

Fire Research Report

Social & Economic deprivation and fatal unintentional domestic fire incidents in New Zealand 1988 - 1998

University of Otago

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This report reviews international literature concerning relationships between social and economic circumstances of households, and risk of death or injury in fire events. Analysis is undertaken of New Zealand fire fatality data from July 1988 to June 1998 compared with New Zealand indices of social and economic deprivation. International literature indicates that the most socially and materially deprived households experience higher rates of fatal fire incidents.

NZ Fire Service incident report data were geocoded to census meshblock level and analysed with New Zealand indices of deprivation. Fatal domestic incidents occurred disproportionately in dwellings in the most socially and materially deprived meshblocks. Rates of fatal fires in the most deprived decile were 4.5 times the rates in the least deprived decile. Strategies to address this differential risk for fire related mortality need to identify and take into account barriers to household fire safety in these vulnerable population groups. In the longer term addressing the underlying socio-economic determinants through strategic policy development will also be important.

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1988-1998

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Social and economic deprivation and fatal unintentional domestic fire incidents in New Zealand 1988-1998

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Introduction

This report to the New Zealand Fire service commission reviews international literature concerning relationships between social and economic circumstances of households, and risk of death or injury in fire events together with analysis of New Zealand fatality data from July 1988 to June 1998 with New Zealand indices of social and economic deprivation.

This report is part one of two research reports commissioned by the New Zealand Fire Service through the contestable research fund.

Part two describes the geographical distribution of fatal fires in New Zealand at territorial authority level.

Executive Summary

International literature indicates that that the most socially and materially deprived households experience higher rates of fatal fire incidents. Specific factors that may contribute to this socio-economic gradient include:

- Housing tenure and quality;
- Differential community prevalence of smoke detector installation;
- Smoking and alcohol use;
- Lack of support for sole parents;
- Educational underachievement; and
- Affiliation with minority ethnic group.

NZ Fire Service incident report data were geocoded to census meshblock level and analysed with New Zealand indices of deprivation. Fatal domestic incidents occurred disproportionately in dwellings in the most socially and materially deprived meshblocks. Rates of fatal fires in the most deprived decile were 4.5 times the rates in the least deprived decile.

Strategies to address this differential risk for fire related mortality need to identify and take into account barriers to household fire safety in these vulnerable population groups. Specific intervention strategies which may improve fire safety for vulnerable population groups include increasing prevalence of installed and functioning smoke detectors; steps to improve quality and affordability of housing, and regulation of specific characteristics of cigarettes to reduce risk of ignition from abandoned heat sources.

In the longer term addressing the underlying socio-economic determinants through strategic policy development will also be important.

Background

Mortality in domestic fire incidents

Residential fire incidents are the principal cause of death from thermal injury for New Zealand children (Waller & Marshall, 1993) and adults (Waller, Marshall, & Langley, 1998). Fatal fire incidents also impact on the physical and mental health of survivors, many of whom show symptoms of psychological distress months after the event (Keane, Jepson, Pickett, Robinson, & McCorkle, 1996). New Zealand Fire Service data indicate that from 1986-1998 an average of 27 people each year have died in their place of residence. Eighty-three deaths (25 per cent of the total) were of children aged under 15 years. Although absolute numbers are relatively small, fatal fire incidents are of public health interest because they result in preventable premature deaths, because population based studies have identified useful intervention strategies, and because such incidents illustrate important issues regarding household and community safety.

Previous research

The project builds on previous work in New Zealand and overseas which indicates that certain communities, and population groups are particularly vulnerable to fire-related injury. Cropp (1997) reviewed deaths occurring in fire incidents in New Zealand between 1995 and 1997 suggested that fire related deaths were more likely to occur in rental accommodation, and in the cheapest houses in the lowest-valued part of town. Median meshblock income for the addresses in which fatal fires occurred was at least eight per cent lower than the New Zealand average personal income.

In the USA social reformers have linked housing quality, poverty and fire hazards to fire risk since the 1930s (E.E. Wood cited by Jennings, 1999). Findings from a number of studies, conducted from different disciplinary perspectives, “point to each community’s socioeconomic and environmental factors as the primary determinants of fire loss” (Jennings, 1999). Epidemiological studies in the USA have found that death and injury rates in residential fires are highest in census tracts with low rental values of properties (Mierley & Baker, 1983), and in areas with low median household income, lower property values, and poor quality housing (Mallonee et al., 1996).

