, have negative effects in that it may frighten children or causes them to become interested in matches without giving them the competence to deal with matches effectively.

(iv) Elderly

Programmes for the elderly appear to follow the general rule that the most effective way to affect fire safety behaviour among the elderly is to contact them in the setting in which they reside (Walker, Beck, Walker and Shemanski, 1992; Whitaker, 1983). This can mean either conducting home visits, or, for those elderly who take part in community social events, linking fire safety education to such social events, or going to the appropriate care institutions for elderly who no longer live in their own homes. At the same time, each of these approaches requires first raising a reasonable level of interest in the programme, so the elderly will agree to participate; home visits cannot be conducted if entry into the home is refused. The following sections consider the issues of where and how to involve the elderly in fire safety education.

(a) Home visits

An Australian safety programme, “Make it Safe”, focused on reducing the risk of falls and fires in the home, by visiting homes and evaluating their hazards, arranging for preventative modification (such as the instalment of smoke alarms), and encouraging risk-reducing behaviour. This programme resulted in a reduction in falls of over 50 percent in the year after intervention; data is not available on the effects on fires (Thompson, Somers, and Wilson, 1997).

However, the success of any programme relies on the elderly agreeing, in the first instance, to participate in the programme. A number of reviews of programmes for the elderly make the point that “the most onerous task associated with the programme has been recruiting participants. ... There seems to be a problem convincing older people that they are at high risk” (Thompson, et al., 1997; Rosenbaum, 1991).

The “Make it Safe” programme in Australia went through a variety of means of persuading elderly people to attend their programme. Thompson, et al., (1997) report that firstly, attempts were made to reach the elderly through the media. There was such a poor response to the published editorials and print advertising that it was difficult to document any community reaction at all. Posters and pamphlets in general practitioners’ offices and pharmacies produced only the occasional enquiry. Only three out of about 200 recruited at the time of the television advertising campaign said they had contacted the “Make it Safe” programme after seeing it on television. Even live appearances on daytime television provided on average only about six enrolments in the 24 hours after each presentation. The milk carton advertisements, which offered a range of free products and services, attracted only 33 enrolments. An all-day staffed display at an Arthritis Conference recruited only nine elderly people. (Ibid).

A second approach proved much more successful: sending letters offering a speaker on the subject of home safety to a range of organisations for elderly people. The speaker would personally invite those at the talk to enrol in the programme. Speakers were in demand, and a one-hour presentation usually led to 40–50 percent of those present enrolling in the programme.

The organisers of “Make it Safe” conducted market research, which found that very few elderly people enrolled in the programme for themselves, “believing that they were not old enough and not yet in need of help, but they would agree to a home safety inspection for the

benefit of their partners, and for their older friends or relatives who regularly visited their homes” (Thompson, et al., 1997). Application of this knowledge led to speakers regularly enrolling over 50 percent of those present at the presentation.

Finally, the last strategy was to send personal letters to the elderly patients of general practitioners (GPs), urging them to participate in the programme, with the letter signed by the GP. All letters not resulting in an enrolment were followed by a second letter. Letters worded in a scientific, technical tone led to an initial response rate of 5 percent, with a further 25 percent enrolling after the follow-up letter. Less technical letters led to an initial response rate of 22 percent, with a follow-up rate of another 36 percent.

This approach gained the same response rate as did speakers, with a smaller investment in labour and time. Both the speakers and the letter from a GP gave ease of enrolment, and reassurance of the benefits of doing so, which was not available from media campaigns. Of course, as Thompson et al. (1997) point out, such collaboration with GPs requires a programme to be well established and of proven benefit.

(b) Linking with social events

Rosenbaum (1991) discusses another approach to raising interest in fire safety education among the elderly. She developed a programme that used a weekly dance at a community centre to develop a “teachable moment”; every week at the dance uniformed fire personnel were present, information leaflets were available, there was a safety tip in the monthly newsletter of the community centre, and a mute television played looped safety messages during the intermission at the dance. This programme was a response to previous failed attempts at creating interest in fire safety informational programmes among the elderly population of the area. Fire service informational programmes had been “poorly attended and had little impact”, while peer counselling groups in the community residential associations did raise interest but did not attract enough people. News releases and announcements also seemed to have little effect in increasing programme attendance.

The programme was based on research by Fischer (1986) cited in Rosenbaum (1991), which found that encouraging participation in educational activities by active older adults required emphasising self-directed learning, skills for building dependable relationships, and an increased awareness of educational opportunities. Rosenbaum also conducted research in the community itself, and found that one out of 10 elderly people would attend an informational programme, while nine out of 10 would attend a social activity.

The programme had a positive result: over the ten months it was carried out there were increasing amounts of informational brochures taken, an increasing number of requests for safety information, and an improvement in fire safety knowledge.

Rosenbaum (1991) analysed aspects of the approach which were particularly helpful. Participants at first avoided the fire service, but once the fire services became a regular and familiar presence, it were seen as useful. Requests for more safety information and programmes were usually directed to the fire fighter with whom the people in the programme had made friends. The television safety messages had a mixed response. They did promote conversation, but they were difficult to watch due to the size of the screen. However, while many people had objected to the idea in theory, they did not mind it in practice. Rosenbaum comments that other researchers have also found that, for adult learners, television is best used as an incidental part of the programme, or supported by

personal instruction and teaching materials (Guellette, 1988; Stokes and Panowski, 1988; both cited in Rosenbaum, 1991). Most successful, it seems, were the brochures, but their success depended on their format and content. Brochures that were colourful, multi-page, bold print and with self-explanatory pictures were more popular than tri-fold pamphlets. More importantly, the leaflets with safety messages aimed specifically at seniors were the least successful. Rosenbaum (1991) comments that observations confirmed with the community service agency, the receptionist and other senior agencies all agreed that seniors do not like to be reminded of their age and will avoid any literature or any reference to it.

The most recent fire safety programme for the elderly developed by the National Fire Protection Association of America also operates on the principle that the elderly are more likely to listen to fire safety advice in a social setting (Appy, 1999a). The programme, called “Remembering When”, seeks to actively integrate the fire safety information offered with the memories of the elderly. It is run somewhat like a quiz evening. The fire safety educator begins by asking the participants what their parents used to do to deal with burns. The evening then moves into a trivia game, where participants compete in teams to correctly answer questions on past popular culture and events, interspersed with fire safety questions. The educator physically demonstrates the correct answers, such as “stop, drop and roll”. The evening ends with the educator asking the participants to imagine one thing they could do differently to improve fire safety in their home.

(c) Using community organisations

Rosenbaum (1991) discusses a trend away from traditional fire safety education approaches for the elderly to a newer, community-based approach. She characterises this trend by looking at two programmes. The “traditional programme” is represented by the “Blueprint for Fire Safety”, developed by the United States Fire Administration in 1987. It was a programme planning guide on basic fire safety lessons, delivered by fire service personnel. Programme participants were attracted through advertising, press releases and announcements in newsletters. Fire Service networking in the community and with government was encouraged. The “newer programme” is represented by “Let’s Retire Fire”, developed by the United States Fire Administration, in 1990. It saw a shift to programme delivery and the recruitment of participants by community organisations and peer counselling outreach, rather than by the fire service. Instead of giving a basic plan for fire safety lessons, it gave a guide to planning a presentation, guiding the presenter through the steps of finding data, establishing objectives and a timeline, and recruiting people with an interest to help. It encouraged the use of a media or Fire Service spokesperson to outline fire safety concerns and statistics, to give credibility to the programme.

Several of the programmes discussed above show this general trend towards involving the community in making fire safety programmes for the elderly a success, for example giving talks to community groups, linking with social events, using peer counselling, and drawing on respected members of the community, such as GPs, for support. Traditional methods for reaching the elderly, such as advertising and press releases, were shown to be less successful than expected.

(d) Linking fire safety to general safety

Research by Hayes and Burke (1987, cited in Rosenbaum, 1991) found that many elderly have a high level of fear for safety which can lead to protection through isolation. They argue that building relationships with others at peer counselling or social occasions can help to address this. Thus, programmes such as Rosenbaum's or the NFPA's "Remembering When" can achieve a number of positive effects by encouraging social interaction around the issue of fire safety, and thus possibly reducing safety fears.

Such an approach of linking fire safety to general safety is also used in New Zealand. In Christchurch, the police and fire service offer joint seminars on safety, called the "Confident Living Programme" (Crean, 1998). Programme staff said that they have to break down unrealistic fears of violent attacks and burglaries. Attempts by some elderly people to make their homes more secure are actually endangering the people who live there. Extra locks on doors and windows and extra security screens can make it difficult for elderly people to get out in case of a fire. They can also make it more difficult for neighbours and emergency services to bring help. The programme has been "invaluable in boosting the use of smoke detectors"; programme participants are offered installation and the fire service returns each year to check detectors and change batteries. It was found many people put their detectors in the wrong place and did not realise smoke, rather than flames, was the killer in fires.

Approaches which link fire safety with broader safety concerns have in common an awareness that excessive fear is counter-productive in attempts to increase safety. Empowering the elderly, through encouraging a realistic view of safety and providing opportunities for the building of relationships, can lead to more positive, active approaches to safety by the elderly.

(e) Age-specific educational needs

Much of the educational theory for adults, detailed above, applies to the elderly also. In particular, learning must be active and self-directed; the elderly have a lifetime of experience to contribute and need to be able to interact with the fire safety education in this context (Powell, 1997). Just hearing a lecture or seeing a video is unlikely to have much impact; full discussion is essential. This is supported by research by Walker et al. (1992), who taught a one-hour workshop to a group of elderly people that involved showing a fire safety video with brief discussion afterwards. This approach did not have a significant effect on the fire safety knowledge of the participating group, nor did it improve fire safety attitudes. It did result in an improvement in the number of fire safety practices the participants reported they planned to engage in, in the future. The authors of the study conclude that this may mean that "watching the video was simply not enough to improve the knowledge of these participants to a desired level. If the time spent administering the pre and post-test had been spent in discussion or reviewing the information in the coursebook, more learning might have occurred".

Many elderly also have a need to build dependable relationships. This need can be addressed through linking fire safety education with community organisations, peer counselling and social occasions.

Gamache (1997) considers some of the issues involved in teaching older people fire safety education. Drawing on work from the Learn Not To Burn Foundation and the

American Association of Retired Persons, she supports the basic point that presentations should be interactive, while keeping in mind limitations on hearing and sight. Further, Gamache draws on research in the field of advertising that found that the elderly are frequently sceptical, and should not be talked down to or patronised. Pictures should show elderly people in positive roles, avoiding stereotypes. As found by a number of the schemes cited above, the elderly often do not like to be reminded of their age, particularly when the implication is that they are less able to manage risks to themselves than they once were. This can be addressed by convincing elderly people to partake in programmes for the sake of others, such as their partners, or, as in the case of a British programme seeking to convince elderly people in London to install smoke detector, for the sake of their pets (Seaton, 1996). Such an approach is not just a good tactic for encouraging involvement in programmes, it also taps into a genuine need. For example, as Gamache (1997) points out, there is a need to train elderly who care for children to keep the house fire safe for the children.

Fire safety education for the elderly must take their needs into account. For example, it is important to speak clearly, keep rooms warm, and ensure lighting is not too harsh (Powell, 1997). As Gamache (1997) suggests, home-health workers need to be trained to bring fire safety information to elderly who are not mobile. Printed materials should be in at least 12-point type and on buff paper (Gamache, 1997).

Practical advice on running home visits is given by a Leicestershire pilot study for a home safety inspection programme (Home Office, 1982). It comments that, in order to gain entry into homes in the first place, visits must be preceded by a letter about the programme and the proposed time of visit. Also, visits must not take place at night, when many elderly will not answer the door due to safety concerns. There is a need to know the social pattern of the area, and the names and circumstances of the elderly, if possible—this can be done through receiving details from local groups such as Age Concern. In this way, visits can be scheduled around other events in the local elderly community, and can be tailored to the circumstances of the elderly in question. It is most useful for the visits to have a casual rather than formal approach, so that the person feels comfortable describing their daily routines, thus giving clues to any possible fire dangers. Involving voluntary organisations that visit the elderly, for example in distributing fire safety leaflets, can be very helpful. Finally, it may be best to schedule visits prior to winter; if faults are found in electric blankets or heaters during the winter period, residents are likely to continue to use the faulty appliance, of necessity, while organising a replacement. In other seasons, the appliance is less likely to be in use while a replacement is organised.

(f) Care institutions

For those elderly who reside in a care institution, it is possible to affect fire safety through educating their carers (Walker, et al., 1992). Walker et al. report on a programme that aimed to improve the knowledge of institutional carers (1992). They found that workshops, ranging in total length from four to six hours, which taught from a coursebook on fire safety and showed a short video, had a positive effect on the level of knowledge of participants. Effects on fire safety attitudes were less marked, perhaps due to a high level of positive fire safety attitudes prior to the workshops.

(g) Smoke detector programmes

One of the main fire safety behaviours emphasised in many programmes for the elderly is the need to install and maintain smoke detectors. These programmes often supply and install smoke detectors free of charge, thus circumventing issues of low-income and potential limitations on physical capability to install a smoke detector properly. For example, in the USA, supplying or installing smoke detectors for the elderly is a common approach to improving fire safety, and is teamed up with education programmes for the elderly run by community groups (Gamache, 1997).

Research by the West Midlands Fire Service's Fire Research and Investigation Team found that the elderly and disabled were the least likely to buy a smoke alarm (Fire Protection Association, 1995b). Thus, they obtained funding for a large number of free smoke alarms from the fire authority and local authorities. These were fitted for free in the homes of the elderly and disabled, with the result of at least three documented cases of recipients being saved by the presence of the smoke alarm (Ibid.).

A similar approach has been used in Northern Ireland, where Ulster Television, Age Concern, other charities, government departments, fire brigades, and volunteer smoke alarm fitters, all co-operated to fit smoke alarms for the elderly (Fire Protection Association, 1996).

- **Key Points**

- Many programmes for the elderly use home visits to ensure a wide spread of elderly are reached, with positive results.
- A number of sources comment that many elderly respond negatively to any emphasis on their high-risk status; having spent years looking after themselves and others, they do not wish to be told their ability to do so is declining. This can be circumvented by appealing to a wish to create a safe environment for partners, friends, grandchildren or pets. Alternatively, one could present fire safety as a general health and safety issue. This taps into existing concerns of the elderly, and modifies the suggestion that the elderly are "incapable" into a more neutral health or safety focus, akin to a regular medical check-up.
- Elderly people are unlikely to respond to media campaigns. They are better reached through community groups, social events, or personalised appeals by people they respect such as doctors.
- Linking fire safety with community groups, peer counselling or social events will not only improve the involvement of elderly people in fire safety programmes, but it also addresses a major need of much of the elderly population, the need to build dependable relationships with others. This can have a positive effect on overall safety also, as it counteracts the tendency of some elderly people to respond to a general fear for their safety by isolating themselves.
- Fire safety education for elderly people needs to be interactive and draw on their knowledge and life experience.

- Fire safety education for elderly people needs to be mindful of the physical limitations of older age; for elderly people who reside in care institutions, the education of caregivers is also effective.
- The supply and installation of smoke detectors is a frequent and successful part of fire safety education programmes the elderly people.

(v) Lower Socio-economic Groups

Lower socio-economic groups are frequently referred to in the literature as “hard to reach” with fire safety education. In Britain, the Community Fire Safety Task Force (1997), modified this concept, commenting that using television to deliver the fire safety message to groups at risk is not the core problem because in many cases the groups in question are likely to have seen the messages more frequently than other social groups. The problem is that the groups at risk have simply not responded to the messages they have seen or heard. These groups are therefore more accurately described as difficult to influence rather than difficult to reach.

(a) Real-life fire safety education programmes for lower socio-economic groups: Involving the community

A 1996 study by McConnell, Dwyer and Leeming looked at a fire safety programme introduced for the residents of public housing in Memphis, USA.

McConnell, Dwyer and Leeming were members of Memphis University’s Behavioural Community Psychology Group, and they designed a fire safety programme for residents of Memphis Housing Authority (MHA) homes, a low-income group, on the request of the Memphis Division of Fire Services. Their first step in designing a programme was to determine the pattern of fires among the residents. They found that the risk of fire was one fire for every 895 renter months, or in other words the average renter could expect one fire every 74.6 years. The most high-risk time for fires was between 12 noon and 6 p.m. Fires were most commonly caused by children playing with matches, followed by cooking accidents, arson, electrical problems, and finally smoking materials. Children playing with fire and smoking materials were the two most common causes of injury-producing fires. Finally, while smoke detectors were issued to each unit, spot checks had found that less than 8 percent of the units had a functional smoke detector, with 92 percent of smoke detectors vandalised or made non-operable through, for example, the removal of batteries.

The 35-minute programme that was developed consisted of a pre-test, videotape accompanied by lecture, behavioural contract (where the trainee committed, in writing, to specific self-selected fire prevention behaviours), post-test, and fire safety reminder card. The information given focused on the fire safety problems that occurred in the MHA homes, in particular children playing with fire and in operational smoke detectors, with all fire safety behaviour related back to MHA residents. In order to reach a wide number of people, the programme was presented during the mandatory orientation sessions for all MHA heads-of-households.

