

Fire Research Report

Fire incidents resulting in deaths of New Zealanders aged 65 and older 1991-1997

University of Otago

March 2001

A methodology is outlined for collating fire fatality data from the Fire Incident Recording System and New Zealand Health Information Service and linking with coroners' files to provide a comprehensive account of fire-related deaths in New Zealanders aged between 15 and 64 years in domestic fire incidents.

Mortality rates for people between the age of 65 and 74 years are consistent with that for younger adult age groups, but rates triple for each decade over the age of 75. The older age groups show increased mortality rates for women but this is consistent with the increased proportion of women in those age groups. Mortality rates are higher for Maori than for other New Zealanders aged 65 and over. A disproportionate number of victims in this age group lived alone. The most common location of origin for fatal fires was found to be bedrooms, followed by lounge and kitchen. Heating appliances were the main heat source with bedding the most common item ignited. The data highlights the high risk of fire in rest homes.

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Fire injury research team

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Table of contents

Introduction	4
Acknowledgements	5
Executive Summary.....	6
Recommendations.....	7
Background	8
Study aim and objectives.....	9
Methods	10
Results	11
Fatal fire incidents involving seniors.....	11
Unintentional domestic fire deaths.....	11
Personal characteristics.....	11
Fire characteristics.....	13
Environmental characteristics.....	15
Rest home fatal fires.....	16
Fatal fires in other non-domestic structures.....	16
Discussion	17
Data issues	17
Intervention strategies.....	18
Raising awareness.....	18
Addressing disparities	19
Heating	19
Cigarettes.....	20
Clothing design.....	20
Fire retardant furnishings.....	20
Smoke alarms	21
Sprinkler protection.....	21
Rest homes and other non-domestic structures	22
Addendum	23
References	24

Introduction

This report to the New Zealand Fire Service Commission describes features of structural fire incidents in Aotearoa New Zealand which resulted in the deaths of people aged 65 years and over in the years 1991-1997. The over 65 age group has been considered separately as it is likely that different factors are important for prevention policy in different age groups in the population. The focus of the report is on structural fire incidents which occurred in domestic locations. A domestic fire incident is a fire incident which occurred in a structure, or in mobile property being used as a structure, occupied by a household of one or more people. This definition of a structure is consistent with the census definition of a private dwelling (temporary or permanent). The report is one of a series contracted for in the New Zealand Fire Service Commission Contestable Research Fund for the 2000-2001 research year. Reports will also be presented on child injury from fire and flame, on fire-related mortality among adults aged 16-64 years, and an overall mortality review.

Acknowledgements

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Executive Summary

Data from the computerised Fire Incident Reporting System (FIRS) and New Zealand Health Information Service (NZHIS) were augmented by Fire Investigation Reports and coronial records to understand and identify personal, fire related, and environmental factors associated with deaths of New Zealanders aged 65 and over in structural domestic fire incidents.

In the years 1991 to 1997 the study identified 38 structural fire incidents in private dwellings which resulted in the unintentional deaths of 39 New Zealanders aged 65 years and over. The mortality rates in unintentional structural fire incidents in private dwellings increased with age from 0.6 per 100,000 person years at age 65-74, 1.8 per 100,000 person years at age 75-84, to 4.4 per 100,000 person years at age over 85. There was no statistical difference in rates between men and women. However the age structure of the population meant that most deaths in the oldest age group were of women. Mortality rates as a result of injury from fire and flame were higher for Māori than for nonMāori among New Zealanders aged 65 and over.

Post-mortem alcohol levels or verified histories of alcohol consumption on the day of death were available for 28 of the deceased (72 per cent) and were negative in all but four cases. Incomplete information in the data sources did not permit quantification of the relative importance of prescription medication or pre-existing disability in mortality from fire and flame in private residential dwellings. Over half of the deceased lived alone which is disproportionately high compared with the 28 per cent of New Zealanders aged 65 and older who lived alone at the time of the 1996 census.

Fatal fires affecting New Zealanders aged 65 and over started most commonly in the bedroom (42 per cent of incidents). Other rooms of origin were the lounge and kitchen (each accounting for 25 per cent of incidents). Heating appliances were the most common heat source, with electric heaters the heat source for 41 per cent of all fatal incidents. Smoking materials, cooking appliances and electric blankets were also important heat sources. Narrative accounts of the incidents illustrated inappropriate use of appliances in several cases.

Bedding or combustible materials in the bedroom were the most common items ignited. Ignition of combustible materials in the lounge, clothing ignitions and miscellaneous items such as pots, rubbish bags, laundry and carpets were also noted.