In the UK “deaths due to fire and flame ... for children in social class V is over 16 times that of children in social class I ... the explanation that is best supported by research evidence is that the gradients [for childhood mortality from injury] reflect differential exposure to health damaging physical and social environments. For fire deaths this entails exposure of children to temporary accommodation and substandard housing” (Roberts, 1997). Social stress also plays a role in injury rates as parents who may “lack the means to resolve the recurrent setbacks which dominate their domestic lives ... are less well equipped to provide continuous and vigilant protection” for their children (Townsend, Davidson, & Whitehead, 1992). Addressing inequalities in health status is an ongoing challenge to public policy makers in different sectors.

Measuring socio-economic status

There is an increasing need for accurate socioeconomic characterisation of individuals and populations for the purposes of health needs assessment.

(Crampton & Davis, 1998)

The New Zealand Indices of deprivation (NZDep91 and NZDep 96) have been developed and validated in New Zealand as measures of social and material disadvantage, relative to the wider society, at census meshblock level (Crampton, Salmond, & Sutton, 1997). Because the indices are area based measures of deprivation, they can be used to identify vulnerable communities if an association is shown between social and material deprivation and risk of fatal domestic fire events. Area based indices also have the advantage of being able to be applied to all cases for whom an accurate address is available. In contrast occupational based indices of personal deprivation require information which is often not available in routinely collected data. The dimensions of deprivation included in NZDep96 are listed in Table 1. Factors such as age, gender and ethnicity are not included because although correlated with adverse outcomes, these factors are fixed and cannot be altered by changes in policy (Crampton et al., 1997).

Table 1. Census variables included in NZDep 96 index of deprivation. Source Crampton, 1998.

Dimension of deprivation	Variable (calculated as proportions for each small area)
Communication	People with no access to a telephone
Income	People aged 18-59 years receiving a means-tested benefit
Income	People living in households with equivalised income below an income threshold
Employment	People aged 18-59 years not employed
Transport	People with no access to a car
Support	People aged less than 60 years living in a single parent family
Qualifications	People aged 18-59 years without any qualifications
Owned home	People not living in own home
Living space	People living in households below equivalised bedroom occupancy threshold

Project objective

To determine the magnitude of any relationship between social and economic deprivation at census meshblock level, and risk of death in a domestic fire incident in New Zealand.

Methods

Data

New Zealand fire mortality data were obtained from the New Zealand Fire Service Fire Information Recording System (FIRS) for the period July 1988 to June 1998. A subset of these data has previously been matched with New Zealand Health Information Service data and found to be over 90 per cent complete (personal communication Angela Pidd NZHIS September 1999).

Fire investigation reports were requested from regional offices of the New Zealand Fire Service to clarify address and location details.

Private dwelling data were obtained from Statistics New Zealand. The number of private dwellings consists of the count of dwellings on census night. This figure excludes hotels, motels and other non-private dwellings.

Inclusion and exclusion factors

All incidents occurring in residential structures, and in mobile property being used as a structure (caravans).

Intentional injury incidents, and incidents where the presumed cause was unlawful were excluded from the study. Incidents occurring in commercial premises such as motels and hotels were also excluded.

Geocoding

Incidents were geocoded to census meshblock level. Each incident was assigned a level of deprivation according to the NZDep index appropriate for the time period (Table 2).

Table 2. Time periods, census meshblock used in geocoding, and index of deprivation used in analysis.

Time period	Year of census	Index of deprivation
July 1988 – June 1993	1991 census	NZDep 91
July 1993 – June 1998	1996 census	NZDep 96

Analysis

All incidents occurred in separate meshblocks (i.e. there were no meshblocks with more than one incident.) Incidents occurring in meshblocks at each of the ten deciles of social and economic deprivation were counted. Rates of fatal incidents at each of the ten decile levels of social and economic deprivation were calculated using the aggregate number of private dwellings in meshblocks at that level of deprivation. The Statistics New Zealand field ‘total private dwellings’ includes both temporary and permanent private dwellings, and excludes motels, hotels and boarding houses. This denominator data fits best with the case definition of incidents occurring in residential structures, and in mobile property being used as a structure

Results

Number of fatal incidents

Review of FIRS data identified 196 fatal incidents occurring in residential structures or mobile property being used as a structure in the time period July 1988 – June 1998. Of these incidents 187 (95.4 per cent) were able to be geocoded to census meshblock level.