The programme showed very positive results: the post-test saw average knowledge gains of 39 percent. More importantly, during the 15 months of the study, only four fires occurred in the homes of trained residents, two of which were due to behaviours covered in the

programme. This translates to a fire risk of one fire for every 4,312 trained renter months, or in other words the average trained renter could expect one fire every 359 years. Even more strikingly, during the same time period there were 87 fires in the homes of non-trained MHA residents; the relative fire risk of current residents who had not been trained was 5.5 times greater than that of current trained residents. This result occurred despite the fact that analysis of past data showed that, typically, new residents were more likely to experience fires.

Interestingly, trainees felt that MHA staff and fire-fighters were more knowledgeable than civilian educators, and felt they learnt more from them. This was not backed up by figures on what was in fact learnt, with results for fire-fighter educators slightly below that of MHA and civilian educators.

McConnell, Dwyer and Leeming (1996) attribute the success of their programme to the fact that it was targeted specifically at MHA residents. The video used was filmed in an actual MHA apartment, and the programme was also subjected to a process of review by the residents, with residents' advice on how they felt the programme should be incorporated into the design. The behavioural contracts were also useful in causing changes in behaviour. McConnell et al. also point out the limitations of this study: it did not allow an analysis of the long-term effects of the programme, nor did it permit the isolation of specific aspects of the programme to determine that were the most effective.

While the MHA programme enjoyed a great deal of success, the fact that its audience was "captive" meant it did not have to overcome a main problem usually faced in teaching fire safety education to lower socio-economic groups: namely getting the targeted group to participate or respond in the first place, and in a manner that ensures the programme will have some influence.

A programme run in Portland, USA, sought to overcome the difficulties of gaining an audience for fire safety information among low-income groups (Gamache, 1997). The Portland Fire Bureau found that an area of the community containing five percent of the population was experiencing 26 percent of the fires. The target audience was discovered by market research to be a low-income, mostly African-American group, which did not respond to fire bureau information about smoke detectors, and did not allow fire service personnel to install smoke detectors. A campaign was developed that used a community network to distribute free smoke detectors, with the result that the number of working smoke detectors rose from 77 percent to 85 percent. The number of people able to recall proper smoke detector maintenance rose from 37 percent to 58 percent, and the number of fire deaths dropped by nearly half. The success of the programme was attributed to the community taking ownership of the problem and creating its own solution.

The TriData Corporation then launched a larger-scale programme in 1991, to test the methods used in Portland in other settings (cited in Gamache, 1997). In Cleveland, the distribution of free smoke detectors was tested and found to have no effect on fire death rates. However, it was found that the most at-risk group, in a poor Latino community, was not responding to the programme. When a targeted community based programme was launched that had extensive liaisons with Latino groups, churches, and fire-fighters, the response from the Latino community increased beyond all expectations. Within 45 days, 10 times more requests for free smoke detectors had been received by the Latino community than had been received within the two years the non-targeted programme had been running.

In New Orleans, also, a targeted community programme was established. Smoke detectors were given away and installed by fire-fighters. Two community liaison officers were appointed, of the same race and gender (African-American females) as the targeted group. These liaison officers worked with community groups to gain support for the programme and to recruit volunteers to go door-to-door seeking people willing to be in the programme. The result was positive: the percentage of target homes with a smoke detector rose from 54 percent to 76 percent, while the percentage of homes with escape plans rose from 40 percent to 58 percent.

Gamache (1997) draws on this work by the TriData Corporation to develop some general principles of the community-based approach:

- Geographical targeting
- Market research to learn more about the target audience
- Grassroots community involvement, instigated through liaison with community groups and leaders.

As Gamache comments, the community-based approach can also be used to run school-based programmes that seek to reach children in low-income communities (Ibid.). In this case, it is important to be aware of the problems existing in schools in poorer neighbourhoods; to get fire safety education accepted by the school it is useful to provide new resources to the schools being targeted.

- **Key Points**

- Lower socio-economic groups are not so much hard-to-reach as hard-to-influence.
- The key factor in influencing lower socio-economic groups to adopt fire safe practices is involving the community to be targeted in the design and implementation of fire safety programmes. Programmes that use this approach have had a great deal of success.
- A main aspect of many programmes for lower socio-economic groups has been smoke detector give-aways; if such a give-away is carefully targeted and involves the community in question in its administration and implementation, it can result in significant drops in fire fatalities.

(vi) Rural Population

An example of a successful fire safety education programme for a rural area is the programme used in Beauregard Parish, Louisiana in 1973 (Strother and Buchbinder, 1980). In this rural area, deliberate wood burning had been a problem. Research found that the population was aware of mass media fire prevention messages, but often did not perceive these as relevant to them, wood burning being “rationalised in terms of economic and other motives which lie behind deliberate firesetting activities in rural communities”. Therefore, a change of strategy was implemented. The new programme used influential local people and opinion leaders to reinforce the fire prevention message. This led to a 55 percent reduction in set forest fires within five years of the programme starting.

Gamache (1997) considers programmes targeted at the rural poor. She quotes the example of “Get Alarmed, South Carolina” as a successful programme: it reduced fire deaths

by 53 percent over three years. It used a number of strategies arrived at after a strategic conference by groups in the state. These included a smoke detector instalment programme, a prevention programme for children, media coverage, and coalition building. Citing a number of other examples, including programmes in Mississippi, Arkansas and West Virginia, Gamache concentrates on the importance of coalition building within these communities as key to successful programmes. Coalition building is aided by the generosity of the fire department in sharing materials, training, and resources with others in the coalition. Other characteristics of these successful programmes included: the identification of local agencies related to the target groups; the recognition that “one size does not fit all” in programme development; the use of multiple leaders and the sharing of responsibility and roles in coalitions; offering training and technical assistance rather than just educational materials; creating initial efforts that show a positive result; and evaluation.

- **Key Points**

- Successful fire safety education in rural areas appears to involve the same factors as considered important for other groups: community involvement and coalition building.
- In the case of poorer rural communities, tactics used with lower socio-economic groups, such as smoke detector give-away programmes, are likely to be successful.

(vii) Ethnic Groups

There is very little material on programmes aimed specifically at ethnic groups.

In general terms, one frequently encounters the advice to print educational materials in a range of languages, or to rely on pictures rather than words to get a message across (Gamache, 1997). Stamps et al. (1980) mention a programme directed at American Indians that concentrated on reducing the risk of fires from the spilling of flammable liquids, with a resulting 65 percent fire reduction; however, specific programme design details are not discussed. The Federal Emergency Management Agency (1990) mentions a Portland programme directed at South-East Asian refugees, that used public service announcements, booklets and a video, all produced in English, Khmer and Vietnamese, resulting in a 66–75 percent decrease in fire emergency calls made by the target population.

It can be assumed that techniques used for reaching lower socio-economic groups, particularly community involvement in design and implementation of programmes, will also be effective with ethnic minorities.

- **Key Points**

- There is little information published on programmes aimed specifically at ethnic groups.
- A key way to reach various ethnic groups is to produce educational materials in the appropriate language.
- Community involvement in design and implementation of programmes would presumably have a positive effect.

(viii) Other Areas

(a) Smoking materials

While smoking materials are clearly a very high fire risk, particularly when smokers drop cigarettes accidentally if they fall asleep or are inebriated, there have been very few attempts to deal with this behaviour. The literature is almost silent on the issue as regards public education, save to comment that even Sweden, which has had great success with its public fire safety education programmes, has not been able to change people's approach to tobacco (Hall, 1998a). Smoking is considered to be among the hardest behaviours to change.

Brennan (1998), in relation to alcohol-related smoking fires, finds that a high proportion of people who cause such fires has been responsible for similar incidents in the past; since the person's behaviour is obviously difficult to change, perhaps "Education needs to be targeted to those sharing accommodation with high-risk people as well as the people themselves".

• Key Points

- There is little material on how to educate to reduce the risk of fires started by smoking materials. Smoking is a very difficult behaviour to change.
- Alcohol and smoking behaviours appear to be a regular behaviour pattern with certain people, making it even more difficult to change.
- This suggests a need to educate those who live with high-risk individuals to mitigate that risk where possible, and to know safe escape behaviours.

(b) General fire safety awareness

There is little written on attempts to improve the general fire safety awareness of adults.

Forsberg (1994) discusses the issue of adult fire safety education in the USA. He comments that the approach of USA fire safety education has been to focus on the young, as well as high-risk groups, ignoring the majority of the population: "[Fire departments] thought that if they taught the young long enough then everyone would eventually have been taught. Fire departments failed to realise that fire prevention education should be ongoing and throughout the lifecycle" (Forsberg, 1994).

Despite the tendency to focus on high-risk groups and children, adult fire safety education programmes are offered by 74 percent of USA fire departments surveyed by Forsberg (1994). These programmes are most often about how to use fire safety technology, such as extinguishers and smoke detectors. Less common are programmes that teach adults fire escape behaviours, fire prevention, or fire safe behaviours such as stop, drop and roll. Programmes are not at all well attended, with any particular program being attended by, typically, 2 percent of working age adults in an area (Forsberg, 1994). It is estimated by Forsberg (1994) that, over time, 79 percent of departments reach less than 10 percent of the working age adult population.

Some ideas have been offered to improve participation rates by working age adults in fire safety education. A common tactic seems to be to use fires that occur as "teachable moments": usually, people are most aware of and interested in the issue of safety when fires

occur in their neighbourhood, or are publicised in the media. This awareness can be utilised by the fire service as a chance to teach fire safety; in particular, giving out fire safety advice through the media or through neighbourhood meetings are suggested as effective tactics. While such tactics are frequently suggested in the literature (Saily, n.d.), no evaluation of the results of such tactics has been located.

Another possible approach is to reach parents through their children. There appears to be very little evaluation of this approach. New Zealand research has found that parents who are aware of their child's fire safety education are more likely to have a smoke detector installed (Decision Research Ltd, 1997).

Forsberg (1994) suggests reaching working age adults through their workplaces; this would make them easier to reach and would minimise their time commitment.

- **Key Points**

- There is little material on how to improve the general fire safety awareness of adults.
- Focus tends to be on educating high-risk groups, or children, rather than on working age adults.
- The adult fire safety education programmes offered by the majority of USA fire departments reach, over time, only about 10 percent of the working age adult population (Forsberg, 1994).
- Four possible approaches to improve adult involvement in fire safety education are to hold neighbourhood meetings after fires occur in the area, to use media coverage of fires to present positive fire safety information, to reach parents through children's fire safety education programmes, and to reach adults through their workplace.

(c) *"Chip pan" fires*

"Chip pan fires" is a UK term for fires begun when cooking with large amounts of oil in a saucepan, for instance, when cooking chips. A campaign to reduce the number of chip pan fires was launched in the UK in 1976 (Whitaker, 1983; Rutstein and Butler, 1977). It focused on public advertising, using the TELEVISION, with two main messages—how to prevent a chip pan fire, and how to extinguish a chip pan fire. House visits by fire-fighters supplemented the advertising. The effects were positive: there was a 30 percent drop in the number of chip pan fires the fire service was called to attend, both at higher and lower levels of advertising intensity. Thus, it was concluded that the campaign was cost-effective, at least at the lower level of advertising. However, the effects of the campaign began to diminish six months after the end of the advertising, with the level of calls to the fire service reaching the pre-campaign levels. A reminder campaign had the same effect as the original campaign. Interestingly, the visits by fire-fighters did not appear to have an additional effect.

Rutstein and Butler (1977) looked in more detail at the changes in knowledge and attitudes caused by the campaign. They found that, while levels of awareness of chip pan fires were already high due to past advertising, the 1976 campaign led to a further increase in awareness, to 80–90 percent awareness of the advertising. Generally, people were aware of television rather

than print advertising. People particularly recalled the importance of not overfilling a chip pan; not leaving a pan unattended; using a damp cloth to extinguish fat pan fires—one-fifth to one-third of those surveyed claimed they had been taught to use a damp cloth by the advertising campaign; and turning off the heat under a chip pan fire. Prior to the campaign, the most common method claimed to be used to extinguish a fat pan fire was taking or throwing it outside. After the campaign this changed to using a damp cloth. The strongest effect on attitudes seems to have been regarding the extinction message, not the prevention message. However, in terms of behaviour, there was more evidence of fires being prevented due to the campaign than that fires were extinguished due to the campaign. It must be noted though that a drop in calls to the fire service might mean either fewer fat pan fires, or people being more effective at extinguishing such fires themselves. Finally, the extinction message was remembered for much longer than the prevention message.

- **Key Points**

- The example of a British campaign indicates that cooking fires can be reduced through public advertising; in particular, people absorbed messages on how to extinguish such a fire. However, an advertising campaign does not have a long-term effect on cooking fire levels. This suggests that other approaches, such as those suggested under specific target groups, may be more effective.

(ix) Smoke Detectors

Hall (1998b) argues that because so many of the fatalities occur in fires caused by difficult-to-alter behaviours—careless smoking, children playing with fire, unattended cooking, etc—it would be highly beneficial to use both detectors and sprinklers in conjunction with public education efforts.

(a) Smoke detector standards

The latest standards developed by the National Fire Protection Association of America (NFPA) recommend that, at least, there be a smoke detector installed outside each sleeping area, in the basement of a house, and on each storey of a house (Schuchard, 1997). Of even more benefit is a smoke detector in each sleeping room (Ibid.) An Australian study, (Beever and Britton, 1999) found that around two minutes extra warning time is available if smoke alarms are installed in every room, rather than only in a corridor or hallway. Smoke detectors should be fitted on the top of a wall or on the ceiling, but not in the “stagnant zone” where the wall joins the ceiling (Moyses, 1983).

(b) Campaigns to increase smoke detector usage

One very successful campaign to increase the use of smoke detectors was run by the Home Office in Britain from 1988. Annual television advertising together with various programmes run by fire brigades around the country increased the national ownership of smoke alarms from 9 percent in 1987 to 79 percent in 1997 (Community Fire Safety Task Force, 1997), while fire deaths in dwellings fell 65 percent (Stack, 1996). This programme was initially general, and then targeted at specific “at risk” groups who had not yet installed

alarms, based on research on the attitudes of these at risk groups to smoke detectors (Community Fire Safety Task Force, 1997).

The United States Fire Administration also ran a continuing smoke detector campaign (Strother and Buchbinder, 1980). It was based on a two-step process: firstly, smoke detector facts were broadcast through the media and information leaflets. Secondly, community leaders and other community members went house-to-house, reinforcing the message and offering assistance in installing smoke detectors and developing an escape plan, as well as inspecting the home for fire hazards. This programme had a high success rate; for example, in one California town fire loss dropped 46 percent.

In broader terms, smoke detector campaigns in the USA have resulted in an increase in smoke detector use, which in 1995 stood at 93 percent of households having at least one smoke detector. Pat Coughlin of the National Fire Protection Association believes that decreasing fire death and injury rates in USA home fires are due to the increase in smoke detectors, as well as the use of public education programmes, particularly the Learn Not To Burn programme (Fire Protection Association, 1995c).

As discussed in sections regarding lower socio-economic groups and elderly people, smoke detector give-away programmes have been used successfully to encourage the use of smoke detectors by groups who are otherwise less likely to do so.

(c) Campaigns to improve smoke detector maintenance

As discussed previously, at any point in time, a large percentage of smoke detectors are not in working order; thus, programmes which encourage smoke detector use should also address smoke detector maintenance. Smoke detectors need to be checked monthly. Ahrens, (1998b) found only 40 percent of Americans did so, and 16 percent never checked their smoke detectors. Smoke detectors also need to be backed up by an escape plan which is practised; Ahrens, (1998b) found 59 percent of Americans had a household escape plan, but only 44 percent practised it. To be of use, smoke detectors need to be correctly installed with a power source (such as batteries) available to them.

The dangers of giving away smoke detectors without ensuring appropriate maintenance and installation assistance is highlighted in the case of Oklahoma City. A year after a smoke detector give-away programme, follow-up research indicated that only 51 percent of the smoke detectors given away were correctly installed and functioning (Ahrens, 1998b). Similarly, a free smoke alarm project in Oklahoma found that only 45 percent of the free smoke alarms provided were still in working order four years later (Lewis, 1996).

Appy (1999b) comments that the development of a household escape plan can be encouraged through the workplace, for example by distributing leaflets and giving workshops on fire safety. This is in the employer's interest, and employers are especially likely to become involved if there is opportunity for fire safety materials to be relevant to the workplace, or to be customised with the company logo. Of course, households with children can also be reached through take-home materials included in educational programmes for children. This is the approach that has traditionally been used.

Another approach used recently in America to encourage the development and practice of an escape plan was the "Great Escape" programme of the National Fire Protection Association (Wolfe, 1998). This programme encourage people to do a fire drill at a set time and day during fire safety week. It was hoped that by rallying an entire community around a

set time to practise a fire escape, people would be more likely to recall and act on the advice to carry out drills.

Smoke detector maintenance, and more specifically the need for batteries to be changed regularly, can be linked with existing public service announcements and advertising campaigns. For example, in the U.S. a number of states use the Eveready Batteries “Change your clock—Change your battery” campaign to suggest that people also change smoke detector batteries at the switch to daylight saving time (Federal Emergency Management Agency, 1990).

Smoke detector maintenance can also be taught in schools. A programme in Vermont found that, after being taught about smoke detectors, around three-quarters of students went home and checked their smoke detector, while 30 percent changed the batteries (Federal Emergency Management Agency, 1990).