Most of the fatalities (90 per cent) occurred in permanent dwellings. Information about presence or absence of smoke alarms was incomplete in the data sources, but it appeared that very few dwellings had an installed, functioning smoke alarm, despite awareness of habitual risk taking behaviour in some cases.

From 1991 to 1997 11 New Zealanders aged 65 years and over died in rest home, hotel or motel fires. The mortality rate in rest home fires for New Zealanders aged 65 or over was 4.2 per 100,000 person years; ages of the six deceased ranged from under seventy to over 85. Fatalities in private hotels and motels highlight the diverse living arrangements of people aged 65 years and over. Five of the six fires in rest homes, hotels or motels resulted in multiple fatalities.

Recommendations

That the New Zealand Fire Service Commission ensure that findings of this study are disseminated among agencies and individuals concerned with the well-being of New Zealanders aged 65 and older. Further, that the New Zealand Fire Service Commission liaise with agencies and individuals concerned with the well-being of New Zealanders aged 65 and older to incorporate fire safety strategies in individual and population based health promotion strategies for this age group. Such groups will include Te Puni Kokiri, Age Concern, Greypower, Māori and mainstream health service providers including Public Health service providers, and Māori and mainstream social service providers.

That the New Zealand Fire Service Commission give priority to the development of bicultural policy, with reference to the Treaty of Waitangi, and of a partnership between the Fire Service Commission (as a Crown entity) and Māori. Primary goals for the partnership would be to address the Māori: nonMāori disparity in fire fatality rates, and to develop a service which is able to deliver effective services to Māori. Further that the New Zealand Fire Service Commission give urgent attention to the appointment of adequately resourced Māori liaison staff in each fire region, with skills to develop and implement appropriate fire safety programmes for Māori including those aged 65 years and over.

That the New Zealand Fire Service Commission determine characteristics of safe home heating systems and develop fire safety promotion programmes to promote heating safety, with particular reference to New Zealanders aged 65 and older.

That the New Zealand Fire Service Commission support the Cigarette (Fire Safety) Bill through representations to the Government Administration Select Committee and appropriate Ministers.

That the New Zealand Fire Service Commission liaise with the Ministry of Consumer Affairs regarding the possibility of flammability standards and design for adult nightwear, and bedding materials.

That the New Zealand Fire Service Commission continue to promote the use of smoke alarms in domestic dwellings through public education and community based fire safety programmes which intentionally include adults aged over 65 years. Further, that the New Zealand Fire Service Commission support mandatory installation of smoke alarms in new dwellings with a longer term view to mandatory alarms in all private dwellings.

That the New Zealand Fire Service Commission investigate the applicability of developing and promoting sprinkler systems (retrofitted where necessary) in the homes of New Zealanders aged 65 and over, particularly those living with a significant degree of physical disability.

That the New Zealand Fire Service Commission liaise with all Local Authorities to ensure rest homes, hotels and motels achieve compliance with the building code; to promote awareness of fire safety precautions among operators of such businesses; and to ensure staff have adequate training in evacuation procedures and fire safety issues.

Background

Adults aged over 65 years experience high rates of fire-related mortality compared with other age groups in the New Zealand population (Duncanson, Woodward et al. 2000). These New Zealand findings are consistent with overseas studies (Mierley and Baker 1983; Ballard, Koepsell et al. 1992; Barillo and Goode 1996; Marshall, Runyan et al. 1998; U.S. Fire Administration, 2001a). Key features of mortality from fire and flame in the over 64 age group in the UK include the relatively greater importance of electrical heaters and blankets as heat sources, and lesser importance of smoking materials (Elder, Squires et al. 1996). Ethnic disparity has been noted in the USA, with older black people having a death rate five times greater than that of white people¹ (Gulaid, Sacks et al. 1989). USA reports also note the importance of pre-existing disability, which may impede exit from a fire, and of prescription medication, which may increase drowsiness and impair judgement (U.S. Fire Administration, 2001a). Review of Australian coronial data suggested that alcohol was not a factor in fire related deaths of people over 75 years (Brennan 1998).

This report differs from a previous investigation of adult thermal injury in New Zealand (Waller, Marshall et al. 1998) in having a narrower focus on injury caused by fire and flame in the over 65 age group. The focus allows characterisation of incidents affecting a high risk population group, with a view to development of appropriate intervention strategies. Linkage of Fire Service and Health Service data has allowed description of the characteristics of the fatal fires as well as of the victims.

¹ Death rates for people of other races not cited in paper, due to low numbers.