In the five years from July 1988 to June 1993 there were 83 geocoded fatal fire incidents. In the five years from July 1993 to June 1998 there were 104 fatal domestic fire incidents. In both time periods fatal incidents occurred disproportionately in census meshblocks with high levels of social and economic deprivation, as assessed by the NZDep91 and NZDep96 indices of deprivation (Table 3). The most deprived 20 per cent of New Zealand meshblocks experienced almost 40 per cent of the fatal fire incidents in each time period. Conversely the least deprived 20 per cent of New Zealand meshblocks experienced less than 10 per cent of the fatal fire incidents in each time period.

Table 3. Number and percentage of fatal domestic fires occurring in census meshblocks at each decile level of social and economic deprivation, as measured by NZDep indices of deprivation. Data source: NZ Fire Service.

Time period	Level of Deprivation	Number of incidents	Percentage of incidents
1988-1993			
NZDep91	1	1	1.2
	2	5	6.0
	3	5	6.0
	4	6	7.2
	5	8	9.6
	6	12	14.5
	7	7	8.4
	8	8	9.6
	9	13	15.7
	10	18	21.7
1993-1998			
NZDep96	1	4	3.9
	2	3	2.9
	3	8	7.7
	4	7	6.7
	5	9	8.7
	6	12	11.5
	7	12	11.5
	8	11	10.6
	9	18	17.3
	10	20	19.2

Rates of fatal incidents

Rates of fatal incidents occurring between July 1993 and June 1998 were calculated with the number of incidents in meshblocks at each level of deprivation as the numerator, and the total number of private dwellings in meshblocks at each level of deprivation as the denominator. There was a clear gradient with increasing rates of fatal incidents with increasing material and social deprivation, as measured by NZDep96. The rate of fatal fire incidents for private dwellings in the most deprived 10 per cent of meshblocks was 4.5 times the rate for private dwellings in the least deprived 10 per cent of meshblocks (Figure 1). These findings are statistically robust. The observed trend of increasing fire fatality risk with material and social deprivation is extremely unlikely to have occurred by chance ($p < 0.00001$)