Another approach is to use publicity. The Northern Ireland Fire Brigade was concerned with the level of alarms that were not in working order and began a campaign to improve this situation. They used local celebrities in television advertising, followed up with posters featuring the campaign slogan. A follow-up survey found that 81 percent of the sample could recall the advertisement, 94 percent of alarms in the area were in working order, and 76 percent of alarm owners tested them at least monthly (Fire Protection Association, 1995b). The number of accidental fire deaths fell from 27 to just eight from 1986 to 1996 (Community Fire Safety Task Force, 1997).

- **Key Points**

- Smoke detectors need to be installed at least outside sleeping areas and on each level of a house. Better still, there should be one in each bedroom. Even better is a smoke alarm in every room, as this will provide around two minutes more warning than if the smoke alarm is only in a corridor or hallway. They need to be maintained properly, and to be supported by escape plans.
- A combination of advertising and targeted programmes has had great success in increasing smoke detector use in both the UK and the USA.
- Specific groups may be most effectively encouraged to use smoke detectors by give-away and installation programmes; in particular this applies to the elderly and to lower socio-economic groups.
- The development and practice of escape plans is a more recent focus of fire safety education. While suggested approaches to encourage the development and practice of escape plans include involving employers, or having a yearly national day for practising a fire drill, these approaches have not yet been evaluated.
- Smoke detector maintenance can be encouraged through a special advertising campaign, school programmes, and incorporation in existing successful programmes and advertising.

(x) Evaluating Public Fire Safety Education Programmes

(a) An evaluation hierarchy

The Community Fire Safety Task Force in Britain (1997) points out that brigades have found it difficult to assess the success of their approach, scheme or project, and so have tended to measure activity (e.g., number of schools attended) rather than whether behaviour was changed, awareness raised, or if the scheme made the difference in the way intended. Similarly, USA fire departments have generally had difficulties evaluating programmes effectively. In a survey of USA fire departments, Tucker (1997) found that only 31 percent attempted any evaluation at all, with only 14 percent measuring end results, and 4 percent measuring changes in behaviour.

Various sources in the fire safety education literature have argued the need for improved evaluation systems. The most influential of these arguments came from Schaenman et al. (1990). The authors developed a hierarchy of evaluation measures, which the Community Fire Safety Task Force of Britain (1997) recommended for use as a basis for evaluation.

The hierarchy developed runs from the weakest forms of proof to the strongest (Schaenman et al., 1990):

- Institutional change: e.g., introduction of safety curriculum in schools.
- Adding another agency to aid delivering the message.
- Likeability and usage of programmes: e.g., percentage of teachers who think the programme materials are good and use them.
- Extent of programme outreach: getting the safety information to enough of the target audience to make a difference: e.g., percent of population receiving educational materials; percent of elderly visited by trained carers; percent of school children who received fire safety education.
- Awareness/knowledge gain: the level of understanding and recall of the materials by the audience; does it add to their knowledge or remind them what they know, e.g., percent of public who know how to extinguish chip pan fires; percent of public who have an escape plan; percent of public who know to “stop, drop and roll”.
- Behaviour or environment change: the target audience acting on the knowledge/awareness change; actions to improve home safety must be done correctly and maintained: e.g., percent of households who have a working smoke detector.
- End impact: the effect of behavioural or environmental change on the types of problems that occur, as far as these effects are not overwhelmed by factors beyond control: e.g., number of deaths; number of injuries. financial loss.

(b) Finding proof: Some difficulties

Schaenman and Gunther (1997) comment that proof of any of these effects may come in the form of anecdotes. They argue that this is acceptable, since “at the local level or even nationally it does not take that many anecdotes to drastically change the fire loss picture”. This would certainly be the case in New Zealand, where the actual number of fire deaths each year is small.

Hall (1997d), writing for the NFPA, discusses some of the key issues in evaluation. He poses three key questions for evaluation: was the target audience reached by the strategy; did the strategy change the target audience as intended; and did the fire problem decline?

Determining whether the target audience was reached is the easiest part of the exercise. This includes compiling data on which people and groups had the programme delivered to them (Hall, 1997d).

Discovering whether the strategy worked is more difficult. Ideally, it would require a series of post-tests of knowledge or behaviours (Hall, 1997d).

However, the most difficult part of evaluation is to determine if the fire problem declined due to education. It requires comparing fire death rates before and after the programme, but these rates may be affected by factors other than those relating to programme. As Hall (1997d) details, there are two key factors that can skew results. First, fire loss rates will vary randomly, often significantly, over time. Second, Hall (1997d) identifies the programme effect. Namely, just being in a programme may inspire participants to be more fire conscious and therefore more fire safe, even if they haven't learned anything more. In theory, this problem can be countered by running a "placebo programme", and by checking for effects over the long term. One also needs to consider the way in that education had an impact, in order to know what is actually causing effects. For example, announced inspections of homes for fire safety may lead to lower fire death rates either because the checks locate and fix fire risks, or because the prospect of an inspection will cause people to check their homes themselves.

Schaenman and Gunther (1997) expand on the need to be careful in attributing results to a programme. They list a range of factors that can affect programme results:

- Uncontrollable factors: include age profile, income distribution, educational level, geographical scatter and ethnic composition of population; weather or climate change; economic changes; migration; nature of local business and industry; changes in fire reporting procedures;
- Semi-controllable factors: condition of housing; architecture of homes; hazards of new technology; and
- Starting conditions: severity of fire problem; previous exposure of population to fire education; current level of smoke detector installation and maintenance.

Schaenman and Gunther (1997) comment that programmes can also have unintentional effects, including greater reporting of minor fires and a rise in fires set by children if curiosity is increased by publicity. Further, programmes may scare children, which can interfere with careful behaviour, and programmes may result in parents feeling harassed by a child's insistence on fire safety messages.

An example of a programme where results were affected by external factors is the 1977 space heater (i.e. free-standing, usually portable heaters) campaign run in the UK (Gilbert, 1979). This campaign produced no statistically significant results on a reduction in the number, or the severity, of space heater fires. However, the campaign had been affected by industrial disputes involving the fire service. The campaign was re-scheduled from early winter to late winter/early spring, due to the industrial dispute. Further, the industrial dispute, which was resolved before the campaign was begun, had led to a great deal of fire safety publicity in the national press and television. Thus, it is possible that fire safety awareness was already unusually high at the start of the campaign. Further, it is likely that

the use of space heaters was already declining prior to the campaign due to the changing seasons.

Detailed discussion of technical and statistical issues involved in fire safety education evaluation can be found in Schaenman and Gunther (1997), and Schaenman et al. (1990).

- **Key Points**

- Proof of the effectiveness of public fire safety education can range from weak, such as knowing a new programme has been introduced, to strong, such as finding a reduction in fire fatalities.
- Proof of effects may come in the form of anecdotes. It has been argued that this is acceptable “since at the local level, or even nationally it does not take many anecdotes to drastically change the fire loss picture”. (Schaenman and Gunther, 1997) This would be true of New Zealand where the actual number of fire deaths each year is small.
- Determining cause and effect—whether fire problems changed due to a programme—can be extremely difficult due to uncontrollable factors such as climate changes or random variations in fire statistics.
- Detailed discussion of technical and statistical issues involved in fire safety education evaluation can be found in Schaenman and Gunther (1997) and Schaenman et al. (1990).

APPENDIX 2

LIST OF ORGANISATIONS REPRESENTED IN THE KEY INFORMANT INTERVIEWS

Age Concern

Two interviews were conducted with representatives from this organisation, which has an aim to “empower older people through information”.

One interview was with a person concerned with the care of the elderly in their homes, and the other was with a senior administrator from the organisation.

Barnados New Zealand

This organisation has extensive contact with parents and children under five from all socio-economic groups, including contact with children and their families who are referred to Barnados by social services agencies. The interviewee was the co-ordinator of a range of services, which mostly involve the provision of child-care within caregivers’ homes.

The New Zealand Fire Service

Three staff members were interviewed. Two interviewees were senior employees involved in the development of the current Fire Service National Promotion Plan for fire safety for 1999–2001. One of these also had extensive experience in another country on the development and implementation of effective fire safety education programmes for the elderly and children. The third interviewee was working on effective fire safety education for Maori.

The Free Ambulance Service

The interview was conducted with a supervising officer with over 10 years experience in the ambulance service, including experience in attending house fires.

Home Care 2000

The interview was conducted with a senior manager in this agency, that works on contract to local health providers. The agency provides personal care such as showering, cleaning and shopping for the elderly and long-term disabled.

Massey University at Wellington

The interviewee has been involved in student accommodation for over 10 years. The university owns some older flats and provides a letting agency service for students.

Morris Communications

This agency has the contract for communicating the Fire Service National Promotions plan for fire safety for 1999–2001.

Pacific Community

The interview was conducted with a leading member of the Pacific community who regularly provides advice on Pacific matters to government and private sector agencies.

Property investors group

The interviewee is a leading member of a private property investors' association. He has been representing the interests of residential landlords at national level for a number of years.

Salvation Army

The interviewee manages a service which provides support for people on low incomes in need of assistance. This includes the provision of home-furnishings and food parcels, and budgeting and counselling services. Clients include young people, families, and the elderly.

Victoria University of Wellington

The interview was conducted with several staff directly involved in the administration of student accommodation and student services in general. Collectively, the interviewees had knowledge of student living habits in student hostels, university owned flats, and private rental accommodation. The university accommodation service currently has 900 students registered, and about 2000 students use its services each year.

Wellington City Council

The interviewee is involved in the maintenance of over 2,000 flats. They are mostly in large apartment blocks but there is also a significant amount of free-standing housing stock. The policy of the council is to provide rental accommodation to those who might have difficulty renting privately. This includes refugees, immigrants with poor English, low-income families, people with psychiatric needs, physically incapacitated people, and older people.

Wellington City Mission

This organisation provides services for families, such as budgeting advice and counselling. They also provide a range of services for youth including alternative education for suspended school students, a youth recreation centre, and counselling for alcohol and drug abuse. The three managers of these services took part in the interview.

APPENDIX 3

LETTER TO KEY INFORMANTS

Improving the fire safety knowledge and practices of vulnerable groups

Thank you for agreeing to be interviewed as part of this study currently being undertaken by the New Zealand Council for Educational Research.

The study has been funded through the Contestable Research Fund of the New Zealand Fire Service Commission. It aims to:

- provide a clear picture of the current knowledge of fire safety among vulnerable groups such as older people, young children and their carers, youth, Maori, Pacific Island people, and people of low-income, and;
- establish what people from these groups know, and how they learn, about fire safety; how they would be likely to respond to a fire emergency; what strategies and actions would best reduce their risk of fire and its consequences; and how such strategies and actions could best be communicated for adoption by them.

At this stage we are interviewing some “key people”, such as yourself, to inform our understanding of particular issues which might be faced by people from these groups.

With your permission, the information you provide during the interview will be taped to make it easier for us in recording and analysing the information. Anything you tell us will be treated confidentially and will only be used for the purposes of this study. Your name will not be used in any research reports, and you will not be able to be identified. The data collected will be stored at the offices of NZCER, and will be subjected to the security and disposal guidelines of the Council. You are free to withdraw your consent to participate at any time, and you can also inspect and change your responses if you should wish to do so.

If you would like any further information, or you wish to discuss the study, please contact me. A summary of the main findings of the study will be sent to you when the study has been completed.

I look forward to interviewing you at the time arranged. Again, thank you for participating.

Anna Chalmers
Senior Researcher
NZCER
Phone 8021462; email anna.chalmers@nzcer.org.nz
September 1999

APPENDIX 4

CASE STUDIES FROM CORONERS' REPORTS

1995 July – Female – 94 years – European name.

The deceased lived alone in a unit. The origin of the fire was the lounge floor, beside a heater situated on the floor. The supposed cause of the fire was bedding material coming into contact with the heater. The deceased had been sitting in the lounge wrapped in shawls and other items. She was also using cushions/pillows. The fire service was alerted at 2:45 a.m., after neighbours heard glass breaking and investigated. The report states, “if a domestic smoke alarm had been installed, neighbours would have been alerted to her plight at an earlier stage of the fire”. No alcohol was detected in the deceased’s blood.

1995 July – Male – 32 years – European name.

The deceased was a part-time mechanic who lived in rental accommodation with his partner and their young child. The child was being cared for at another address at the time of the fire. The fire was noticed at 4:15 a.m. by police on routine patrol in the area, who saw smoke coming from the house. Both the deceased and his partner were asleep in the lounge at the time of the fire. There were indications that the deceased had intended to cook a meal. The deceased’s partner subsequently reported that he had planned to fry chips. The two front elements of the electric range were both switched to the “high” position. There was a pot of fat on one of these elements, and it was reported he intended to boil water to poach eggs on the other element. The couple had arrived home between 11:30–12:00 p.m., after visiting several pubs since 6:30 p.m. The deceased’s partner stated, “I was intoxicated but not drunk. I’m not sure how much “Name” had to drink but he was not drunk also”. Both the deceased and his partner were rescued from the fire by fire-fighters. His partner survived but the deceased died in hospital eight days later. Consequently, there is no information on the amount of alcohol in the deceased’s blood.

There was no information on the presence or absence of a smoke alarm in the report. However, it seems unlikely that one was operating as the police who discovered the fire did not report hearing a smoke alarm in their statement for the fire investigation report.

1995 October – Female – 40 years – European name.

The deceased’s occupation was described as a “housewife”. She lived with her husband in a house owned by her husband’s employer. The origin of the fire was the kitchen area. The cause was undetermined. Her husband woke to smoke, found the “phone dead so went next door to “phone the Fire Brigade at 2 a.m. Before he left he called to his wife that the “place is on fire”. When he returned he could not get into the house because of the intensity of the flames. The deceased was found inside the house after the fire had been extinguished. The level of carbon monoxide poisoning in the deceased’s blood was within the fatal range, and her blood-alcohol level was 138 milligrams of alcohol per 100 millilitres of blood. This blood-alcohol level is defined as “serious” intoxication (O’Hagan, Robinson and Whiteside, 1993).

The fire service investigation report stated, “had a smoke alarm been installed, it would have given the occupants early warning and may have facilitated a safer exit”.

1996 May – Female – 66 years – described as Maori – and her male partner – 61 years – Maori name.

The fire started about 2 a.m. in the rental accommodation where the male deceased lived. Both the deceased were asleep at the time of the fire. The male was in bed and the female was in the sitting room. The other occupant of the house at the time survived the fire. He was the twelve-year-old son of the deceased male. The boy was awake and survived the fire when the window of the windowsill on which he was sitting (while unaware of the fire) blew out, and he was pushed outside. Both the deceased died of smoke inhalation. The deceased male had 280 milligrams of alcohol per 100 millilitres of his blood; the female had 171 milligrams of alcohol per 100 milligrams of blood. These “dangerous intoxication” and “serious intoxication” blood-alcohol levels (Ibid).

Both persons were described in a report for the coroner as alcoholics. The police report for the coroner stated the “race” of one of the deceased. She was described as Maori. (It is unusual to see “race” stated). The exact cause of the fire was unknown, but it may have been caused by the careless disposal of smoking materials. One of the deceased was described as a heavy smoker. The findings from the coroner stated, “the public needs to yet again be alerted to the life-saving effects of operable smoke alarms, and the need to safely extinguish and dispose of all materials from smoking and from fires”.

1996 June – Male – 49 years – Indian.

The deceased was unemployed and lived alone in rental accommodation. In the opinion of the fire investigating officer, the fire was caused by some type of material coming into contact with a heater. It was thought that once this was ignited, the fire travelled over the carpet or mat via an ordinary combustible e.g., paper or clothing, and ignited oilskin wet weather clothing. The fire service was called at 6.30 a.m. when a neighbour saw flickering lights and, on investigation, saw flames around the window area of the property next door. It appeared from his position (reclining in bed as if reading), that the deceased was not aware of the fire. The house was probably built in the late 1930s or 1940s and as a crib. The deceased was a loner who kept to himself, and neighbours stated he only spoke to them if spoken to first. The contents of the house were very sparse and there was very little furniture. The deceased had been treated for depression earlier and was under psychiatric care at the time of his death. He was not receiving medication at the time of the fire.

It seems unlikely that a smoke alarm was in operation as there is no information in the report on this aspect.

1996 October – Male – 63 years – European name.

The deceased was retired and lived alone. The fire was noticed about 9.50 a.m. by neighbours who called the fire service. The deceased died when the kitchen accidentally caught fire while he was cooking using either fat or cooking oil, which had spilt on the element of the stove and ignited. The cause of death was burns, and the deceased was severely incapacitated by alcohol intoxication. was a known heavy drinker, and his blood

contained 240 milligrams of alcohol per 100 millilitres. This is classified as a “dangerous” level of intoxication (Ibid). The deceased fell while trying to put out the fire.

There is no information in the report about the presence or absence of a smoke alarm, but it seems unlikely there was one in operation, as neighbours were alerted by flames.