Study aim and objectives

The overall aim of the study was to understand and identify factors associated with deaths of New Zealanders aged 65 and over in structural domestic fire incidents, through careful and systematic evaluation of available data and documents.

The specific objective of the study was to collate existing information from the New Zealand Health Information Service, The New Zealand Fire Service, and the Coroners' Court concerning domestic fatal fire incidents affecting New Zealand residents aged 65 and over, and describe personal, fire related, and environmental factors relevant to prevention policy.

Methods

Data sources

Data on fatal incidents attended by the New Zealand Fire Service were obtained from the national computerised database Fire Incident Reporting System (FIRS).

Deaths from injury caused by fire and flame in the domestic location were identified from the New Zealand Health Information Service (NZHIS) mortality database using the following International Classification of Disease 9th edition (ICD 9 CM) codes:

- E codes E890-899 (Accidents caused by fire and flames); and
- Domestic location code.

These ICD-9 codes do not include deaths as a result of acts of suicide or homicide which have different E codes.

Subsequently data were also obtained by using the E code E9881 (undetermined injury by burns or fire, at home) and event field matching using the keywords fire/ignition/burn/conflag/smoulder.

Identifying information from the two databases was matched electronically with the index to coronial files to locate coroners' verdicts on people who died in fatal fire events.

Inclusion criteria

Inclusion criteria for the investigation of fatal domestic fire incidents were all people aged 65 and over who died in a structural fire incident in a private residential dwelling in the years 1991-1997. The term private dwelling included mobile homes, caravans and campervans that were being lived in as a home, but not those being driven or towed, at the time of the incident. Incidents in rest homes, motels and hotels are discussed separately.

Analysis

Rates were calculated using New Zealand census population data and intercensal population estimates. The sole Māori denominator was used to calculate Māori rates, using 1991-1994 data only. Rate ratios and confidence intervals were calculated using EpiInfo statistical software (CDC 1996).

Results

Fatal fire incidents involving seniors

In the years 1991 to 1997, the study process identified 59 New Zealanders aged 65 and over who died as a result of injury from fire and flame. Most (41 deaths, 71 per cent) occurred in private dwellings. Five people died in three hotel or motel fires, six in three rest home fires, and seven in five outdoor or motor vehicle fires. Four of the deaths were intentional (homicide or suicide), and two of these occurred in private dwellings. This leaves a total of 39 unintentional fire deaths in private dwellings in the time period 1991 – 1997. These 39 deaths occurred in 38 incidents. Because of relatively small numbers individuals are potentially identifiable. To protect privacy categories have been combined to ensure that there are at least two individuals or incidents in each cell of a table.

Unintentional domestic fire deaths

Personal characteristics

Age gender and ethnicity

The 39 fatalities of people aged 65 and over, from injury from fire and flame in an unintentional domestic fire incident, occurred predominantly in the 75-84 age group, although rates were highest in the over 85 group (see Table 1). Because of the relatively low numbers of fatalities the statistical precision of these rates leaves room for some uncertainty which is illustrated by the 95 per cent confidence intervals (95%CI) shown in Table 1. For those aged 65 to 74 the true rate is most likely to lie between 0.3 and 1 death per 100,000 person years.

Table 1. Numbers and rates of fatalities as a result of injuries from fire and flame in private dwellings among adults aged 65 years and over in New Zealand 1991-1997, by age and gender. Data source New Zealand Health Information Service.

Age group	Male deaths	Female deaths	Total deaths	Rate (95%CI)*
65-74	6	5	11	0.6 (0.3-1.0)
75-84	7	10	17	1.8 (1.0-2.7)
85-94	2	9	11	4.4 (1.8-6.9)
Total/Overall	15	24	39	1.2 (0.8-1.6)

*per 100,000 person years

More women than men aged 65 and over died in domestic fire incidents in the 1991-1997 time frame. This was accounted for by a relatively high number of deceased women aged 85 years and over. There was no statistical difference between mortality rates of men and women in each age group (Overall Female: Male RR 0.93; 95%CI 0.46-1.7). In this case the 95 per cent confidence interval for the rate ratio between men and women includes a value of one, and a ratio of one indicates no difference between rates.

The manner in which ethnicity data was recorded in the health service changed in 1995. Accordingly a restricted time frame has been used for analysis of ethnicity data, using the years 1991-1994 only. From 1991-1994 the rate of Māori deaths exceeded nonMāori by a factor of 6. Even allowing for statistical variability as a result of the small sample size, the rate among Māori is likely to be at least twice that of nonMāori, and may be as high as 18 times that of nonMāori (RR6.3; 95%CI 2.2-18.25).