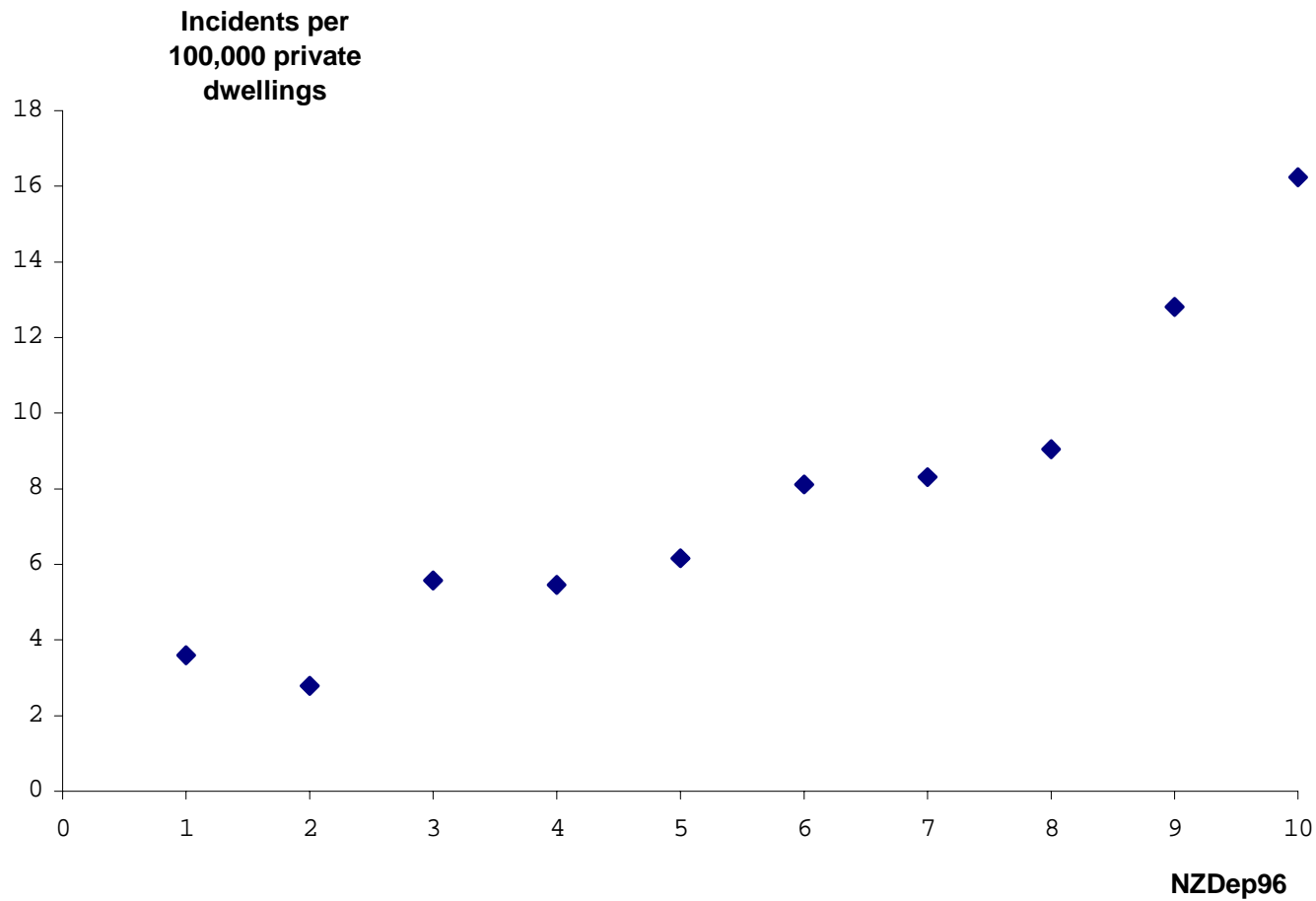


Figure 1. Rates of fatal fire incidents per 100,000 private dwellings in NZ census meshblock in each decile of material and social deprivation as measured by the NZdep96 index of deprivation, 1993-1998. Data sources: NZ Fire Service, Statistics New Zealand

Discussion

Data issues

As indicated earlier the FIRS database is considered to be comprehensive and to include almost all fatalities directly resulting from fire incidents.

Consistency with other studies

The findings of this research project are consistent with international observations of increased risk of fire fatalities in socioeconomically deprived population groups. In the USA high fire death rates are associated with high rates of poverty, smoking, lack of education and rurality at state level (Welch, 1999). Investigating all fires (not restricted to fatal fires) Schaenman (1977), Karter and Donner (1978), and Gunther (1981) (all cited by National Fire Data Center, 1997) identified socioeconomic factors at census tract level which are associated with increased or decreased fire risk (Table 4). Parental presence, poverty, and under-education each explained an average of 39 per cent of the variation in all fire incidents between census tracts. Good education, race (sic), home ownership, adequate income and housing crowdedness were also important in explaining variation in fire rates (Schaenman). “Gunther was able to show that there was a strong negative relationship between income and fire rates. As income rose, there was a significant drop in the fire rate...” (National Fire Data Center, 1997).

Table 4. Factors correlated with fire risk at census tract level. Sources National Fire Data Center, 1997.

Negative correlation (decreased fire risk)	Positive correlation (increased fire risk)
<ul style="list-style-type: none">• Home ownership (proportion of housing units which were owner-occupied)	<ul style="list-style-type: none">• Under-education (percentage of persons aged over 25 with less than 8 years schooling)
<ul style="list-style-type: none">• Adequate income (percentage of households with income above \$15,000)	<ul style="list-style-type: none">• Housing crowdedness (percentage of households with more than one person per room)
<ul style="list-style-type: none">• Parental presence (percentage of children under age 18 living with 2 parents)	<ul style="list-style-type: none">• Poverty (percentage of persons below the poverty level)
<ul style="list-style-type: none">• Good education (percentage of persons aged over 25 with at least high school education)	

Mechanisms of association between socioeconomic status and fire related mortality

...while the incidence of poverty has been shown to be associated with increased fire risk, poverty in and of itself does not cause fires.