1997 January – Siblings – males – 2 years and 4 years – European names.

The deceased children lived in a rural area in rental accommodation that came with their father’s job as a share-milker. The family did not have a phone, but the father had a radio-telephone. He called the Fire Service on the radio-telephone at 6.50 a.m. after he heard his wife screaming nearby and became aware of the fire. The fire was caused by the older boy, or both boys, playing with a cigarette lighter in one of the boys’ bedrooms. The parents both smoked and kept their cigarettes and lighters on top of the freezer in a sealed container in the kitchen area. They did this because the older boy was known to play with lighters. Usually there would be two spare lighters in the container. The older boy had a habit of hiding lighters. He had burnt paper, and curtains in both his room and his brother’s room previously. The remains of a lighter were found in one of the boys’ bedrooms near the origin of the fire. The mother had woken to a smashing sound after her husband had gone to work. When she discovered the fire she called to her 12-year-old sister, who was staying with the family, to get out of the house with the 18-month-old child with whom the sister was sharing a room. These three escaped successfully. The boys’ bedrooms were in flames at this time.

The report stated, “had a smoke detector been installed in the household, early detection of the fire would have been established, enabling early evacuation of family members”; and it recommended “that there be safety catches on cigarette lighters to make them childproof”.

1997 February – Siblings -female - 2 years and male - 3 years - Maori names.

This was a caravan fire to which the fire service was called at midday. The fire was discovered by a family member who saw smoke from nearby. The caravan, which was situated at the rear of a house, was used as a bedroom for these two children, one other child, and the deceased children’s mother. The supposed cause of the fire was “child playing with matches”. The children had been left alone in the caravan while their mother was in the house. The mother had locked the caravan door (“for the first time ever”) when she went back to the house, after putting the children in the caravan for their daytime sleep. The mother smoked and smoking material was left in the caravan. Another child at the property advised fire investigation officers that the elder of the two children (the 3-year-old boy) had been lighting paper with matches previously. The detective who investigated the fire reported he believed this fire was most likely to have been caused by a match being dropped in between the two single mattresses on the double bed and igniting the wooden material beneath. The mother didn’t recall there being any matches in the caravan, but said there was a lighter in the cupboard and one under the mattresses where she kept her tobacco. Investigation beneath the bed at the origin of the fire revealed a plastic bag containing tobacco and several loose matches, both live and used.

There was no information about the presence or absence of a smoke alarm in the caravan, but it seems unlikely that there was an alarm in operation as the fire was first noticed by a family member seeing smoke.

1997 June - Male - 45 years - European name.

At 2:15 a.m. police on mobile patrol were flagged down by a member of the public in a rural area who had seen a house fire and called the fire service. The deceased was alone in the house at the time of the fire. The fire had originated on the kitchen stove. Under the grill were the remains of two chops. The grill switch was in the “on” position. The supposed cause of the fire was “unattended cooking equipment igniting items being cooked”. The deceased had been at a local bar from approximately 6 p.m.–11.30 p.m. He had been asked to leave the bar because of a disturbance, and he was “pretty full” by then, stated the bar manager. The post-mortem revealed that his blood contained “296 milligrams of alcohol per 100 millilitres”. This level of intoxication is classified as “dangerous” (Ibid). The deceased was found in the living room. It is likely he had fallen asleep while cooking. There was no information in the report about the presence or absence of a smoke alarm, but given that there was no mention of this in the accounts of those attending the fire, it seems unlikely that one was operating.

1997 June - Male - 23 years - Maori name.

The deceased was a builder’s labourer who lived in the house. The cause of the fire was a Conray heater turning over or being placed too close to the couch in the lounge where he was lying. The cause of death was smoke inhalation. About 6.30 a.m. some of the occupants awoke to the smell of smoke coming from the lounge. Four of the five occupants managed to leave the house and contact the fire service. All occupants had been to a local hotel the night before and had been drinking heavily. A witness stated that the deceased was heavily intoxicated, and possibly under the influence of drugs when he left the hotel. He had returned home about 2 a.m. and continued drinking alcohol in the lounge until approximately 5–6 a.m. The deceased and one of his friends then fell asleep in the lounge. As the fire started where the deceased was lying, he would have been overcome by smoke, causing him to pass out. There is no record in the post-mortem report of the amount of alcohol in his blood, and no information about the presence or absence of a smoke alarm, although it seems unlikely that one was operating given that the occupants who did wake were woken by the smell of smoke.

1997 August - Male - 40 years - Maori name.

The deceased was unemployed and lived in the rental accommodation with his partner and their two infant children. The property was owned by the Housing Corporation. The family had been out and arrived home about midnight and went to bed. It was stated that they had “consumed quite large amounts of alcohol during the course of the evening”.

The fire started about 1 a.m. in the lounge behind the television set, which was left plugged in and going. A guest sleeping in the lounge awoke to find a fire in the lounge. Apart from the deceased, the occupants made their way outside after waking. The deceased tried to move the television set, which was alight, but failed to do so and was seemingly overcome

by smoke. The fire investigation report stated, “good practice would recommend that operative smoke alarms be fitted in sleeping areas and egress routes from private homes. For an average three bedroom house, one or two alarms is all that is required at the cost of about \$15–\$25 each. The New Zealand Fire Service will install them free of charge and it recommends the purchase of only Fire Service recommended, standard-approved New Zealand and Australian brands, and that the batteries be changed annually and the alarms be tested periodically”. There was no information in the report about the blood-alcohol levels of the deceased, or the presence or absence of smoke alarms. However, it seems unlikely that there was a smoke alarm operating, given the above recommendation of the Fire Service.

1997 August – female – 75 years – European name.

The fire in the deceased’s bedroom was discovered at 2.30 p.m. by her nine year old grandson, who was visiting at the time, after the deceased called for help. When he opened the bedroom door he found his grandmother on fire on her bed. He called the brigade on 111, and applied cold water to his grandmother’s burns – “this deserves recognition”, stated the report. He had received instruction at school from the Fire Service on fire emergencies. The boy informed the fire investigation officer that his grandmother had been lighting a cigarette when the match broke and set fire to the bed and then her bed clothing. The fire service removed her from the fire, and treated her burns. She died in hospital some 10 days later from heart failure and broncho-pneumonia complicating her recent skin burns. The deceased had a history of emphysema and was a smoker. There was co-existing Alzheimer’s dementia.

1997 September – Female – 21 years – Maori name.

The deceased who was a smoker, lived alone in rental accommodation. She had been drinking after finishing her work as a rousie in a shearing gang at 5 p.m. Alcohol was consumed on the trip back from work. On arriving back, she went to the shearers’ quarters, a local hotel and a house. She was last seen just before midnight as she left to walk home, and was described as being “a bit intoxicated”. The fire service received a call at 12.40 a.m. from a next door neighbour advising of the fire. The fire originated at the foot of the deceased’s bed, with the cause thought to be either the electric blanket (which may have been left on all day in a crumpled state) overheating and igniting bedding, or a cigarette being dropped onto the bedding. The deceased had a heart condition, which may have affected her ability to evacuate the house. There were no indications of a smoke alarm being installed in the house. The Fire Service report stated, “installation of a smoke alarm may have given sufficient early warning to allow the deceased to safely evacuate the building”. The deceased had a blood-alcohol level of 175 milligrams of alcohol per 100 millilitres of blood”. This is “serious” intoxication (O’Hagan, Robertson, and Whiteside, 1993). The coroner’s decision included a reminder on the value of smoke alarms. “They are so cheap and so easy to fit, and there is assistance from the New Zealand Fire Service in fitting them, that I fail to see why everybody does not have smoke alarms...generally speaking they offer the possibility of warning, and it is recommended that people fit them in their homes. I hope these remarks might help avoid another horrible accident such as this in the future”.

1997 September – Female 9 years, and male 5 years – Female European names Male – Maori name.

The children died in a caravan where they had been sleeping. The caravan, at a holiday park, had been the home of the mother and her three children for the past three weeks. The fire was most likely caused by bedding falling onto a single bar electric heater and igniting. The mother rented the caravan for \$145 per week. The two older children were in their bunks and the mother was asleep with her two-year-old daughter. She had turned on the single bar heater before getting into bed, and placed it at the foot of the beds, between the bunks. She stated she was only planning to keep the heater on for a little while – just enough to keep them warm. She went to bed about 9 p.m., about the same time as the children, and almost immediately fell asleep. She woke about midnight to the smell of smoke and her blanket on fire. She yelled to the children to wake up and get out. She took the youngest child outside with her and went back to get the other two, but the flames sent her back from the door. She tried to get them out through a window, and broke the glass, putting her arms out to reach the children, but a flame swept across in between her and the children, and in her words, “my children were gone in front of my eyes”.

The report made several recommendations. “This incident highlights the need to continue to educate the public in basic fire safety – i.e. have a home escape plan in order, install smoke alarms for early warning, take preventative fire measures – use intrinsically safe appliances and comply with the “heater metre” (a minimum distance of one metre between heating appliances and furniture and clothing). This could only be achieved in similar caravans with heaters fixed high on a wall, and not of the electric bar type”.

1997 November – Male – 9 weeks – European name.

Matches were found on the windowsill in the mother’s bedroom where the four-year-old sister of the deceased was playing shortly before the fire. The mother had found the four-year-old playing with matches once before when she was two or three years old. The fire service was called at 9.45 p.m. by a neighbour after the mother had discovered the fire when she went to check on her children and then alerted a neighbour. The mother and the father of the baby, who did not live at the address but visited daily, both smoked.

The fire started on top of the double bed in the mother’s bedroom, where the infant was. There was no smoke alarm in the rental accommodation. The fire investigation report stated, “if a smoke alarm had been correctly installed and maintained, the adults would have been warned of the fire earlier”. The cause of the fire remains undetermined but was thought to be either a child playing with matches, or something either around or above the light fitting in the ceiling of the room, igniting and falling onto the bed where it burnt the bedclothes, mattress and base.

The coroner’s findings include a discussion of circumstances surrounding such fires. This discussion is based on the coroner’s questioning of a fire officer who is reported as having investigated 130 fires in the last two years within this region. A summary of this discussion is reported below:

The fire officer stated that organisations or departments other than the Fire Service need to consider their responsibilities in terms of providing support mechanisms or safety education programmes to the community. The design of such programmes should be targeted towards people at all levels of the socio-economic spectrum, (but particularly those at the lower end), and structured to raise general health and safety awareness. The effectiveness of such systems needs ongoing monitoring.

His experience was that the fires appeared to occur in the lower socio-economic areas and in rented accommodation. He stated that the Fire Service spends much time and energy trying to educate the public as to how they can assist themselves to be safe from fire. One of the obvious ways is through a smoke alarm campaign. The fire officer believed the Fire Service was acting somewhat in isolation in this area, and the coroner felt he was suggesting other organisations provide further assistance. The fire officer said one smoke alarm placed in the centre of the ceiling in the hallway, would have been sufficient in the case of this fire. The purpose of a smoke alarm is to wake those who are sleeping. The rationale being that those who are conscious and walking about will notice the fire themselves. Early warning of a fire through a smoke detection system would give occupants more time and choices in what they can do and more opportunities to save lives. The coroner states that the point about the incidence of fire within low socio-economic accommodation suggests it would be worthwhile to seek some sort of subsidy to allow people to purchase smoke alarms at a very affordable price. Another suggestion made by the fire officer was legislation. This was supported by this coroner. He stated that it would not necessarily mean national legislation, but at a local level such as building requirements on further constructions. It was the coroner's understanding that new residential dwellings do not require smoke alarms. He suggested that people are more in danger of dying from the effects of smoke and fire than they would be from someone attempting to break into their house. He added that often no expense is spared in installing burglar alarm systems, but no attention is paid to an early warning system for smoke and fire. The coroner recommended that local bodies and councils should consider amending their building requirements to include smoke alarms as being a mandatory fixture.

1997 November – Male – 2 years – European name.

The deceased child lived in a two bedroom house with his mother, his five-year-old brother, his 16-year-old uncle, who was “unemployed and not doing any courses”, and his mother's partner. At approximately 9 a.m. on the day of the fire, the deceased was playing with his brother in a bedroom while his mother slept, following her completion of a night shift, the previous night. The mother had worked from 7 p.m. to 5 a.m. that night, arriving home at 6 a.m. She was aged 23 years. Her partner was at work at the time of the fire. The likely cause of the fire was the children playing with a cigarette lighter. The two-year-old had played with lighters before, and both the mother and the 16-year-old smoked. The fire started in the 16-years-old's bedroom (he kept cigarettes and a lighter in this room), around the end of a bunk. The burnt remains of a cigarette lighter were found nearby. The mother awoke to a “terrible scream and saw smoke”. She escaped from the fire with the five-year-old, but there was confusion about which room the deceased child was in. Attempts to locate

him were unsuccessful and he died in the house. The coroner reports the cause of the fire as undetermined.

1998 March – Male – 31 years – European name.

The deceased lived with his parents and was probably on a sickness benefit. He died as a result of severe burns sustained while attempting to dry his clothes. The clothes were covered in paint and petrol, most likely caused by paint splashes as he was mixing paint (in preparation for painting a car), and the lid coming off the paint pot. He then used petrol from a motor mower to try and clean himself. Following this, he had attempted to dry his clothes in front of a stove by turning the elements on full and then probably inadvertently lit his cigarette lighter, which ignited flammable vapours. He had been diagnosed with schizophrenia and was being treated for this with medication at the time of his death.

1998 March – Male – 76 years – European name.

The fire started in the laundry of a privately owned residence. The supposed cause was an electrical appliance. At 3.30 a.m. a neighbour heard the tinkling of glass, and on investigating, saw flames coming from a nearby house. She then called the Fire Service. The deceased was in poor health. He suffered from severe respiratory disease, and walked with a walking frame. No alcohol was detected in the blood. This death resulted from smoke inhalation in association with severe chronic respiratory disease. His female partner survived the fire.

The Fire Service Investigation report concluded, “had smoke detectors been installed within this structure, the occupants may have received early warning of the developing fire and evacuated to a place of safety.”

1998 April – Twin males – 3 years – Pacific Island names (one adult in the family described himself as Tongan).

An extended family of five adults and the twin boys were living at the address. Three of the adults were males who worked for the family construction business. The other male adult was unemployed. The fifth adult was the mother of the twins. The likely cause of the fire is believed to have been “children playing with a cigarette lighter.” At the time of the fire, the five adults were at the house. It seems that about 4 p.m. the boys had been playing with a cigarette lighter in the wardrobe of the bedroom they shared with their mother. The mother reported the five adults all smoked, and there were usually several lighters and packets of matches lying around the house. The mother kept the lighters on top of the fridge in the kitchen or on the shelf in her wardrobe. Over the past few months the mother had found one of the boys playing with a lighter on several occasions. The mother was aged 23 and there was no telephone or clock in the house.

A firm of consulting civil and structural engineers was requested to investigate, using computer modelling simulation, the benefit of early warning that smoke detectors would have given in this fire. They reported that a smoke detector in the bedroom of fire origin would have activated after 11 to 14 seconds with an ultra-fast fire growth, and at approximately 27 seconds with a fast fire growth rate. They added that it was quite possible

that smoke detectors would have activated earlier than these times calculated, that the assumption of an ultra-fast fire growth may be inaccurate and that tenability times could well have been slightly longer than those calculated. They concluded from the modelling that a smoke detector in the bedroom of fire origin would have sounded at least 76 seconds before the room became untenable. A smoke detector in the hallway would probably have given adequate, early warning of the fire had the bedroom door been open at the time of the fire. They stated, “it is our opinion that had there been a smoke detector in the bedroom of fire origin, then the lives of the twins would almost certainly have been saved”. The coroner recommended that “a localised campaign be organised to promote the installation of domestic smoke detectors in local residences: that legislation be introduced banning the importation of cigarette lighters that are not child resistant and making smoke detection installation in all residential dwellings mandatory.”

1998 April - Female -17 years - European name.

The deceased was unemployed. She lived in a sleepout on the same property as her mother’s house. The house was occupied by her mother and a boarder. There was no telephone at the house, which was in a rural area. The mother was on invalid’s benefit and had no car. The sleepout caught fire about 3 a.m. The deceased was known to smoke marijuana and was reported as hearing voices. She had recently been in residential care for detoxification. At the time of the fire she had been sniffing petrol in front of a heater and had fallen asleep. Her whole body was set alight. A Fire Safety Officer in an accompanying newspaper report, pointed out the value of having smoke detectors, an escape plan with at least two escape routes, and having extinguishers or a hose connected permanently to a water supply. “When you live in a rural community, help is further away so you need to be better prepared”, he said.

1998 April - Female - five months - Maori.

The deceased was from a single parent family living in Housing NZ rental accommodation. The supposed cause of the fire was discarded smoking materials igniting the contents of a rubbish bag. The origin of the fire was the kitchen. The mother was a smoker, as was her friend with whom she returned home shortly before the fire. The mother had been drinking since 9 a.m., and was reported as being in an advanced state of inebriation. She returned home with the baby about 7 p.m. – the baby had been returned to her from relatives just prior to this. She placed the baby in a cot at home and was satisfied she was asleep. No one else was at home at the time. She then left the house and visited a neighbour across the street. She had been gone for at least 20 minutes, and returned when she became aware of the fire, which had started between 7.30 p.m. and 8 p.m. There were two older children staying elsewhere. There was no smoke alarm in the house. The Fire Service investigation report stated “the need for legislation compelling home owners and occupants to install smoke alarms and to develop an exit plan.”