Alcohol and drugs

Post-mortem blood alcohol levels, or verified histories of alcohol consumption on the day of death, were available for 28 (72 per cent) of the deceased. Alcohol was detected in only four of these cases, and then at relatively low levels (25-100MG/dL). Although a level of blood alcohol of 80mg/dL is the New Zealand legal limit for drink-driving, the comparatively conservative level of 100mg/dL indicating impairment is often used in overseas studies (Warner, Smith, et al, 2000). Results of testing for other drugs were not systematically reported in the data sources. However levels of benzodiazepine sleeping medication sufficient to cause drowsiness, or a history of use of sleeping medication were recorded in two cases.

Presence of disability

Information about disability was not recorded systematically in the data sources. There were no cases in which absence of disability was stated definitively. Fifteen of the deceased (39 per cent) were noted to have impaired mobility, and five (13 per cent) were noted to have one or more additional type of disability, for example sensory disability, chronic illness or dementia. In the 1996 census 50 per cent of New Zealanders aged 65 and older, and living in households, reported living with disability. With the information available it is not possible to determine accurately the prevalence of disability among those who died, since the absence of comment about disability cannot be assumed to indicate an absence of disability. In this age group there may in some circumstances be a tendency to assume presence of disability and therefore not to formally state it. Injury surveillance systems would have added value if the presence or absence of pre-existing disability was recorded systematically.

Living alone

Over half of the deceased lived alone (21 people, 54 per cent). In the 1996 census 28 per cent of New Zealanders over the age of 65 years lived alone, suggesting that living alone increases risk of death as a result of injury from fire and flame.

Fire characteristics

Room of origin

The fatal fires affecting aged 65 years and older started most commonly in a bedroom or sleeping area, followed by the lounge and kitchen. In three cases the room of origin was not specified.

Table 2. Number and percentage of unintentional fires in private dwellings resulting in deaths of New Zealanders aged 65 years and older 1991-1997, by room of origin. Data sources Fire Incident Reporting System; Coronial Verdicts.

Room of origin	Number of incidents	Percentage of incidents
Bedroom/ sleeping area	16	42
Lounge	10	26
Kitchen	9	24
Unspecified	3	8
Total	38	100

Heat source

The most striking finding is the high proportion of fires resulting in the death of people aged over 64 years in which the source of ignition was a heating appliance (see Table 3). The vast majority of these fires were started by an electric heater (16 incidents, 41 per cent), with a further two incidents (5 per cent) caused by a gas heater or open fire. Smoking materials made up the next largest ignition source group (7 fatalities, 18 per cent) followed by cooking appliances and electric blankets. The narrative accounts of incidents indicate that unconventional and inappropriate use of electrical appliances is not uncommon. Examples of inappropriate use include removing electric blanket from bed before retiring for the night - leaving it folded on the floor, wrapping oneself in electric blanket to stay warm in lounge, using a portable oven as a heat source, and using an electric heater to dry clothing.

Table 3. Number and percentage of unintentional fires in private dwellings resulting in deaths of New Zealanders aged 65 years and older 1991-1997, by presumed source of ignition. Data sources Fire Incident Reporting System; Coronial Verdicts.

Heat source	Number of incidents	Percentage of incidents
Electric/gas heater/open fire	18	47
Cigarette/ Matches	7	18
Oven/ Stove top/coal range	4	11
Electric blanket	3	8
Other	4	11
Undetermined	2	5
Total	38	100

Items ignited

In almost a quarter of cases (9 cases, 23 per cent) the material ignited was classified as 'combustible materials' and not specified further. In these cases the room of origin has been included to give increased specificity to the findings (see Table 4). The items most commonly ignited were bedding, or combustibles in the bedroom. These were followed by combustible materials in the lounge or living room, clothing ignitions, and a series of other items including pots, rubbish bags, clothing not being worn, and carpet. Clothing ignitions in this age group often went on to lead to a structural fire, particularly when there were no other adults present to extinguish the fire.

Table 4. Number and percentage of unintentional fires in private dwellings resulting in deaths of New Zealanders aged 65 years and older 1991-1997, by presumed items ignited. Data sources Fire Incident Reporting System; Coronial Verdicts.