(National Fire Data Center, 1997)

To understand the association between social and economic deprivation and fire deaths it is necessary to identify those factors associated with deprivation which lead to an increased incidence of fatal fires. Gunther (cited by National Fire Data Center, 1997) found a strong negative relationship between income and intentional or suspicious fires, and fires caused by smoking, cooking and children playing. At a household and individual level the following factors associated with socioeconomic deprivation and fire related injury can be identified from a review of literature:

- Housing tenure and quality;
- Lack of a smoke detector;
- Smoking;
- Alcohol intoxication;
- Sole parenthood;
- Low educational level; and
- Minority ethnic group affiliation.

Housing tenure and quality

Tenants of rental accommodation have higher rates of residential fire deaths and injuries compared with owner occupiers. Goodsman, Mason, & Blythe (1987) found that council flats and housing association flats in two UK metropolitan boroughs were most susceptible to fires which resulted in injury. The relative vulnerability of tenants of different types of rental property in the New Zealand context is not known.

Housing quality is considered a key factor in the high injury rates experienced by poor children in the UK (Roberts, 1997; Roberts & Pless, 1995). Temporary accommodation is also associated with increased fire risk. Living in a mobile home poses a higher risk of death if a fire occurs (Runyan, Bangdiwala, Linzer, Sacks, & Butts, 1992). A fatal fire in New Zealand was linked in media reports with the temporary nature of the dwelling (Watkin, 1997). Poor housing conditions may exist in cheaply constructed new dwellings, and in poorly maintained older dwellings. It is probable that older homes may be more vulnerable to electrical wiring faults. Although such faults account for less than two per cent of all fires in New Zealand, they account for almost six percent of fatal fires (Irwin, 1997).

A review of rural fire deaths in the southern United States suggested that use of portable heaters was related to fire fatalities in low income households (Gunther, 1982). Low income households may also be more likely to have more inflammable furnishings and carpets which increase fire risk (Shipp, 1996).

Lack of a smoke detector

At a household level lack of a smoke detector has been demonstrated to increase fire mortality risk. Fatal fires were over three times more likely to occur in a home without a functioning smoke detector compared with non-fatal fires (Runyan et al., 1992). Economically and socially deprived households, who are at most risk of fire related death or injury, are the least likely to have functioning smoke detectors installed (CM Research, 1998; Gorman, Charney, Holtzman, & Roberts, 1985; Roberts, 1996). Programmes to supply and install smoke detectors to vulnerable households have resulted in reductions in fire injury rates (Gorman et al., 1985).

Smoking

There is a strong association between personal and household socioeconomic conditions and smoking rates (Crampton & Davis, 1998). While the long term health consequences of smoking are well publicised, their lethality in situations of unintentional fire incidents is not so well known. Nearly one in four fire deaths in the United States in 1995 was attributed to smoking materials, with older adults a particularly vulnerable group (Hall, 1998).

Nationwide [USA] cigarettes are the leading cause of fire; twice as many deaths due to residential fires are associated with smoking as are caused by ... the next most important causes. In a common scenario, a lighted cigarette falls onto an upholstered sofa or chair, where it smoulders unnoticed while everyone goes to bed. Hours later, odorless carbon monoxide claims the lives of sleeping victims; many of them are not the smokers of the cigarettes. Many are not even members of the same household but live in adjacent apartments.

Baker, 1992

Alcohol

Alcohol appears to play an important role in fire deaths, usually in relation to smoking. Runyan Shrikant et al (1992) found that presence of an alcohol-impaired person was the strongest independent risk factor for death in the case of a fire. An epidemiological study in King County, Washington found that although households with members who consumed five or more drinks at a time were at greater risk of injury in a domestic fire, this was at least partly because households including heavy drinkers also reported higher smoking levels (Ballard, Koepsell, & Rivara, 1992).

Sole parenthood

“The children of lone mothers have the highest death rates of all social groups” in the UK, with injuries accounting for 60 per cent of the deaths (Roberts & Pless, 1995). Sole parenthood is often associated with poverty, poor housing, and increased smoking rates. Scholer, Hickson, Mitchel, & Ray (1998) found that childhood fire fatality risk increased with young age and low educational achievement of the mother, and with the presence of two or more children in the household. This finding implies that compromised capacity to provide supervision of children is also an issue increasing injury risk for children of sole parents.