1998 April – Male – 32 years – Niece described him as Maori.

He was also described by the niece as being a very heavy drinker and a heavy smoker. He left her house about 1 p.m. on 10 April, and she described him as “really drunk.” The supposed cause of fire is recorded as the “careless disposal of smoking material”. The fire originated in the couch on which the deceased was resting, and was thought to have been burning for up to five hours prior to discovery. The deceased was the brother of the tenant of the flat, and was the only occupant at the time of the fire. The post-mortem revealed that the deceased had a level of blood alcohol of 167.00 milligrams of alcohol per 100.00 millilitres of blood. This is “serious” intoxication (O’Hagan, Robinson, and Whiteside, 1993).

1998 May – Male – 78 years – European name.

The deceased was reported by his partner to be healthy and played golf, skied and rode a bike. The cause of the fire, at his holiday house, is most likely to have been bedding falling on a one bar heater in his bedroom (which was most probably in almost continual operation, plugged into a thermostatic control device), and the heater igniting the bedding. Two smoke alarms were in the house, but not were not heard by his partner (sleeping at other end of house with door shut) until smoke and flames were coming from the deceased’s room. The partner woke about 5 a.m. The deceased did not smoke. His blood contained 124 milligrams of alcohol per 100 millilitres of blood. This is “serious” intoxication (Ibid). Due to the configuration of the room of the fire’s origin, it would have taken a reasonably long period of time for smoke to reach either of the two smoke alarms. Both smoke alarms were poorly located with the one in the hall only being effective if a fire has started in the bathroom or toilet area. The deceased died of smoke and fume inhalation and burns. He wore a hearing aid, which he would have taken out at night according to his partner who escaped from the fire.

1998 June – Female – 85 years – European name.

The deceased was retired, and lived alone. The fire was discovered at 3 a.m. The deceased’s memory was deteriorating and her short-term memory was almost non-existent. She also suffered from deafness. The cause of the fire was undetermined. The deceased had a day bed in the kitchen, with an electric blanket which was “left on 3 day and night”.

1998 June – Female – 7 years – European name.

A fire in the kitchen was caused by a pot of cooking oil being inadvertently left on an element that was left turned on after the deceased’s father had been cooking chips. The fire burned for about 30 minutes before being discovered. The smoke alarm situated in the hall sounded as soon as the mother opened the kitchen door. The deceased remained in the lounge after the alarm sounded although her mother, who had a disability problem, called for her daughter to come outside. The child had a low level of comprehension, according to her school principal, and had been absent from school when her class had received fire safety instruction. The child was described as timid, and when faced with such a dangerous and serious situation, she was regarded as being incapable of taking any self-preservation action. The coroner recommended “that particularly in the case of families with young children,

each home should have an escape program so that children know immediately what to do in an emergency”.

1998 June – Male – 62 years -European name.

The deceased lived alone and died trying to put the fire out. According to the report, he was “in state of intoxication which would have severely impaired the deceased’s ability to care for himself in an emergency”. It appeared heat from a coal range ignited a nearby object. He was known to be a regular heavy drinker. It is thought he awoke to find his house on fire and attempted to remove what he thought were the burning items (catbox) to the outside. On his return into the hallway, he was hit by a falling piece of architrave and was overcome by the by-products of combustion. The Fire Service were called at 11.15 p.m. by a neighbour who noticed flames from a distance. There is no mention of a smoke alarm in the report.

1998 August – Female – 83 years – European name.

The deceased lived alone and died when she fell across a two bar radiant heater, which severely burned her. It appears she was unable to move away from the heat source. She had experienced disturbed balance over the past two years and had had a number of falls. The fire did not spread as all the doors and windows in the room were closed, thus starving the fire of oxygen. She drank at least three whisky and waters each night. The smoke detector did not activate as two doors were closed, preventing smoke from reaching the detector.

The fire went unnoticed until a neighbour went to check on her the following morning.

1998 August – Male – 81 years – European name

The deceased lived alone. He had been watching television in the lounge during the evening with an electric blanket wrapped around his legs for warmth. When he went to bed, he forgot to switch the electric blanket off, leaving it on the couch in the lounge. During the early hours of the morning, the blanket either over heated or short-circuited and set alight furnishing in the lounge. The deceased had discovered the fire and attempted to get out of the house, but he was overcome by smoke near the front door, and subsequently died. He was known to have a serious hearing disability, was partially crippled and required crutches to get around. There were no smoke alarms.

“The use of, and the way in which the electric blanket was left after use is a dangerous practice, as historically, blankets being used improperly and poorly maintained have caused a number of fires.” The Fire Service reported all internal doors in the unit were open, which allowed the fire to spread unhindered.

The following recommendations were made in the report:

- 1) Regulations to make smoke detectors mandatory in all private residences.
- 2) Monitoring system for fire in any emergency be provided by the Health System, for all elderly persons and people with handicaps who chose to live independently.
- 3) The Fire Service conducts Fire Safety education programmes for the public on the dangers of electric blankets when used for purposes other than their designated use, and safe practices for closing internal doors at night without smoke alarms.

APPENDIX 5: SUPPORT AGENCIES USED TO IDENTIFY STUDY PARTICIPANTS

Age Concern
Alzheimer's Carers Support Group
Anglican Social Services
Barnados
Catholic Social Services
Community Resource Centres
Maori Trust Boards
Marsden Club
Presbyterian Social Services
Salvation Army
Wellington City Mission
Wellington Hospital Elderly Services Rehabilitation Services
Wesley Care for the Elderly

APPENDIX 6: GEOGRAPHICAL LOCATION OF PARTICIPANTS

Christchurch
Featherston
Hokitika
Lower Hutt
Masterton
Otaki
Porirua
Te Kuiti
Timaru
Twizel
Wanganui City
Wanganui (rural area)
Wellington
West Auckland

**APPENDIX 7:
LETTERS TO PARTICIPANTS**

APPENDIX 8
QUESTIONNAIRES AND FOCUS GROUP SCHEDULES

APPENDIX 8A(I)
QUESTIONNAIRE FOR PARENTS

APPENDIX 8A(II)
PARENT FOCUS GROUPS—SCHEDULE OF QUESTIONS

APPENDIX 8B(1)
QUESTIONNAIRE FOR OLDER PEOPLE

APPENDIX 8B(II)
OLDER PEOPLE FOCUS GROUPS—SCHEDULE OF
QUESTIONS

APPENDIX 8C(1)
QUESTIONNAIRE FOR CARERS

APPENDIX 8C(II)
CARERS' FOCUS GROUPS—SCHEDULE OF QUESTIONS

APPENDIX 9:
TABLES

APPENDIX 9A: TABLES RELATING TO PARENT DATA

Table 1

Response to the question: As a parent/primary caregiver of a baby, toddler and/or older pre-school child, what do you think of when you hear the phrase “keeping young children safe from house fires?”

	Maori n=26	Non-Maori n=64	Total n=90
Lighters and matches away – includes keep away from children	14	32	46
Supervision of children	6	21	27
Open fires and kent fires – includes guards	6	18	24
Heaters – includes guards	2	18	20
Stoves – includes ovens, elements, cooking	5	13	18
Smoke alarms	3	15	18
Escape – includes escape plans	3	10	13
Teaching children – includes various aspects of fire safety	5	8	13
Other – includes electric blankets, fire extinguisher, fire alarms, candles, parent education	2	11	13
Making the environment safe	3	6	9

Table 2

Response to the question: “What do you think are the main causes of house fires, particularly for families with babies, toddlers, and/or older pre-school children?”

	Maori n=26	Non-Maori n=64	Total n=90
Matches/lighters – includes children playing with lighter and matches, lighter and matches lying around	21	55	76
Cooking – includes left unattended/adults distracted	6	20	26
Heaters – includes drying clothes, supervision of children	3	17	20
Open flames – includes candles open fire, kent fires, enclosed fires, gas heater, leaving unattended, drying clothes	4	15	19
Other – includes clothes dryers, alcohol, depression, negligence, not having a smoke alarm, toasters, adults distracted generally, electrical (generally)	4	10	14
Electrical fittings – includes wiring, fuses, playing with sockets, overloaded plugs	3	9	12
Electric blankets	1	4	5

Table 3

Response to the question: “Have you any thoughts about fire dangers with heaters/open fires for families with babies, toddlers and/or older pre-school children?”

	Maori n=26	Non-Maori n=64	Total n=90
Need for a screen around heat source – includes open fires/gas heaters/electrical bar heaters	16	37	53
Other – includes educating children, drying clothes, don’t have fires/heaters at all, chimney fires, don’t leave fires/heaters unattended	12	34	46
Need for supervision of children near a heat source	11	25	36

Table 4

Response to the questions: “Any thoughts about heaters/fires and things being on or near them?” and “Any thoughts about clothes dryers?”

	Maori n=26	Non-Maori n=64	Total n=90
Clothes dryers – includes overloading, overheating, clean lint from filter, turn off, don’t put clothes not properly spun in dryer, don’t leave dryer going with clothes that are properly dry	6	28	34
Other combustibles too close to heat source	9	23	32
Drying clothes too close to heat source – includes use of drying frames	8	19	27
Other	0	2	2

Table 5

Response to the question: “Thinking about families with babies, toddlers and/or older pre-school children, any thoughts about fire risks when cooking with gas or electricity?”

	Maori n=26	Non-Maori n=64	Total n=90
Children at/near the stove	16	30	46
Unattended cooking – includes adults distracted	4	18	22
Tea towels and other items on elements	2	11	13
Dangers with fat/oil – includes cooking fires	2	10	12
Other – turn stove off at main, educate children	9	3	12
Cooking with gas can be dangerous	3	1	4
Faulty equipment	1	3	4

Table 6

Response to the question: “Thinking about families with babies, toddlers and/or older pre-school children, anything about cooking with fat or oil?”

	Maori n=26	Non-Maori N=64	Total n=90
Awareness of safe cooking with fat or oil – includes dangers of overheating fat or oil	36	18	54
Unattended cooking – includes take pan off element before going out of room, forgetting to turn stove off by children distracted from cooking	22	4	26
Strategies for dealing with fat fires – includes baking soda, salt, keep a lid handy to cover the fire, take it outside, smoke alarm in kitchen	3	1	4

Table 7

Response to the questions: “Thinking about families with babies, toddlers and/or older pre-school children, anything about cigarettes and fire risk?” and “Thinking about families with babies, toddlers and/or older pre-school children, anything about extinguishing/putting out cigarettes and fire risk? Anything about matches and lighters? Any thoughts about the childproof lighters now on sale?”

	Maori n=26	Non-Maori n=64	Total n=90
Completely extinguish cigarettes – includes especially if putting butts into a plastic rubbish bag, don’t fall asleep with a cigarette going, use ashtrays	22	47	69
Ensure lighters, matches and lit cigarettes out of reach of children	18	51	69
Safety lighters not necessarily safe – includes children learn how they work and can use them, children can remove the safety device and use them, harder for children to light but they can still do it	14	31	45
Safety lighters generally safe – includes even some adults find them hard to use	7	22	29
Don’t smoke in the house	9	15	24
Don’t let children play with lighters/ matches / lighted cigarettes	2	8	10
Children copy adults – includes can work out how a lighter works, parents underestimate children’s knowledge, don’t smoke in front of children	2	8	10
Teach children – includes lighters and matches are dangerous/not to touch them, controlled fire lighting	2	5	7
Other –don’t smoke in bed/bedroom, need more research on child proof lighters	1	6	7

Table 8

Response to the question: “Thinking about families with babies, toddlers and/or older pre-school children, anything about alcohol and fires?”

	Maori n=26	Non-Maori n=64	Total n=90
Cooking – includes don’t cook, don’t cook with fat or oil, could leave cooking unattended, fall asleep	11	17	28
Smoking – includes likely to fall asleep while smoking, could drop cigarettes, forgetting to extinguish cigarettes	11	14	25
General lack of care – includes keep away from appliances, forget to turn off appliances, memory not good, loose control, would be unable to escape from a fire	5	20	25
Less vigilant with children – includes can’t be looking after the kids	4	7	11
No response, no opinion on this, don’t see this as a problem, don’t see the connection	1	9	10
Heaters and open fires – includes keep away from the heater, no fires	1	5	6
Other – if drink have someone who stays sober	0	1	1

Table 9

Response to the questions: “Thinking about families with babies, toddlers and/or older pre-school children, anything about electric blankets?” and “Thinking about families with babies, toddlers and/or older pre-school children, anything about use of electric blankets, maintenance of electric blankets?”

	Maori n=26	Non-Maori n=64	Total n=90
Don’t have/use them – includes because of fire risks, prefer hot water bottles, prefer lots of blankets	19	30	49
Need checking regularly	6	41	47
Problem with overheating – includes must be turned off before getting into bed tend to forget, should not be left on during the day, tend to leave them on when sleeping	7	27	34
Problems with children’s use of – includes wet beds, they can short circuit wiring when wet, roughen them up, play with them, turn them on themselves, check child’s frequently at night, tell children not to turn them on	3	26	29
For safe use old blankets should be thrown out, should not be folded, should be rolled up over summer	5	10	15
Bad experiences with them – includes waking up in smoke filled room, neighbour’s house burned down, brother burned back, sister had a fire, as a child mine caught fire	0	8	8

Table 10

Response to the question: “Thinking about families with babies, toddlers and/or older pre-school children and fire risks, anything about wiring, or heater cords?”

	Maori n=26	Non-Maori n=64	Total n=90
Damaged cords can be a fire risk	13	40	53
House wiring can be a fire risk – wiring needs to be checked, power points should not be overloaded	9	17	26
Only electricians should do repairs	0	6	6
Plugs – includes don’t overload plugs, short circuit plugs can spark	0	5	5

Table 11

Response to the question: “Thinking about families with babies, toddlers and/or older pre-school children and fire risks, anything about keeping an eye on young children?”

	Maori n=26	Non-Maori n=64	Total n=90
Watch them all the time	11	31	42
Can’t watch all the time	8	16	24
Heaters/fires – have to watch them near heaters, use fire screen	4	16	20
Matches/lighters/cigarettes – keep matches and lighter away from children	3	11	14
Make environment safe for children – keep them out of the kitchen	3	8	11
Educate children – includes tell them where they are not allowed to go, keep them aware, make sure they know how to escape from the house	3	3	6
Other – includes don’t ask others to watch, must know all danger areas in house, don’t sleep in the mornings	1	1	2

Table 12

Response to the question: “Moving on to another question now, are there things that you do to make sure you do not have a fire in your own home?”

	Maori n=26	Non-Maori n=64	Total n=90
Fire escape/control – includes smoke/fire alarm installed or checked regularly, have small extinguisher, have escape plan	5	23	28
Check around house before going to bed – includes check fire burnt down, heaters off, oven off, smokes, mains off, ashtrays wetted, candles out, door shut	12	11	23
Lighters/matches kept up high/in a specified safe place care with lighters and matches	13	18	31
Care with combustibles close to fire/heater – includes do not dry clothes, no papers stored nearby	2	16	18
Care with stove – includes switch off at wall, check elements	5	10	15
Care with other appliances and heat sources – includes dryer, mains, gas bottle in heater, appliances in general, candles	6	4	10
Do not leave cooking unattended	0	9	9
Maintain appliances – includes checked regularly	1	4	5
Care with inflammable materials –includes disposing of ashes ,empty ashtray in sink/fire, use ashtrays, hot ashes from fire in fire proof bin	0	1	1

Table 13

Response to the question: “Thinking about families with babies, toddlers and/or older pre-school children and security against intruders, is there anything about locked doors and fire risks?”

	Maori n=26	Non-Maori n=64	Total n=90
Doors locked but easy to open	10	27	37
Doors locked and not easy to open	7	14	21
Need an escape plan for family	4	10	14
Use window to escape	1	13	14
Do not see it as a problem	4	4	8
Recognise problem but see no solutions	0	4	4

Table 14

Response to the question: “Suppose you and your children couldn’t get out of the house through the front or back door because of flames or smoke, do you know of alternative ways out of your house?”