Item ignited	Number of incidents	Percentage of incidents
Bedding/ combustible materials bedroom	14	37
Combustible materials lounge	7	18
Clothing being worn	6	16
Other materials	7	18
Undetermined	4	11
Grand Total	38	100

Environmental characteristics

Type of dwelling

Most of the fatalities (35 cases, 90 per cent) occurred in permanent dwellings, with seven incidents in flats or apartments with up to eight units, and the remainder in detached houses. Four incidents occurred in temporary dwellings such as mobile homes, sheds or baches. Calculation of risk by type of dwelling will be carried out on the full sample, because of the small numbers of deceased aged 65 and over living in temporary dwellings. Previous studies in New Zealand and the US have shown an increased fire fatality risk for occupants of mobile homes (Runyan, Bangdiwala et al. 1992; Cropp 1997). It is also likely that temporary dwellings are intrinsically less fire-safe, and less likely to have smoke alarms or other warnings of a fire.

Smoke alarms

Information about the presence of smoke alarms was not recorded systematically in the data sources. However in 19 cases (50 per cent) it was stated in the FIRS report or the coronial verdict that there was no alarm in the dwelling. This indicates that the prevalence of smoke alarms in dwellings occupied by seniors who died in fire incidents is lower than the estimated prevalence of smoke alarms in all New Zealand homes of 65 per cent (CM Research, 1998). Three dwellings were noted to have one or more alarms, although the single alarm in one dwelling did not operate at the time of the fatal incident. Coronial recommendations to the effect “that all buildings housing elderly people and others should have smoke detection warning devices fitted” (Department of Justice letter 11 August 1992) were made in several instances.

Risk taking behaviour

In several instances it was noted that those associated with the deceased had noticed increased fire risk in the dwelling prior to the fatal incident. This applied particularly to regular lifestyle patterns such as smoking in bed, and using heaters close to combustibles. Interventions had been limited to a personal level, with advice to desist from the practice. No cases mentioned environmental changes to minimise risk from habitual behaviour.

Rest home fatal fires

Six people, with ages ranging from under 70 to over 85, died in three rest home fires in the study period. One of these fires was a clothing ignition which did not spread beyond the cell of origin. In the 1996 census the living arrangements of New Zealanders aged 65 and over indicated that 20190 people lived in rest homes. Assuming this number was constant through the time of the study, the mortality rate for unintentional death from injury from fire and flame in rest homes is thus relatively high, estimated at 4.2 deaths per 100,000 person years. This rate is similar to that of adults aged 85 years and over, although half the deceased rest home occupants were under 85 years of age. Key issues raised in coronial and Fire Service investigations of rest home fire incidents include:

- Importance of adequate staff training in occupational safety and health issues
- Responsibility of Local Authorities to ensure that inspections to ensure compliance with the building code are thorough and complete
- Importance of ensuring that fire break doors are kept closed (and in particular not wedged open) at all times
- Recommendation for installation of sprinkler systems in rest homes regardless of the number of residents, in order to give valuable time which may allow residents to evacuate the building
- Importance of adequate staffing levels to evacuate all residents as quickly as possible, with particular regard to the proportion of residents who are less mobile and require assistance
- Importance of strict supervision of smoking by rest home residents.

Fatal fires in other non-domestic structures

Five New Zealanders aged 65 and over died in three fires in other non-domestic structures in the 1991-1997 time period. One of these incidents was intentional. Evacuation procedures in one incident were heroic and undoubtedly saved many other lives. Investigations into fire incidents in commercial dwellings highlight the importance of operational fire safety procedures, such as keeping fire stop doors closed, and of explaining evacuation procedures to occupants of short-term accommodation.

Discussion

Data issues

The datasets used in this study are the most reliable sources available. The NZHIS provides the most comprehensive data available regarding mortality in New Zealand. During the study period, coding was carried out according to internally and externally audited coding standards. Nevertheless some coding errors do occur in such a large dataset with multiple data entry staff. Searching by non-domestic location, by additional E codes, and by key words in the event field identified several eligible cases.

FIRS data are recorded manually by fire-fighters at fire scenes and entered into a national database which provides the most comprehensive record of fire incidents in New Zealand. In the combined dataset of people aged over 65 years, created for this study, there were nine incidents identified from NZHIS data which were not able to be identified by date in the FIRS data. The observation that six of these incidents had Fire Service Investigation reports, or Fire Service reports to the coroner, included in the coronial file suggests a breakdown in information transfer from regional to central records. There were three fatalities that were apparently not attended by the Fire Service; all involved electric heaters igniting adjacent furnishings and two apparently involved a fall by the deceased. Omission from FIRS is understandable, as the fire service does not necessarily attend all fatal fires, particularly those confined closely to the cell of origin and those which may be extinguished early by household members, or through lack of combustible materials.