Low educational level

Low educational level is associated with low literacy skills which may significantly limit the ability to understand and respond to fire safety messages. In New Zealand 20 per cent of the adult population have very poor literacy skills, and over a million adults are below the minimum level of competence required to use printed and written information to function in society (Ministry of Education, undated).

Ethnicity

Lack of ethnicity data in the FIRS database means that linkage with health data is necessary to analyse patterns of fire mortality by ethnic group. The disproportionate burden of injury related death and injury borne by Māori is however well established (Broughton, 1999). Maori are hospitalised for injuries from fire and flame sustained in the domestic location at a rate three times that of nonMaori (Duncanson et al., in press). Some of the ethnic disparity may be explained by socioeconomic and educational factors. Careful assessment of ethnicity, and inclusion in analysis in future research, will help to establish the extent to which ethnicity independently affects fire related injury and mortality rates.

Addressing social and economic determinants of health

The National Health committee identified four areas for possible policy interventions to address the issue of social and economic disparities in health status which are also relevant to fire safety (see Figure 2):

1. Underlying social and economic determinants of injury. Intervention at this level has considerable potential to reduce risk of injury and improve population health. However it requires political consensus of appropriate strategy, and it may be difficult to reconcile philosophical differences.
2. Intermediary factors such as improving housing safety, installing smoke detectors, and minimising fire risk from cigarette smoking can reduce risk, although they do not address underlying causes.
3. Effect of injury on socioeconomic position can be addressed by provision of adequate support for families affected by fatal or non-fatal fire incidents.
4. In the event of a residential fire, injury can be minimised by provision of appropriate services to extinguish fires and treat injuries in a timely manner. Pre event strategies to increase community awareness of appropriate action are also important.

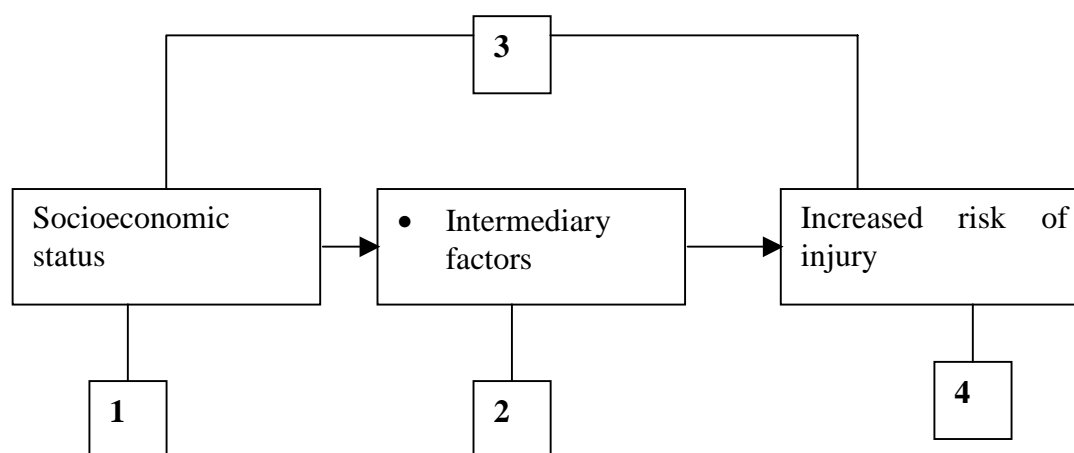


Figure 2. Possible targets for interventions to reduce socioeconomic disparities in risk of domestic fire injury. Source National Health Committee 1998, adapted from Mackenbach, Erasmus University.

Potential risk reduction strategies

Public policy

Public policy has an important place in improving the fire safety in New Zealand. Social and economic policy significantly affect many of the determinants of injury discussed in pages 14 to 16. Legislation and government policy can also ensure that housing stock is affordable and safe for New Zealand households. Recent policy initiatives which address fire injury in a more immediate way include legislation to ensure that lighters are childsafe, smokefree legislation, and provision of programmes to help smokers become smokefree. A current review of the constituents of tobacco provides an opportunity to regulate cigarettes to reduce fire risk. Production of a self extinguishing cigarette is feasible but requires political will for implementation (Brigham & McGuire, 1995; Hall, 1998; Karter et al., 1994).