	Maori n=26	Non-Maori n=64	Total n=90
Could use windows – includes break them	23	46	69
Only some windows are suitable	1	8	9
Other doors available	1	6	7
Other – includes have a fire escape, would use telephone for help, escape routes already planned, not sure	1	5	6
Windows unsuitable and no other options – includes most windows too small, windows are too high	0	4	4

Table 15

*Response to the question: “We’ve talked about some of the things that might cause fires, and some of the things that you do to make sure there isn’t a fire in your home, but suppose there was a major fire in your house when you and your children were at home, what would you do **first**?”*

	Maori n=26	Non-Maori n=64	Total n=90
Get children and self out first	24	59	83
Others – includes call fire brigade, don’t know, put wet blankets around first, children know family escape plan, turn off mains	2	4	6

Table 16*Response to the question: "Are there any other things you would do?"*

	Maori n=26	Non-Maori n=64	Total n=90
Call fire brigade – includes from neighbours, from portable	15	40	55
Other – take possessions/push alarms, go to neighbour	4	14	18
Prevent spread – includes turn off at mains, shut doors if possible	5	7	12
Get animals out	2	8	10
Get out with children	3	3	6
Get children well away	1	4	5
Kids know escape plan	1	0	1

Table 17*Response to the question: "Suppose the house was filled with smoke, what would you do to get yourself and your children out?"*

	Maori n=26	Non-Maori n=64	Total n=90
Crawl – includes try to close doors as well as crawl, cover faces with wet cloths if possible, cover with blanket if possible	22	56	78
Other – includes get out (no other strategy), break fire alarm, contact fire service, get out window or nearest exit, don't know, cover face with wet cloth and get out (not crawling)	2	8	10
Don't know	1	1	2

Table 18*Response to the question: "Suppose your clothes or your children's clothes were on fire, what would you do?"*

	Maori n=26	Non-Maori n=64	Total n=90
Drop and roll – includes stop, drop and roll	14	28	42
Wrap in blanket/ towels and roll – includes wrap in wet towel	6	19	25
Wrap in blanket/towels	2	13	15
Use water – use shower, bucket of water	5	10	15
Take clothes off	2	6	8
Other – includes panic, roll outside, my carpet is nylon and would melt	0	4	4
Beat at fire	0	2	2

Table 19

Presence of Smoke Alarms

	Maori n=26	Non-Maori n=64	Total n=90
No smoke alarm/s	8	18	26
Smoke alarm/s installed	17	45	62
Smoke alarm purchased but not installed	1	1	2

Table 20

Reasons for not having a smoke alarm

	Maori n=8	Non-Maori n=18	Total n=26
Mean to get one but haven't got around to it / forgot about it	4	7	11
Too expensive	0	1	1
Haven't thought about getting one	1	1	2
Don't like the idea	1	0	1
Other	2	5	7

Table 21

Situation of Smoke Alarms

	Maori n=14	Non-Maori n=36	Total n=50
Hall	11	36	47
Bedroom	5	17	22
Lounge	7	22	29
Kitchen	6	12	18
Other	3	7	10

Table 22

Smoke Alarm Currently Working

	Maori n=17	Non-Maori N=45	Total n=62
Yes	12	38	50
Don't know	4	2	6
No – got a flat battery	0	1	1
No – battery taken out as went off at wrong times	1	2	3
No – battery taken out as needed for something else	0	0	0
No – other reason	0	2	2

APPENDIX 9B:

TABLES RELATING TO OLDER PEOPLE DATA

Table 1

Response to the question: Firstly, what do you think are the main causes of house fires, particularly for older people?

	Maori n=27	Non-Maori n=33	Total n=60
Heat sources left on – includes stove, electric blankets, heaters	12	15	27
Combustibles too close to heat source – includes falling over heater/fire, sitting too close, drying clothes too close	7	12	19
Not extinguishing cigarettes properly – includes falling asleep while smoking, smoking in bed, being distracted while smoking	7	10	17
Unattended cooking – includes being distracted by telephone, falling asleep, leaving kitchen while element on	3	14	17
General absentmindedness/ forgetfulness	6	9	15
Other – includes rubbish left lying around, general physical infirmity, candles, old wooden houses, poverty	5	4	9
Old/faulty appliances, old wiring	4	3	7
Children and matches and lighters	1	1	2

Table 2

Response to the question: “Have you any thoughts about fire dangers with heaters/ open fires?”

	Maori n=27	Non-Maori n=33	Total n=60
Distrust open fires – includes fire guard needed, sparks can fall out, wood can fall out, fall asleep and forget it, forget to put guard up	13	19	32
Combustibles too close to heat source – drying clothes, sitting or standing too close to heater	7	9	16
Falling over/heater falling over – includes bar heaters are a risk	3	6	9
Heaters – bar heaters are unsafe, heaters require maintenance	4	5	9
Not turning appliances off – includes electric blanket, heater	4	3	7
Fire maintenance – includes chimneys need cleaning	2	3	5

Table 3

Response to the question: “Any thoughts about heaters/fires and things being on or near them?” “Any thoughts about clothes dryers?”

	Maori N=27	Non-Maori n=33	Total n=60
Combustibles too close to heat source – people too close, falling asleep, drying clothes	18	20	38
Danger of clothes dryer overheating – includes don’t go out leaving it on, need safety switches	4	5	9
Lint needs to be cleaned from clothes dryer for fire safety	3	6	9
Other – don’t use heaters	0	1	1

Table 4

Response to the question: “Any thoughts about fire risks when cooking with gas or electricity?”

	Maori n=27	Non-Maori n=33	Total n=60
Tendency to forget cooking if distracted – includes use several timers, leave the oven, get distracted easily	8	16	24
Gas cooking perceived to be more dangerous	8	5	13
Fire risk of combustibles left near/ on elements on stove	4	6	10
Cooking with fat/oil	4	4	8

Table 5

Response to the question: “Anything about cooking with fat or oil and fire risks?”

	Maori n=27	Non-Maori n=33	Total n=60
Caution in cooking with fat or oil – includes use a very small amount, don’t over head, don’t leave unattended, keep lid handy	18	29	47
Knowledge of appropriate strategies if cooking does catch fire – includes don’t throw water on it, put lid on	3	3	6

Table 6*Response to the question: "Anything about cigarettes and fire risks?"*

	Maori n=27	Non-Maori n=33	Total n=60
Not extinguishing cigarettes properly – includes putting down cigarette and forgetting about it	10	12	22
Fire risk of falling asleep while smoking – includes smoking in bed or bedroom	9	9	18
Don't leave matches and lighters lying around if children are present	4	1	5
Smokers go outside to smoke	4	1	5
Smoking dangerous when drinking	4	1	5

Table 7*Response to the question: "Anything about extinguishing cigarettes and fire risks?"
Anything about lighters or matches and children?"*

	Maori n=27	Non-Maori n=33	Total n=60
Keep lighters away from children – includes have a specific place where they are hidden when children visit	16	17	33
Cigarettes should be properly extinguished – includes ashtrays should be provided, butts should be wet, empty ashtrays carefully	12	16	28
Other – shouldn't smoke in bedroom	0	1	1

Table 8*Response to the question: "Anything about alcohol and fire risks?"*

	Maori n=27	Non-Maori n=33	Total N=60
Smoking – includes liable to drop cigarettes, fall asleep, not extinguish cigarette	11	7	18
Alcohol makes you less able to cope – includes more likely to fall asleep, forget heaters, problem when living alone, alcohol makes you over confident/careless, less able to deal with crisis situations	7	11	18
Cooking – includes liable to fall asleep, forget to turn it off, particularly dangerous if using fat	5	5	10
Not a problem, hadn't thought about it	2	2	4

Table 9

*Response to the question: “Anything about electric blankets and fire risks?”
 “Anything about use of electric blankets and fire risks?” “Maintenance of electric blankets and fire risks?”*

	Maori n=27	Non-Maori n=33	Total n=60
Regular checking/maintenance important	19	27	46
Fire risk from overheating – includes don’t switch on if going out of house, switch off when getting into bed	11	17	28
Fire risk if folded	6	6	12
Other – children should not have them, cheap blankets from op shops dangerous, MED used to do checks free. Should be free check available	7	4	11
Don’t use them because of fire risk	2	7	9
Problem with getting wet – includes bed wetting	2	2	4

Table 10

Response to the question: “Anything about clutter around doors and exits and fire risks?” “And clutter near heaters and open fires?”

	Maori n=27	Non-Maori n=33	Total n=60
Clutter prevents easy movement – includes prevents easy exit in fire, danger of falling over things	18	21	39
Clutter near a heat source is a fire risk – includes if stored near fires, can catch a spark from fire	14	10	24
Clutter is a fire hazard – includes stacked newspapers, cardboard boxes, a dropped match can smoulder for a long time	6	6	12
Managing clutter can be a problem for elderly – lifetime accumulation, lack the energy to clear clutter	2	7	9
Other – includes don’t have any clutter, keep all rubbish in a safe place, never thought about it	1	4	5

Table 11

Response to the question: “Anything about wiring, or heater cords and fire risks?”

	Maori n=27	Non-Maori n=33	Total n=60
House wiring needs to be checked/maintained	19	15	34
Damaged cords are a fire risk	10	14	24
Don’t overload plugs	4	6	10
Cords can be tripped over by elderly and can fall on heater	0	2	2

Table 12

Response to the question: "Thinking about security against intruders, anything about locked doors and fire risks?"

	Maori n=27	Non-Maori n=33	Total n=60
Don't see it as a problem – exit is simple – includes don't lock doors, keys are kept in doors, windows open easily	17	12	29
Recognise problem – concerned about escape in fire	2	12	14
Recognise problem – concerned about rescue in fire	3	7	10

Table 13

Response to the question: "Moving on to another question now, are there things that you do to make sure you do not have a fire in your own home?"

	Maori n=27	Non-Maori n=33	Total n=60
Check appliances (off before going out/going to bed) – includes stove, fire/heater, switch off everything at the wall, remove all plugs at night, try to be last to leave the house so that I can check	18	17	35
Attend to cooking – includes don't leave cooking unattended, always switch off stove if distracted, use a timer for cooking	4	6	10
Keep house free of clutter – includes paper	2	4	6
Open fires/flames – includes no candles, ashes put in fire proof container, use fire guard, no open fires	5	1	6
Cigarettes – includes make sure extinguished, smoke outside	3	3	6
Others – watch children in case they play with lighters, house rewired, don't cook with oil in oven, keep up maintenance	2	2	4

Table 14

Response to the question: "We've talked about some of the things that might cause fires, and some of the things that you do to make sure there isn't a fire in your home, but suppose there was a major fire in your house, what would you do first?"

	Maori n=27	Non-Maori n=33	Total n=60
Get out	11	11	22
Call fire brigade	5	11	16
Try to contain/extinguish	5	7	12
Get others out – includes pets	3	3	6
Other – smash the fire alarm glass, get valuables out	3	1	4

Table 15

Response to the question: “Are there any other things you would do second and third?”

	Maori n=27	Non-Maori n=33	Total n=60
Call fire brigade – includes from a neighbour’s house	15	9	24
Get out	7	15	22
Try and contain/extinguish fire	7	6	13
Get others out – include pets	6	5	11
Other – includes get warm clothes, collect personal papers, set off fire alarm, press life link/medi aid	2	6	8

Table 16

Response to the question: “Suppose the house was filled with smoke, what would you do to get out?”

	Maori n=27	Non-Maori n=33	Total n=60
Crawl below smoke/down low and move	22	26	48
Get out	4	4	8
Don’t know	1	2	3

Table 17

Response to the question: “Suppose your clothes were on fire, what would you do?”

	Maori n=27	Non-Maori n=33	Total n=60
Roll – includes drop and roll	18	10	28
Wrap in blanket/ towels and roll	2	7	9
Wrap in blanket/towels	4	4	8
Use water	3	4	7
Pull clothes off	3	3	6
Beat at fire – includes with cushions or blanket	0	2	2
Go outside and roll	0	2	2
Other – includes I wear wool which only smoulders	1	1	2

Table 18

Response to the question: “Suppose you couldn’t get out of your house through the front or back door because of flames or smoke. Do you know of alternative ways out of your house? What are these?”

	Maori n=27	Non-Maori n=33	Total n=60
Go through window – includes break window	19	21	40
No (easy) alternative exit – windows too high off ground/difficult to get out of	5	6	11
Other doors available – includes ranch sliders	4	8	12

Table 19

Response to the question: “How would you contact the Fire Service if there was a fire?”

	Maori n=27	Non-Maori n=33	Total n=60
Dial 111	23	31	54
No phone	2	0	2
Got the number by the phone	0	1	1

APPENDIX 9C: TABLES RELATING TO CARERS' DATA

Table 1

Response to the question: "Firstly, what do you think are the main causes of house fires, particularly for older people?"

	Total n=30
Unaware of what they are doing – includes turning stove elements on but not cooking; putting things on heater; cords/cloths across elements, leaving heat sources on, including electric blankets	18
Unattended cooking – includes falling asleep while cooking, being distracted from cooking	10
Not extinguishing cigarettes properly – includes falling asleep while smoking; smoking in bed; being distracted while smoking, smoking while drinking	8
Combustibles too close to heat source – includes falling over heater/fire; sitting/standing too close; drying clothes too close	6
Other includes rubbish left lying around; general physical infirmity; candles; types of materials used in houses these days; poor housing	3
Inability to respond – includes not as "fit" as they think they are	2

Table 2

Response to the question: "Have you any thoughts about fire dangers with heaters/open fires?"

	Total n=30
Open fires and fire guards – includes fire guard needed	14
Combustibles too close to heat source – draping things over to dry standing/sitting too close	8
Falling over heater/heater falling over – includes bar heaters are a risk here	8
Heaters – bar heaters are unsafe; does not use a heater now (goes to bed), heaters too dangerous	7
Fire maintenance – includes keeping chimney swept	5

Table 3

Response to the question: "Any other thoughts about heaters/fires and things being on or near them?" "Any thoughts about clothes dryers?"

	Total n=30
Combustibles too close to heat source – standing/sitting too close; clothes too close	21
Lint needs to be cleaned from clothes dryer for fire	6
Danger of letting clothes dryer overheat – includes don't go out leaving it on; need safety switches; overloading	3
Other – keep heater in the open	1

Table 4

Response to the question: “Any thoughts about fire risks when cooking with gas or electricity?”

	Total n=30
Unattended cooking	12
Inappropriate behaviour in kitchen – includes they don’t turn off stoves; putting plastic plates on element; putting elements on high and leaving them	8
Other – includes electricity more dangerous as you can’t see it; some old people have no sense of smell; stove disconnected as it is too big a risk	5
Gas cooking perceived to be more dangerous	4
Combustibles left near/on elements	4

Table 5

Response to the question: “Anything about cooking with fat or oil and fire risks?”

	Total n=30
Cooking must not be allowed to overheat, always turn off when you have a distraction; they leave stove and start a fire	18
Try to avoid cooking with fat or oil	5
Other – include he follows notes she put up; use microwave; stove disconnected as too big a risk; unreliable and likely to do something silly; keep curtains away	5
Knowledge of appropriate strategies if cooking does catch fire – includes don’t throw water on it; put lid on; starve of oxygen; fire extinguisher in kitchen; do wrong thing ad run to tap	4

Table 6

Response to the question: “Anything about cigarettes and fire risks?”

	Total n=30
Keep lighters away from children, have some-free house	19
Not extinguishing cigarette properly – includes going to sleep with cigarette in hand; smoking in bed; keep in ashtray and empty when cold; put out properly outside	11
Smokers sent outside	4

Table 7

*Response to the question: “Anything about extinguishing cigarettes and fire risks?”
“Anything about lighters and matches and children?”*

	Total n=30
Have specific places to hide matches and lighters from children	11
Care with lighted cigarettes and matches; extinguish always in ashtrays; watch where putting butts out	10
Smoking and falling asleep – includes smoke in bed; falls down couch and smoulders	3

Table 8*Response to the question: "Anything about alcohol and fire risks?"*

	Total n=30
Generally alcohol makes you less able to cope – forget to turn things off, fall asleep and not notice fire danger	15
Cooking – includes liable to fall asleep; forget to turn it off	7
Smoking – includes liable to drop cigarettes; fall asleep; not extinguish cigarette; cigarette falls down side of sofa	1

Table 9*Response to the question: "Anything about electric blankets and fire risks?"**"Anything about use of electric blankets and fire risks?" "Maintenance of electric blankets and fire risks?"*

	Total n=30
Regular checking/maintenance important – includes needs to be free, used to be free	22
Fire risk from overheating – includes turn off before getting into bed	18
Fire risk if folded	6

Table 10*Response to the question: "Anything about clutter around doors and exits and fire risks?"*

	Total n=30
Clutter prevents easy escape – includes keep doorways clear	18
Clutter near heat sources	7
Some elderly not able to manage clutter – need help	6
Clutter acknowledged to be a problem – reason not given	3

Table 11*Response to the question: "Anything about wiring, or heater cords and fire risks?"*

	Total n=30
House wiring, cords should be maintained regularly	21
Cords can be risk for elderly – includes can fall over heater, cords across elements	10
Appliances not maintained – includes appliances get older with their owners and not checked/replaced; need family to help	3

Table 12*Response to the question: "Anything about locked doors and fire risks?"*

	Total n=30
Recognise problem – concerned about escape in fire – includes can't get out easily; keys kept separately; deadlocks are a problem	15
Don't see it as a problem – exit is simple – includes don't lock doors; keys are kept in doors; flick locks	10
Recognise problem; concerned about rescue in fire – includes can be rescued if doors locked	8
Don't see problem – security is a greater priority than fire escape	2

Table 13*Response to the question: "Moving on to another question now, are there things that you do to make sure there is not a fire in the house/flat where the person/s you care for lives?"*

	Total n=30
Check appliances – includes turned off, fire out, things not on heaters, unplug cords	20
Other – shut doors, no candles, childproof house	6
Smoke alarms – includes battery operating	5
Safe cooking	2
Keep house clear of clutter	2

Table 14*Response to the question: "Suppose there was a major fire in the house where the person/s you care for lives, and you were in the house at the time, what would you do first?"*

	Total n=30
Get others out – includes person cared for	23
Get self out	4
Dial 111/call fire brigade	3
Try to contain/extinguish fire	0

Table 15*Response to the question: "Are there any other things you would do?"*

	Total n=30
Call fire brigade – includes from a neighbour's house	21
Get out – includes look after myself	12
Try to contain/extinguish fire	5
Get others out – includes person cared for	3
Other – includes get warm clothes; collect personal papers; set off fire alarm; press life link/medi aid	2
Make sure all out, check others safe	1

Table 16*Response to the question: "Suppose the house was filled with smoke, what would you do?"*

	Total n=30
Crawl below smoke/get down low and move	22
Get out (not crawling) – includes wrap towel round face; run	7
Don't know	1

Table 17*Response to the question: "Suppose your clothes or those of the person/s you care for were on fire, what would you do?"*

	Total n=30
Wrap in blanket/ towels and roll	14
Roll – includes drop and roll	9
Wrap in blanket/towels	6
Use water	3

Table 18*Response to the question: "Suppose it wasn't possible to get out of the house through the front or back door because of flames or smoke. Do you know of alternative ways out of the house where the person/s you care for lives? What are these ways?"*

	Total n=30
Go through window – includes break window	21
No (easy) alternative exit – includes windows too high off ground; would never be able to get person cared for out; would have to get help	8
Other doors available – includes ranch sliders	2

APPENDIX 10

DESIGN BRIEF

“Improving the fire safety of vulnerable groups project”

Development brief for posters and accompanying leaflets to reduce the risk of the target audiences being involved in fire fatalities

The idea is to produce resources specifically aimed at the target audiences and customised to address their particular house fire risks.