Coronial records were extremely variable in the degree of detail about the deceased and the incident resulting in death. Blood alcohol levels were taken relatively systematically, and this is likely to be of particular value in the investigation of adult (aged 16-64) fire-related mortality based on findings from overseas studies (Ballard, Koepsell et al. 1992; Brennan 1998; Marshall, Runyan et al. 1998). Benzodiazepine levels were recorded in only one case. Sleeping medication is often prescribed inappropriately among seniors (Cartwright 1990) and may contribute to injury from falls (Koski, Luukinen et al. 1998). Routine blood sampling for benzodiazepines in deaths from unintentional injury among older people would improve knowledge of the contribution of prescription medication to the injury death toll in this age group. Identified shortcomings in the coronial service (Law Commission 2000) have been confirmed by this study. Appointment of a Chief Coroner, and adequate training and resourcing of the coronial service, will be needed to achieve the systematisation of enquiries that could add value to the records. In addition the inclusion of fire-related deaths as a separate category within the coronial records would assist the NZ Fire Service Commission in surveillance of their area of statutory responsibility.

Use of three principal data sources has increased the information available about each fatality. In particular the use of NZHIS data has provided accurate information about the age and gender of the person. Ethnicity data in the health sector continues to undercount Māori (Te Rōpū Rangahau Hauora a Eru Pōmare, 2000), but is the most accurate data available.

Intervention strategies

Raising awareness

The pattern of increasing mortality risk with increasing age over 65 years has been noted elsewhere, most recently in an American review (US Fire Administration, 2000a). In New Zealand, like other developed nations, the proportion of older people in the population is increasing. Assuming medium fertility, medium mortality and long-term annual net migration of 5,000 population projections indicate increasing numbers of New Zealanders aged 65 years and over for the next twenty years from 430,000 in 1996, to 552,000 in 2011 and 749,000 in 2021 (Statistics New Zealand website). Attending to factors associated with mortality from fire and flame among seniors now is likely to have increasing benefit in terms of lives saved in the medium and longer term.

Primary causes of house fires, and of house fire mortality, include individual behaviour as well as physical and social environmental factors. Interventions to reduce the incidence and impact of domestic fire incidents in the over 64 age group must therefore address not only individual factors, but also those operating in society more generally. Raising awareness of fire risk among home dwelling seniors, and providing information about appropriate strategies to reduce that risk, are important first steps to preventing fires from starting. Education can be directed to older people themselves, and to agencies and organisations concerned with their welfare.

Recommendations

That the New Zealand Fire Service Commission ensure that findings of this study are disseminated among agencies and individuals concerned with the well-being of New Zealanders aged 65 and older. Such groups will include Te Puni Kokiri, Age Concern, Greypower, Māori and mainstream health service providers including Public Health service providers, and Māori and mainstream Social Service providers

That the New Zealand Fire Service Commission liaise with agencies and individuals concerned with the well-being of New Zealanders aged 65 and older to incorporate fire safety strategies in individual and population based health promotion strategies for this age group. Such groups will include Te Puni Kokiri, Age Concern, Greypower, Māori and mainstream health service providers including Public Health service providers, and Māori and mainstream Social Service providers.

Addressing disparities

The increased risk of fire mortality experienced by Māori in New Zealand has been demonstrated previously (Duncanson, Woodward et al, 2000), and is also observed among New Zealanders aged 65 and over. The investment by the New Zealand Fire Service Commission in research to address this disparity, and the appointment of Iwi liaison officers in key fire regions are timely actions to begin addressing this issue. These measures could be enhanced by strategic moves to further increase bicultural awareness within the Fire Service at all levels.

Recommendations

That the New Zealand Fire Service Commission give priority to the development of bicultural policy, with reference to the Treaty of Waitangi, and of a partnership between the Fire Service Commission (as a Crown entity) and Māori. Primary goals for the partnership would be to address the Māori: nonMāori disparity in fire fatality rates, and to develop a service which is able to deliver effective services to Māori.

That the New Zealand Fire Service Commission give urgent attention to the appointment of adequately resourced Māori liaison staff in each fire region, with skills to develop and implement appropriate fire safety programmes for Māori including those aged 65 years and over.

Heating

Maintaining a warm home environment is important for the physical health of older people (Isaacs & Donn, 1993). However the means of achieving this must not increase risk of physical injury. In one coronial verdict the coroner highlighted “ the dangers of radiant bar heaters, this being the third such fatality in [this local authority] over the last three years” (Coroner 26 September 1995). Encouraging replacement of radiant heaters with safer models, wall mounted if possible, would contribute to a safer home environment for those aged 65 and older.