Environmental modification

Installation of smoke detectors is a simple, effective environmental strategy to provide early warning of a household fire. The findings of this research indicate that priority should be given to programmes to install smoke detectors in households at the higher levels of social and economic deprivation. NZDep96 is a useful tool to identify such communities. Mandatory installation of smoke detectors in all rental accommodation will provide increased protection for vulnerable members of communities. New Zealand is in the minority of jurisdictions internationally by not requiring smoke detectors in detached, single family domestic dwellings (ISCAIP Smoke Alarm Legislation Collaborators, in press).

There is currently a lack of detailed information about the quality of New Zealand housing. An audit of the housing stock would potentially identify further issues which require attention to improve household safety.

Community development

The negative impact of low socioeconomic status may be mitigated by a “local social identity”. Chandler (1984, cited by Nicolopoulos, Murphy, & Sandinata, 1997) observed a low rate of fire incidents in an area with high unemployment. Closer observation suggested that “fire incidence is lower in close-knit communities in which the population have stayed or been kept together and provided mutual support when needed.” Community participation is therefore an important component of intervention strategies to reduce the incidence of fire related fatalities.

Communities at particular risk of fatal fire events require access to information to facilitate the participation of community members in the development of appropriate injury prevention strategies and advocacy support. This is particularly important in the development of strategies to reduce high risk behaviour. Involvement of community members in developing intervention strategies can lead to development of specific skills to improve the adequacy of housing stock (David Weinstein, personal communication, September 1999).

Intersectoral collaboration

The observation that 11 of the 17 preventable fire deaths in Nottinghamshire (UK) were current or past users of social services in the locality has led to a partnership between the Fire and Rescue Service and the Social Services Department. The Community Fire safety Unit training social workers to assess fire safety of dwellings as a part of routine risk assessment (Manifold, 1999). Many of the underlying determinants of domestic fire mortality also affect health and well being through affecting risk of other types of injury or illness. Addressing such underlying issues is a complex task. A co-ordinated approach across sectors has the capacity to deliver programmes that reduce preventable premature deaths and reduce injury related disability.

Conclusion

This project shows a clear gradient of increasing rates of fatal domestic fire injury in New Zealand with increasing social and economic deprivation at census meshblock level.

Strategies to address this differential risk for fire related mortality will need to identify and take into account barriers to household fire safety in these vulnerable population groups.

References

- Baker, S. (1992). What keeps the home fires burning? *New England journal of medicine*, 327(12), 887-888.
- Ballard, J. E., Koepsell, T. D., & Rivara, F. (1992). Association of smoking and alcohol drinking with residential fire injuries. *American journal of epidemiology*, 135(1), 26-34.
- Broughton, J. (1999). *Injury to Maori: Does it really have to be like this?* Dunedin: Te Ropu Rangahau Hauora o Ngai Tahu and Injury Prevention Research Unit.
- CM Research. (1998). *Fire safety survey* (Confidential). Wellington: New Zealand Fire Service.
- Crampton, P., & Davis, P. (1998). Measuring deprivation and socioeconomic status. *New Zealand Public Health report*, 5(11/12), 81-84.
- Crampton, P., Salmond, C., & Sutton, F. (1997). The NZDep91 Index of deprivation. In P. Crampton & P. Howden-Chapman (Eds.), *Socioeconomic inequalities and health* (pp. 149-156). Wellington: Institute of Policy Studies, Victoria University of Wellington.
- Cropp, D. (1997). *Fire deaths 1996/96 and 1996/97: A report commissioned by the New Zealand Fire Service* . Wellington: New Zealand Fire Service.
- Duncanson, M., Woodward, A., Langley, J., Clements, M., Harris, R., & Reid, P. (in press). Domestic fire injuries treated in New Zealand hospitals 1988-1995. *New Zealand Medical Journal*.
- Goodsman, R. W., Mason, F., & Blythe, A. (1987). Housing factors and fires in two metropolitan boroughs. *Fire safety journal*, 12, 37-50.
- Gorman, R. L., Charney, E., Holtzman, N. A., & Roberts, K. (1985). A successful city-wide smoke detector giveaway program. *Pediatrics*, 75(1), 14-18.
- Gunther, P. (1982). Rural fire deaths: The role of climate and poverty. *Fire journal*(July), 34-39,112.
- Hall, J. R. (1998). The other way cigarettes kill. *NFPA Journal* (January/February), 58-62.
- Irwin, K. (1997). *Domestic fire hazard in New Zealand* (Fire engineering research report 97/5). Christchurch: University of Canterbury.
- ISCAIP Smoke Alarm Legislation Collaborators. (in press). International smoke detector legislation. *Injury Prevention*.
- Jennings, C. R. (1999). Socioeconomic characteristics and their relationship to fire incidence: A review of the literature. *Fire technology*, 35(1), 7-34.
- Karter, M. J., Kissinger, T. L., Miller, A. L., Harwood, B., Fahy, R. F., & Hall, J. R. (1994). Cigarette characteristics, smoker characteristics, and the relationship to cigarette fires. *Fire technology*, 30(4), 400-431
- Keane, A., Jepson, C., Pickett, M., Robinson, L., & McCorkle, R. (1996). Demographic characteristics, fire experiences, and distress of residential fire survivors. *Issues in mental health nursing*, 17(5), 487-501.
- Lamm, F., Ritchie, M., & Rutherford, C. (1998). *New Zealand Fire Service study: Auckland area residential fire safety analysis report* (Unpublished). Auckland: University of Auckland.