Target audiences

1. Parents or other primary caregivers of pre-school children

Specifically, low-income Maori and non-Maori parents of at least one preschool child who live with the child at least some of the time, or other adults who care for a pre-school child at home (as opposed to carers at daycare or childcare). Pre-school children means all children under five years, including babies, toddlers and older children who have not started school.

Purpose of the posters and accompanying leaflets

To educate parents to reduce the risks of the family being involved in a house fire, and family members (most likely children) dying in the fire.

Contributing risk factors

a. Most significant risk factors:

- Parent who smokes and/or other occupants or visitors who smoke
- Children obtaining and playing with lighters or matches
- Limited supervision of preschool children

In our study of 90 low-income families with preschool children at 14 sites, 75 percent of parents in the Maori sample and 50 percent of parents in the non Maori sample smoked. In nearly all cases we interviewed one parent, and in nearly all cases this was the mother. Of those who didn't smoke many mentioned live-in or visiting partners, family members and friends who smoked. One mentioned a boarder who smoked. Thus, the preschool children were very likely to be living in an environment where there was smoking, and lighters or matches were present because they were needed to light cigarettes. Some parents reported that smoking was only allowed outside the house but this does not reduce the presence of lighters or matches in the child's environment.

At particular risk are families where smoking is present and where a parent has identified a child/ren as “tutu”—i.e., curious, mischievous, or very interested where lighters and matches are concerned. Sometimes there is an established behaviour and the child/ren who start a house fire by playing with matches or lighters have been found by an adult playing with lighters or matches on a previous occasion.

b. Significant risk factors:

- parents or children placing “combustibles” too close to a heat source
- use of free standing heaters (may fall over)
- unattended cooking by parents
- parents smoking under the influence of alcohol resulting in cigarettes not being properly extinguished.

Ideas for developing concepts for posters and leaflets to reduce the likelihood of children playing with lighters and matches

a. Gaining attention of target group by showing visuals of young children and/or addressing parents with questions such as: “are you the parent of a young child? a baby? a toddler? or older preschool child?”

b. Asking “do you or other family members or friends smoke?” or assume they do smoke

c. Presenting the following messages explicitly or implicitly:

- If you answered yes to these questions your children are at greater risk of dying in a house fire than other young children. This is because lighters and matches are sometimes left lying around. Children have seen adults using lighters or matches to light their cigarettes many times and as they get a little older they want to play with the lighter too, even though you tell them not to. Children are naturally curious and are drawn to try out new things even when they are told they are dangerous.
- There is only one way to keep your children safe from house fires involving them playing with lighters and matches. Keep your lighters and matches away from children at all times. Always know where your lighters and matches are – keep them in your pocket or in a container around your waist or neck. Don’t leave them on top of the fridge, on a high shelf, or in the car. Children can climb up and get them when you are not in the room, not around or not watching them.
- Some children, just like your children, do get hold of lighters or matches and play with them and every year some children die. This doesn’t have to happen. It doesn’t have to be like this. There is a choice.
- Choose to:

Protect your children - make sure they have no chance of playing with lighters or matches. Ever.

Always know where your children are and what they are doing.

Check them often when they are playing. Look and listen.

Always know where your lighters and matches are.

Check your pockets, the container around your waist or the container around your neck often and make sure your lighter is where you think it is. Only have one lighter/ or one box of matches.

Keep your lighter or matches on you at all times.

To protect your children, insist your partner, family, and friends follow these guidelines too.

Ideas for developing concepts for leaflets to reduce the likelihood of house fires and fatalities caused by other factors

Use the Fire Service's existing messages about ways of preventing house fires and fire escape to produce brochures which show parents and young children.

2. Older people and/or their carers

Maori and non-Maori people aged 60-65 and over (especially those 70-75 and over), living in their own homes and not in residential care. (Originally we used published information to define older people as 65 and up, but our experience of interviewing older Maori has led us to revise this. A number of the older Maori we interviewed were aged between 60 and 65 years. This reflects the lower life expectancy of Maori and should be taken into account).

The carers of older people. This includes family members, friends, professional carers and others who have a formalised relationship as a carer of an older person. It also includes family members, neighbours, friends and others who don't have a formal carer relationship but who may "keep an eye on" the older person, take an interest in them, or play an active role in some way in their safety and well-being. Carers should be people who can positively influence the fire safety practices of the older person.

Purpose of the posters and leaflets

To educate older people and/or their carers to reduce the risks of the older person being involved in a house fire and dying in a house fire.

Contributing risk factors

a. Most significant:

- Falling asleep while smoking (excessive consumption of alcohol may be involved as well, but not necessarily so)
- Unattended cooking
- Leaving appliances on unintentionally
- Combustibles too close to a heat source
- Slowness in getting out in the event of a fire because of such factors as: physical limitations, trying to put fire out, collecting possessions, e.g., photographs or pets, phoning the fire brigade from inside the burning house, lack of smoke alarms to provide earlier warning of the fire, and going back inside.

Taking into consideration the general characteristics of older people, it was decided to focus on behaviours, which could be changed relatively easily and where the changed behaviour could be sustained over time. This ruled out the unsafe practices associated with forgetfulness, falling asleep unintentionally or smoking. With this in mind, the decision was made to: (1) encourage the installation of smoke alarms to increase the likelihood that with earlier warning of a fire older people could "buy" a little more time to use for escape, and (2) promote the messages of getting out as the first priority and not going back inside.

Concepts for posters to improve the likelihood of successful escape

Targeting older people

- a. Smoke alarms save lives – contact your local Fire Service now for help in installing and maintaining smoke alarms in your house.
- b. In a fire, make getting out your first priority and call the Fire service from a neighbour's house. Don't go back inside once you are out. Work out the different ways you could get out of your house if there was a fire and practice using these.

Targeting carers

- a. Smoke alarms save lives - help the older people in your life to get smoke alarms installed and see that these are maintained. Install them in your own house too. Your local Fire Service can provide assistance.
- b. In a fire, make sure the older person in your life knows to get out straight away, stay out of the house and phone the Fire Service from a neighbour's house. Help the older person identify the different ways out of their house and practice using these.

Ideas for developing concepts for leaflets to reduce the likelihood of house fires and fatalities caused by other factors

Use the Fire Service's existing messages about ways of preventing house fires and fire escape to produce brochures using visuals of older people and the carers of older people.

REFERENCES

- Ahrens, M. (1998a). *Socio-economic factors package*. Quincy, Massachusetts: National Fire Protection Association.
- Ahrens, M. (1998b). *US experience with smoke alarms and other fire alarms: Who has them? How well do they work? When don't they work?* Quincy, Massachusetts: National Fire Protection Association.
- Ahrens, M. (1999). Risky behaviour. *NFPA Journal*, Jan/Feb, 42–47.
- Appy, M. (1997). One size doesn't fit all. *NFPA Journal*, May/June, 45.
- Appy, M. (1999a). Remembering when. *NFPA Journal*, March/April, 40.
- Appy, M. (1999b). The great escape works. *NFPA Journal*, May/June, 64.
- Bannerman, D. J., Sheldon, J. B., & Sherman, J. A. (1991). Teaching adults with severe and profound retardation to exit their homes upon hearing the fire alarm. *Journal of Applied Behaviour Analysis*, 24(3), 571–577.
- Baskett, P. (1994, November 16). Fired with safe enthusiasm. *The New Zealand Herald*, p. 2/6.
- Beever, P., & Britton, M. (1999). *Research into cost-effective fire safety measures for residential buildings*. Melbourne: Victoria University of Technology, Centre for Environmental Safety and Risk Engineering.
- Benthorn, L., & Frantzich, H. (1996). *Fire alarm in a public building: How do people evaluate information and choose evacuation exit?* Lund: Lund University, Institute of Technology, Department of Fire Safety Engineering.
- Boot, G., & Treep, L. (1990). *Alcohol and fires: A literature review*. Wellington: Victoria University, Department of Anthropology.
- Brennan, P. (1996). Impact of social interaction on time to begin evacuation in office building fires: Implications for modelling behaviour. In *Interflam '96: Seventh International Fire Science and Engineering Conference, 26–28 March, 1996*. London: Interscience Communications, 701–710.
- Brennan, P. (1998). Victims and survivors in fatal residential building fires. In J. Shields (Ed.), *Human behaviour in fire: Proceedings of the first international symposium* (pp. 157–166). Ulster: University of Ulster, Fire Safety Engineering Research and Technology Centre.
- Brereton, S., & Laing, R. M. (1992). Analysis of injury and death from burning upholstered furniture. *New Zealand Medical Journal*, 105, 429–432.
- Brown, J. (1999). Child's play. *Fire Prevention*, 319, 28–29.
- Bryan, J. (1983). A review of the examination and analysis of the dynamics of human behaviour in the fire at the MGM Grand Hotel, Clark County, Nevada, as determined from a selected questionnaire population. *Fire Safety Journal*, 5 (3/4), 233–240.
- Bryan, J. L. (1997). Human behaviour and fire. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association, 8/3–8/30.
- Buchanan, A. H. (1996). The “culture” of performance-based fire codes. In *Proceedings, 1996 international conference on performance based codes*, 119–125.

- Building Research Establishment. (1993). Human behaviour in fire. *BRE Digest*, 388, 1–4.
- Burning issues. (1996). *NFPA Journal*, Jan/Feb, 104. In M. Ahrens (1998), *Socio-economic factors package*. Quincy, Massachusetts: National Fire Protection Association.
- Canter, D. (Ed.). (1980). *Fires and human behaviour*. Chichester: John Wiley & Sons.
- Canter, D. (1980). Fires and human behaviour—An introduction. In D. Canter (Ed.). *Fires and human behaviour* (pp. 1–12). Chichester: John Wiley & Sons,
- Canter, D. (1980/81). Fires and human behaviour: Emerging issues. *Fire Safety Journal*, 3(1), 41–46.
- Canter, D., & Matthews, R. (1976). *The behaviour of people in fire situations: Possibilities for research*. Borehamwood, Herts: Department of the Environment, Fire Research Station, Building Research Establishment.
- Canter, D., Powell, J., & Booker, K. (1987). *Psychological aspects of informative fire warning systems*. (Building Research Establishment Report # 127). Borehamwood, Herts: Department of the Environment, Building Research Establishment. Fire Research Station.
- Carrol, P. (1998, June 27). Fire deaths: Cause for alarm. *The New Zealand Herald*, p. H11.
- Chandler, K. K. M., Crown, E. M., & Brown, S. A. (1991). Consumer information and education effects on knowledge and choice of fire resistant upholstery. *The Journal of Consumer Affairs*, 25(2), 339–357.
- Collier, P. (1998). *Fire statistics, estimates United Kingdom, 1997*. London: Home Office.
- Community Fire Safety Task Force. (1997). *Safe as houses: The report of the Community Fire Safety Task Force*. London: Home Secretary.
- Conley, C. J., & Fahy, R. F. (1994). Who dies in fires in the United States? *NFPA Journal*, May/June, 99–106. In M. Ahrens (1998), *Socio-economic factors package*. Quincy, Massachusetts: National Fire Protection Association.
- Constable, C., & Renwick, M. (1993). *Children's knowledge of fire safety—A report for the New Zealand Fire Service*. Wellington: New Zealand Council for Educational Research.
- Cote, A. E. (Ed.). (1997). *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association.
- Crean, M. (1998, July 31). Helping Christchurch aged out of the fear zone. *The Press*, p. 13.
- Cropp, D. (1991). *Fatal fires in New Zealand: Where, when and why they occur*. Wellington: New Zealand Fire Service.
- Decision Research Ltd. (1997). *Fire safety knowledge & practice 1997*. Wellington: Area Operations Centre, New Zealand Fire Service.
- Department of Emergency Services. (1998). *Fire fatalities: Who's at risk?* Kedron, Qld.: Department of Emergency Services. Strategic Management and Policy Unit, Strategic & Executive Services Division.
- Dowling, D. M. (1997). Child behaviour in fire. *Fire Engineers Journal*, July, 15–18.
- Dunn, K., & Renwick, M. (1995). *Children's knowledge of fire safety: Stage 2—The final report for the New Zealand Fire Service*. Wellington: New Zealand Council for Educational Research.
- Educating children to be fire safe. (1994). *Fire Prevention*, 269.
- Education about fire. (1975). (“Dear Chief Officer” Letter, 47/1975—[DCOL471975]). London: Home Office.

- Education is the key to reducing domestic fire deaths. (1995). *Fire Prevention*, 284.
- Elliot, N., Crump, J., McGuire, A., Bagshaw, S., & Chambers, S. (1999). Knowledge, attitudes and behaviour towards HIV infection among family planning clinic attendees: Changes between 1991 and 1997. *New Zealand Medical Journal*, 112, 121–3.
- Everyone's responsibility: Fire protection in the wildland/urban interface* (n.d.). http://www.firewise.org/pubs/everyones_resp/
- Fahy, R. F. (1993). Leaving children unsupervised is playing with fire. *NFPA Journal*, May/June, 54–58. In M. Ahrens (1998), *Socio-economic factors package*. Quincy, Massachusetts: National Fire Protection Association.
- Fahy, R. F., & Norton, A. L. (1985). How being poor affects fire risk. *Fire Journal*, Jan/Feb, 28–36. In K. D. Rohr (1998), *Special data information package—Rural fire studies*. Quincy, Massachusetts: Fire Analysis and Research, National Fire Protection Association.
- Fahy, R. F., & Proulx, G. (1997). Human behaviour in the world trade center evacuation. In *Fire Safety Science—Proceedings of the fifth international symposium*, 713–724.
- Federal Emergency Management Agency. (n.d.). *Children and fire: The experiences of children and fire in the United States*. Federal Emergency Management Agency, United States Fire Administration, National Fire Data Center. Available at <http://www.usfa.fema.gov/nfdc/reports.htm>
- Federal Emergency Management Agency. (1990). *Public fire education today: Fire service programmes across America*. Washington D.C.: Federal Emergency Management Agency.
- Federal Emergency Management Agency. (1997a). *Fire death rate trends—An international perspective*. Federal Emergency Management Agency, United States Fire Administration, National Fire Data Center. Available at <http://www.usfa.fema.gov/nfdc/reports.htm>
- Federal Emergency Management Agency. (1997b). *Socio-economic factors and the incidence of fire*. Federal Emergency Management Agency, United States Fire Administration, National Fire Data Center (FA 170). Available at <http://www.usfa.fema.gov/nfdc/reports.htm>
- Fire precautions in schools: Educational building note no. 18: A guide to fire safety in schools*. (1982). (“Dear Firemaster” Letter, 8/1982 [DFML81982]). Edinburgh: Scottish Office.
- Fire Protection Association. (1991). Smoke alarms cut home fire death rate by one third. *Fire Prevention*, 240.
- Fire Protection Association. (1992a). Fire '92 goes to Eastbourne—Juveniles and fire. *Fire Prevention*, 255.
- Fire Protection Association. (1992b). Playing with fire. *Fire Prevention*, 247.
- Fire Protection Association. (1993a). Tackling juvenile firesetters. *Fire Prevention*, 257.
- Fire Protection Association. (1993b). Targeting both educators and pupils. *Fire Prevention*, 259.
- Fire Protection Association. (1994a). Educating children to be firesafe. *Fire Prevention*, 269.
- Fire Protection Association. (1994b). Hampshire children learn not to burn. *Fire Prevention*, 271.
- Fire Protection Association. (1994c). Interactive fire safety education reaps rewards. *Fire Prevention*, 272.