A community survey to assess how commonly free standing electric heaters are used would provide a measure of the magnitude of the issue. The finding that 47 per cent of fire-related fatalities among seniors in New Zealand had heating appliances as the heat source differs from overseas studies where heating appliances account for a lower proportion of fatal fires. In the USA for example, 18 per cent of fatal fires among citizens 65 years and over in 1998 were attributed to heating (U.S. Fire Administration, 2001a). In the USA heating fires are more frequent in rural areas, where central heating systems are less prevalent (U.S. Fire Administration 2001b). Use of portable heaters, rather than central heating systems, is part of the New Zealand ‘way of life’ which needs special consideration in fire safety strategic planning, particularly for the older age groups. A further issue to address is the use of heaters to air or dry laundry. This practice is not uncommon, and contributed to a ‘near miss’ incident in the Bay of Plenty (Butzbach 1997) as well as to incidents in the current series. Consumer education and provision of alternative effective means of drying laundry items need to be considered.

Recommendation

That the New Zealand Fire Service Commission determine characteristics of safe home heating systems and develop fire safety promotion programmes to promote heating safety, with particular reference to New Zealanders aged 65 and older.

Cigarettes

Cigarettes accounted for 18 per cent of the fatal incidents in the present series. Ignition of clothing, bedding, lounge furnishings or contents of rubbish bins by discarded cigarettes can result in slow smouldering fires that are not noticed for many hours (Baker 1992). Manufacture of self-extinguishing or non-flammable cigarettes is possible (Barillo, Brigham et al. 2000), although there has been sustained opposition from cigarette manufacturers (McGuire, 1999; Halbert 1999). Development of 'fire-safe' cigarettes is assessed to have a high benefit-cost ratio in preventing injury (Miller and Levy 2000). A Private Members Bill introduced to the New Zealand Parliament in December 2000 requiring cigarettes sold in New Zealand to be manufactured to reduce their propensity to ignite combustible materials if left unattended. Similar legislation has been passed in New York (Governor George Pataki 2000). In the 1996 census 10 per cent of New Zealanders aged 65 years and over reported smoking regularly. Legislation to reduce risk of fire events from discarded cigarettes will be of direct benefit to those older people who have become addicted to nicotine, and have been unable to quit. Such measures are particularly relevant to those who live with significant disability and may be more likely to smoke in bed or less able to move in the case of clothing or lounge furniture ignition.

Recommendation

That the New Zealand Fire Service Commission support the Cigarette (Fire Safety) Bill through representations to the Government Administration Select Committee and appropriate Ministers.

Clothing design

Clothing ignitions accounted for one sixth of the fatalities in this series. Gulaid (1989) recommended use of fitting (rather than loose) garments and use of flame resistant fabrics for nightwear in seniors. Such measures have proven effective in reducing injury as a result of clothing ignition in children, although the widespread use of home sewn night attire may mitigate against full realisation of potential benefits (McLoughlin, Langley et al. 1986). Consideration could also be given to development of flammability standards for all clothing materials. As it is unlikely that older New Zealanders would replace garments frequently, the effects of such standards would be delayed and have a long term rather than short term effect. As an immediate strategy advice about clothing design could be included in fire safety education programmes directed to older New Zealanders.

Fire retardant furnishings

Over one third of the fatal fire incidents in this series resulted from ignition of bedding or other combustible materials in a bedroom. Some of these incidents would have been prevented by ensuring safer heating appliances in bedrooms, and by requirements for cigarettes to be 'fire-safe'. However it may also be timely to consider flammability standards for bedding, recognising that the effects are likely to be long-term as such household items are not frequently replaced.

Recommendation

That the New Zealand Fire Service Commission liaise with the Ministry of Consumer Affairs regarding the possibility of flammability standards and design for adult nightwear, and bedding materials.

Smoke alarms

As a secondary prevention measure the presence of a smoke alarm in a private dwelling has been shown to be associated with lower odds of death when a fire does occur (Runyan, Bangdiwala et al. 1992; Dowswell, Towner et al. 1996; CDC 1998; Marshall, Runyan et al. 1998). Smoke alarms can be particularly effective in situations like leaving cooking unattended, which are fire risks at all ages, by providing early warning of a fire and allowing time for the occupant(s) to leave the dwelling. Injury prevention counselling, particularly in the context of well child care, may increase smoke alarm ownership (DiGuseppi and Higgins 2000), and could be considered also for older people. Smoke detector legislation has been enacted in many countries (ISCAIP Smoke Detector Legislation Collaborators 1999), and extension to include detached private dwellings is being considered in New Zealand (Building Industry Authority 2000). Impairment of hearing may limit the usefulness of an audible smoke alarm, and the use of concurrent visual cues (e.g. a flashing light) should be considered in these situations. It is also important that all members of a household recognise the smoke alarm signal and know what action to take if activated.