- Mallonee, S., Istre, G. R., Rosenberg, M., Reddish-Douglas, M., Jordan, F., Silverstein, P., & Tunell, W. (1996). Surveillance and prevention of residential-fire injuries. *New England journal of medicine*, 335(1), 27-31.
- Manifold, T. (1999). Brigade links with Social Services in a bid to reduce fire fatalities. *Fire*, 92(1129), 14.
- Mierley, M. C., & Baker, S. P. (1983). Fatal house fires in an urban population. *Journal of the American Medical Association*, 249(11), 1466-1468.
- Ministry of Education. (undated). *Adult literacy in New Zealand; Results from the International Adult Literacy Survey* (ISBN 0-477-05071-9). Wellington: Ministry of Education.
- National Fire Data Center. (1997). *Socioeconomic factors and the incidence of fire* (FA 170): United States Fire Administration, Federal Emergency Management Agency.
- Nicolopoulos, N., Murphy, M., & Sandinata, V. (1997). *Socio-economic characteristics of communities and fires* (Statistical research paper 4/97). Sydney: NSW Fire Brigades.
- Roberts, I. (1996). Smoke alarm use: prevalence and household predictors. *Injury prevention*, 2, 263-265.
- Roberts, I. (1997). Cause specific social class mortality differentials for child injury and poisoning in England and Wales. *Journal of epidemiology and community health*, 51, 334-335.
- Roberts, I., & Pless, B. (1995). Social policy as a cause of childhood accidents: The children of lone mothers. *British Medical Journal*, 311(7010), 925-928.
- Runyan, C. W., Bangdiwala, S. I., Linzer, M. A., Sacks, J. J., & Butts, J. (1992). Risk factors for fatal residential fires. *New England journal of medicine*, 327(12), 859-863.
- Scholer, S. J., Hickson, G. B., Mitchel, E. F., Jr., & Ray, W. A. (1998). Predictors of mortality from fires in young children. *Pediatrics*, 101(5), E12.
- Shipp, M. (1996). Carpet 'increased severity' of fire which claimed four lives. *Fire prevention*, 287(March), 3.
- Townsend, P., Davidson, N., & Whitehead, M. (Eds.). (1992). *Inequalities in health: The Black report: The health divide* (1992 ed.). London: Penguin.
- Waller, A., & Marshall, S. (1993). Childhood thermal injuries in New Zealand resulting in death and hospitalisation. *Burns*, 19(5), 371-376.
- Waller, A. E., Marshall, S. W., & Langley, J. D. (1998). Adult thermal injury in New Zealand resulting in death and hospitalisation. *Burns*, 24, 245-251.
- Watkin, T. (1997, 5 July). Dwelling in misery. *New Zealand Listener*, 159, 22-23.
- Welch, K. L. (1999). Fire loss state by state. *NFPA Journal*, 93(3), 106-115.