- Fire Protection Association. (1995a). Concentrate on fire prevention, Audit Commission tells fire service. *Fire Prevention*, 277.
- Fire Protection Association. (1995b). Domestic fire safety—preventing fires in the home. *Fire Prevention*, 281.
- Fire Protection Association. (1995c). Education is the key to reducing domestic fire deaths. *Fire Prevention*, 284.
- Fire Protection Association. (1995d). Learning lessons from fire. *Fire Prevention*, 285.
- Fire Protection Association. (1995e). Safety in the community. *Fire Prevention*, 285.
- Fire Protection Association. (1996). Fire safety week conference, 30 September 1996. *Fire Prevention*, 294.
- FireNet. <http://online.anu.edu.au/Forestry/fire/firenet.html>
- Fleeton, M. W. (1980). Public and private adjustment to the bush fire hazard in Australia: Empirical evidence from New South Wales. *Australian Geographer*, 14, 350–359.
- Forsberg, P. (1994). *Fire prevention: An assessment of fire prevention educational programmes targeting adults aged 20–60*. (Executive Fire Officer Program, Applied Research Project). Emmitsburg, MD: National Fire Academy.
- Gamache, S. (1997). Reaching high-risk groups. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association, 2/41–2/54.
- Gilbert, S. (1979). *Fire prevention publicity: statistical analysis of the 1977 spaceheater campaign*. Group (FRDG Fire Research Reports and Memoranda, 5/79). London: Home Office, Fire Research and Development.
- Goddard, G., & Poole, J. (1996). *Fire statistics, UK 1994: Summary*. London: Home Office.
- Gomberg, A. (1982). Space heaters—rural death risk. *Fire Service Today*, September. In K. D. Rohr (1998), *Special data information package—Rural fire studies*. Quincy, Massachusetts: Fire Analysis and Research, National Fire Protection Association.
- Graham, R. A. (1998). A closer look at domestic fire deaths. In J. Shields (Ed.), *Human behaviour in fire: Proceedings of the first international symposium*. (pp. 439–446). Ulster: University of Ulster, Fire Safety Engineering Research and Technology Centre.
- Grant, E., Turner, E., Bartlett, M., Winbon, C., & Peterson, H. D. (1992). Evaluation of a burn prevention program in a public school system. *Journal of Burn Care & Rehabilitation*, 13, 703–707.
- Grisanzio, J. A. (1996). What do Americans know about fire safety? *NFPA Journal*, May/June, 77–79.
- Gunther, P. (1981). Fire-cause patterns for different socio-economic neighbourhoods in Toledo, Ohio. *Fire Journal*, May, 52–58. In M. Ahrens (1998), *Socio-economic factors package*. Quincy, Massachusetts: National Fire Protection Association.
- Gunther, P. (1982). Rural fire deaths: the role of climate and poverty. *Fire Journal*, July, 34–39, 112. In K. D. Rohr (1998), *Special data information package—Rural fire studies*. Quincy, Massachusetts: Fire Analysis and Research, National Fire Protection Association.
- Guy, C. (1998, January 28). Homes a burning issue. *NZ Herald*, p. A13.
- Hall, J. R., Jr. (1997a). *Fire in the USA and Canada through 1994: International fire comparison report # 2*. Quincy, Massachusetts: National Fire Protection Association.
- Hall, J. R., Jr. (1997b). *Fire in the USA and Japan through 1994: International fire comparison report # 1*. Quincy, Massachusetts: National Fire Protection Association.

- Hall, J. R., Jr. (1997c). *Fire in the USA and the United Kingdom through 1995: International fire comparison report # 4*. Quincy, Massachusetts: National Fire Protection Association.
- Hall, J. R., Jr. (1997d). Using data for public education decision making. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association, 2/12–2/20.
- Hall, J. R., Jr. (1998a). *Fire in the USA and Sweden through 1996: International fire comparison report # 3*. Quincy, Massachusetts: National Fire Protection Association.
- Hall, J. R., Jr. (1998b). *Patterns of fire casualties in home fires by age and sex, 1991–95*. Quincy, Massachusetts: National Fire Protection Association.
- Hall, J. R., Jr. (1998c). The other way cigarettes kill. *NFPA Journal*, Jan/Feb, 58–62.
- Hall, J. R., Jr. (1998d). *The US fire problem overview report: Leading causes and other patterns and trends*. Quincy, Massachusetts: National Fire Protection Association.
- Hansen, A. S., & Hovden, J. (1998). Do smoke detectors and portable extinguishers in residents affect fire safety. In J. Shields (Ed.), *Human behaviour in fire: Proceedings of the first international symposium*, (pp. 135–143). Ulster: University of Ulster, Fire Safety Engineering Research and Technology Centre.
- Hayden, M. F., & Lefcowitz, M. J. (1985). *Progress report for student research: Fire safety skills for mentally retarded children*. Madison: Wisconsin University, School of Social Work.
- Hillman, H. S., Jones, R. T., & Farmer, L. (1986). The acquisition and maintenance of fire emergency skills: Effects of rationale and behavioural practice. *Journal of Paediatric Psychology*, 11(2), 247–258.
- Holburn, C. S., & Dougher, M. J. (1985). The fire alarm game: Exit training using negative and positive reinforcement under varied stimulus conditions. *Journal of Visual Impairment and Blindness*, November, 401–403.
- Holmes, G. A., & Jones, R. T. (1996). Fire evacuation skills: Cognitive-behavioural versus computer-mediated instruction. *Fire Technology*, First Quarter, 50–64.
- Home Office. (1980). *The protection of life in domestic fires: Summary report*. (FRDG Fire Research Reports and Memoranda, 9/79). London: Home Office, Fire Research and Development Group.
- Home Office. (1982). *Fire prevention advice for the elderly*. London: Home Office (Fire Service Circular, 1/1982).
- Home Office. (1986). *Fire safety education for children*. (“Dear Chief Officer” Letter, 8/1986—H). London: Home Office.
- Hunt, J. H. (1996). Performance-based codes: The New Zealand experience. *Proceedings, 1996 international conference on performance based codes*, 17–28.
- Jennings, C. R. (1999). Socio-economic characteristics and their relationship to fire incidence: A review of the literature. *Fire Technology*, 35(1), 7–34.
- Jones, R. T., & Haney, J. I. (1983). *Refinement of a primary preventative approach to fire emergencies: A comparison of external and self-instruction strategies for training and maintaining fire emergency responding*. Paper presented at the 45th annual meeting of the Midwestern Psychological Association, Chicago IL, May 5–7.
- Jones, R. T., & Kazdin, A. E. (1980). Teaching children how and when to make emergency telephone calls. *Behaviour Therapy*, 11, 509–521.

- Jones, R. T., Kazdin, A. E., & Haney, J. I. (1981). Social validation and training of emergency fire safety skills for potential injury prevention and life saving. *Journal of Applied Behaviour Analysis*, *14*(3), 249–260.
- Jones, R. T., Ollendick, T. H., McLaughlin, K. J., & Williams, C. E. (1989). Elaborative and behavioural rehearsal in the acquisition of fire emergency skills and the reduction of fear of fire. *Behaviour Therapy*, *20*, 93–101.
- Jones, R. T., & Randall, J. (1994). Rehearsal-plus: Coping with fire emergencies and reducing fire-related fears. *Fire Technology*, *30*(4), 432–444.
- Kafry, D. (1980). Playing with matches: children and fire. In D. Canter (Ed.), *Fires and human behaviour*, (pp. 47–61). Chichester: John Wiley & Sons.
- Karter, M. J., & Donner, A. (1978). The effect of demographics on fire rates. *Fire Journal*, *Jan*, 53–65. In M. Ahrens (1998), *Socio-economic factors package*. Quincy, Massachusetts: National Fire Protection Association.
- Klem, T. J. (1984). The rural fire picture: a hidden story. *Fire Journal*, *September*, 21–27. In K. D. Rohr (1998), *Special data information package—Rural fire studies*. Quincy, Massachusetts: National Fire Protection Association.
- Kolko, D. J., & Kazdin, A. E. (1986). A conceptualisation of firesetting in children and adolescents. *Journal of Abnormal Child Psychology*, *14*(1), 49–61.
- Lewis, A. (1996). Children in fire: Are French children endangered by a lack of smoke alarms? *Fire Prevention*, *295*.
- Lopes, R. (1997). Designing disaster education programmes. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.) Quincy, Massachusetts: National Fire Protection Association.
- Lucht, D. A. (1999). *Second conference on firesafety design in the 21st century—Conference White Paper*. Worcester, Massachusetts: Worcester Polytechnic Institute. Available at <http://www.wpi.edu/Academics/Depts/Fire/Conf/whitepaper.html>
- McAra, K., & Hay, G. (1998, June 26). House fire alert. *The Press*, p. 13.
- McCabe, M., & Moore, H. (1990). Is national fire safety week a waste of time? *Fire Prevention*, *232*.
- McConnell, C. F., Dwyer, W. O., & Leeming, F. C. (1996). A behavioural approach to reducing fires in public housing. *Journal of Community Psychology*, *24*(3), 201–212.
- Marchant, E. W., & Idris, M. F. M. (1998). Attitudes to fire safety. In J. Shields (Ed.), *Human behaviour in fire: Proceedings of the first international symposium*, (pp. 761–768). Ulster: University of Ulster, Fire Safety Engineering Research and Technology Centre.
- Maslow, A. H. (1970). *Motivation and personality* (3rd ed.). New York: Harper & Row.
- Meacham, B. J. (1998). Integrating human factors issues into engineered fire safety design. In J. Shields (Ed.), *Human behaviour in fire: Proceedings of the first international symposium*, (pp. 47–58). Ulster: University of Ulster, Fire Safety Engineering Research and Technology Centre.
- Moyse, K. A. (1983). *Domestic smoke detectors: The American experience*. (FRDG Fire Research Reports and Memoranda, 22/83). London: Home Office, Fire Research and Development Group.
- National fire safety week launch is dedicated to the education of children. (1995). *Fire Prevention*, *284*.

- New Zealand Fire Service. (1993, June). Schools take S.T.E.P.S. to enhance security. *Parent & School*, 62–63.
- New Zealand Fire Service. (1998a). Fire safety campaign saves home. *Star*, 29, 1.
- New Zealand Fire Service. (1998b). Keeping the heat out of the kitchen. *Star*, 29, 3.
- New Zealand Fire Service. (1998c). *New Zealand Fire Service emergency incident statistics 1993–1997*. Wellington.
- New Zealand Fire Service. (1998d). *Star*, 29.
- New Zealand Fire Service Commission. (1997). *Annual report—Report of the New Zealand Fire Service Commission for the year ended 30 June 1997*. Wellington: Author.
- New Zealand Fire Service Commission. (1998). *New Zealand Fire Service Commission annual report for the year ended 30 June 1998*. Wellington: Author.
- Norton, A. L. (1989). The fire risks for the homeless. *NFPA Journal*, Nov/Dec, 29–37. In M. Ahrens (1998), *Socio-economic factors package*. Quincy, Massachusetts: National Fire Protection Association.
- O’Hagan, J., Robinson, G., & Whiteside, E. (1993). *Alcohol and drug problems: Handbook for health professionals*. Wellington: Alcohol Advisory Council of New Zealand.
- Porth, D. (1999). Playing with fire. *NFPA Journal*, Jan/Feb, 54–58.
- Powell, P. A. (1997). Fire and life safety education: Theory and techniques. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association, 2/30–2/40.
- Powell, P. A., & Appy, M. (1997). Fire and life safety education: The state of the art. In A. E. Cote (Ed. in chief). *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association.
- Powell, P. A., & Custer, R. L. P. (1998). Fire and life safety education: Bridging the gap between human behaviour and performance-based design. In J. Shields (Ed.), *Human behaviour in fire: Proceedings of the first international symposium*. (pp. 125–134). Ulster: University of Ulster, Fire Safety Engineering Research and Technology Centre.
- Powell, P. (author) Sneed, M., & Hall, R. (Eds.). (1997). *Fire and life safety educator* (2nd ed.). Oklahoma: Oklahoma State University, Fire Protection Publications.
- Proulx, G., & Sime, J. D. (1991). To prevent “panic” in an underground emergency: Why not tell people the truth? *Fire safety science—Proceedings of the third international symposium*, 843–852.
- Randall, J., & Jones, R. T. (1993). Teaching children fire safety skills. *Fire Technology*, 29(3), 268–280.
- Reynolds, C. (1996). *Study into the causes of fire deaths*. London: Home Office.
- Reynolds, C. (1997). *Causes of fire deaths: Summary report*. London: Home Office.
- Ribbe, D. P., & Jones, R. T. (1995). Use of videotaped peer modelling in the acquisition of emergency coping skills: Active versus passive strategies. *Fire Technology*, 31(3), 212–223.
- Rosenbaum, L. (1991). *A fire safety pre-educational plan*. Master of Science Practicum Report, Faculty of the Center for Advancement of Education, Nova University (ERIC Report ED333146).
- Rosenbaum, M. S., Creedon, D. L., & Drabman, R. S. (1981). Training pre-school children to identify emergency situations and make emergency phone calls. *Behaviour Therapy*, 12, 425–435.

- Rutstein, R., & Butler, A. J. (1977). *Cost effectiveness of fire prevention publicity: Final report on the 1976/77 fat pan fire publicity campaign*. (FRDG Fire Research Reports and Memoranda, 9/77). London: Home Office, Fire Research and Development Group.
- Saily, M. (n.d.). *Urban fire education: Seattle case study*. Washington: Federal Emergency Management Agency, US Fire Administration.
- Sampson, B. (1998, February 13). Fires call for fast action. *Otago Daily Times*, p. 17.
- Saunders, W. L. (1998). Comparison of behaviour in building and bushfire emergencies. In J. Shields (Ed.), *Human behaviour in fire: Proceedings of the first international symposium*. (pp. 181–190). Ulster: University of Ulster, Fire Safety Engineering Research and Technology Centre.
- Schaenman, P., & Gunther, P. (1997). Evaluation techniques for fire and life safety education. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association.
- Schaenman, P., Stambaugh, H., Rossomando, C., Jennings, C., & Perroni, C. (1990). *Proving public fire education works*. Arlington, Virginia: Tridata Corporation.
- Schuchard, W. F. (1997). Household fire warning equipment. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association.
- Schumacher, D. (1997). Using the media for educational outreach. In A. E. Cote (Ed. in chief), *Fire Protection Handbook* (18th ed.). Quincy, Massachusetts: National Fire Protection Association.
- Seaton, M. (1996). How different countries teach fire safety. *NFPA Journal*, May/June, 81–87.
- Sime, J. D. (1980). The concept of “panic”. In D. Canter (Ed.), *Fires and human behaviour* (pp. 63–81). Chichester: John Wiley & Sons.
- Sime, J. D. (1992). *Human behaviour in fires: A summary report*. (CFBAC/JCFR Research Report 45). London: Portsmouth Polytechnic, School of Architecture, Building Use and Safety Research Unit.
- Smith, G. A. (1990). *The role and effectiveness of public fire prevention education programmes*. (Brigade Command Course 01/90). Moreton-In-Marsh: Lincolnshire County Council Fire Brigade/Fire Service College.
- Squires, T., & Busuttil, A. (1995). Child fatalities in Scottish house fires 1980–1990: A case of child neglect? *Child Abuse & Neglect*, 19(7), 865–873.
- Stack, G. (1996). Taking fire safety seriously. *Fire Prevention*, 294.
- Stamps, J., White, F., Nichol, T., Lipnack, J., Strother, R., Powell, P., & Buchbinder, L. (1980). *Public fire education planning: A five step process*. Washington D.C.: Office of Planning and Education, United States Fire Administration, Federal Emergency Management Agency.
- Stop the home fires burning. (1995). *Consumer*, 338, 32–33.
- Strother, R. R., & Buchbinder, L. B. (1980). Communications strategies for fire loss reduction. In D. Canter (Ed.), *Fires and human behaviour*, (pp. 315–321). Chichester: John Wiley & Sons Ltd.
- Thompson, P. G., Somers, R. L., & Wilson, R. (1997). Recruiting older people to a home safety program. *Medical Journal of Australia*, 167, 439–440.

- Tucker, S. M. (1997). *Critical success factors in public education*. Emmitsburg, MD: National Fire Academy (Executive Fire Officer Program, Applied Research Project).
- Turner, L. (1998, May 18). Fighting fire—The silent killer. *New Zealand Woman's Weekly*, 20–21.
- Turner, M. (1990, October 28). Deaths mean tenants will learn fire safety. *Dominion Sunday Times*, p. 7.
- United States Fire Administration. (1998). *A profile of the rural fire problem*. United States Fire Administration, Federal Emergency Management Agency (FA-181/August 1998). Available at <http://www.usfa.fema.gov/nfdc/reports.htm>
- Wakelin, S. (1990, October). Be your own fire-fighter. *New Zealand Woman's Weekly*, 88–89.
- Walker, B. L. (1995). The effects of a burn prevention program on child-care providers. *Fire Technology*, 31(3), 244–264.
- Walker, B. L., Beck, K., Walker, A. L., & Shemanski, S. (1992). The short-term effects of a fire safety education program for the elderly. *Fire Technology*, May, 134–162.
- Whitaker, E. (1983). Education of the public and public relations in fire protection. *Fire Safety Journal*, 5(3/4), 241–249.
- Whittington, C., & Wilson, J. R. (1980). Fat fires: A domestic hazard. In D. Canter (Ed.), *Fires and human behaviour* (pp. 97–115). Chichester: John Wiley & Sons.
- Williams, A. W., & Hopkinson, J. S. (1985). *The behaviour of people in fires*. Garston: Fire Research Station, Building Research Establishment.
- Williams, C. E., & Jones, R. T. (1989). Impact of self-instruction on response maintenance and children's fear of fire. *Journal of Clinical Child Psychology*, 18(1), 84–89.
- Wolfe, A. (1997). Playing it safe. *NFPA Journal*, May/June, 58–63.
- Wolfe, A. (1998). The great escape. *NFPA Journal*, May/June, 74–78.
- Wood, P. G. (1972). *The behaviour of people in fires*. (Fire Research Note # 953/72). Fire Research Station, Department of the Environment and Fire Offices' Committee Joint Fire Research Organisation.
- Yoshida, Y. (1996). A study of evacuation behaviour in the World Trade Center explosion. *Fire Technology*, Second Quarter, 174–189.