Recommendations

That the New Zealand Fire Service Commission continue to promote the use of smoke alarms in domestic dwellings through public education and community based fire safety programmes which intentionally include adults aged over 65 years.

That the New Zealand Fire Service Commission support mandatory installation of smoke alarms in new dwellings with a longer term view to mandatory alarms in all private dwellings.

Sprinkler protection

In the presence of disability a sprinkler system may offer better protection from fire injury, as it extinguishes the fire rather than simply warning of the presence of smoke. A low-cost sprinkler system for installation in new dwellings has been developed (Building Research Council of New Zealand 2000). Development of a low cost retro fitted system could have application among older New Zealanders.

Recommendation

That the New Zealand Fire Service Commission investigate the applicability of developing and promoting sprinkler systems (retrofitted where necessary) in the homes of New Zealanders aged 65 and over, particularly those living with a significant degree of physical disability.

Rest homes and other non-domestic structures

Although most of those aged 65 years and over who died as a result of injury from fire and flame in New Zealand from 1991 to 1997 lived in private dwellings, the risk of such death was similar for those residing in rest homes. Previous studies have shown rest homes to have the highest risk of fatality per 100 fires, and the highest risk per square metre of floor area of all occupancy types (Narayanan, Byrne et al. 1996). In the present study two of the three rest home fires resulted in multiple fatalities, with further people injured. Stress associated with evacuating a rest home is high for surviving residents and for staff. The importance of statutory fire safety practices, both structural and operational, is highlighted by the propensity of uncontrolled fires in rest home settings to affect large numbers of people. Comments from one investigation suggested that inspection to ensure compliance with regulatory standards had not been sufficiently thorough, and the deficiencies contributed to the severity of the fire.

The location of fatalities also reflects the diversity of accommodation used by older New Zealanders. In the 1996 census, although the majority of older people lived with a spouse or partner, lived alone or lived with a relative (e.g. sibling, child, or parent), there were some 26676 people living with 'unrelated others' (Statistics New Zealand 1998). This will include those resident in rest homes, and also 6000 older people live in accommodation such as private hotels, group homes and other shared accommodation. In addition older New Zealanders use motel and hotel accommodation when travelling away from home. Investigation of fatal fires in motels and hotels has drawn attention to the importance of regular maintenance of fire safety regulations, in particular ensuring that fire safety doors are kept closed. Occupants of private hotels may include a high proportion of long term occupants living with disability, and this should be remembered when designing fire safety and evacuation procedures. Evacuation procedures in establishments with predominantly short-term occupants should be clearly displayed and easily accessed in unfamiliar surroundings. Special attention should be given to older guests who may have increased difficulty responding to unexpected circumstances in an unfamiliar environment.

Recommendation

That the New Zealand Fire Service Commission liaise with all Local Authorities to ensure rest homes, hotels and motels achieve compliance with the building code; to promote awareness of fire safety precautions among operators of such businesses; and to ensure staff have adequate training in evacuation procedures and fire safety issues.

Addendum

November 2001

Following the completion of this report an additional 10 deceased aged over 64 years were identified from ongoing review of NZHIS data sources. The fire service attended two of these fatalities, although the deaths were not included in FIRS fatality data. Six of the additional 10 deceased were female, and 4 male. Four were aged between 65 and 74 years, four between 75 and 84 years, and two aged over 84 years. Ethnicity was not stated for one of the deceased, the remaining seven were classified as nonMāori in NZHIS data. Inclusion of these additional 10 deceased alters the mortality rates as shown in Table 5. The Māori: nonMāori rate ratio in the over 64 age group also changes from a six-fold to a five-fold increase in risk (RR 5.2, 95% CI 1.8-14.9).

Table 5. Numbers and rates of fatalities as a result of injuries from fire and flame in private dwellings among adults aged 65 years and over in New Zealand 1991-1997, by age and gender. Data source New Zealand Health Information Service.

Age group	Male deaths	Female deaths	Total deaths	Rate (95%CI)*
65-74	7	7	14	0.8 (0.4-1.3)
75-84	8	14	22	2.4 (1.0-2.7)
85-94	4	9	13	5.2 (1.8-6.9)
Total/Overall	19	30	49	1.3 (0.9-1.8)

*per 100,000 person years

Fire scenarios were described for eight of these additional senior fatalities. Scenarios were similar to those previously described with cigarettes or smoking materials igniting clothing or bedding (3 fatalities), means of heating igniting clothing or other combustibles (3 fatalities), oven fire igniting clothing and a naked flame igniting inflammable gases in an enclosed space.

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