Fire Research Report

Fire Safety Features in Housing

BRANZ Limited

June 2013

The research studied trends in fire safety features in the housing stock and the costs associated with mitigating fire hazards. The main findings were:

- The prevalence of smoke alarms in houses is increasing, from 85% in the 2004 survey to 93% in the 2010 survey.
- In general, renters were less likely to have smoke alarms installed than owner occupiers (11% of renters did not have smoke alarms, compared to 6% of owner occupiers).
- Households with a total income of between $10,001 and $30,000 have a lower proportion of houses with smoke alarms, compared to other income groups.
- The average number of smoke alarms per house is increasing.
- However, the proportion of houses with alarms that have at least one operational decreased from 96% in 2004 to 90% in 2010.
- Smoke alarms are most commonly located in hallways.
- 83% of houses had battery powered smoke alarms.
- 8% of smoke alarms were interconnected and this is increasing.
- 77% of houses had additional fire safety equipment installed in the latest survey. These are mainly fire extinguishers and hose reels. Readily accessible garden hoses were considered to be a hose reel.
- The proportion of houses with potential ignition sources decreased between the 2004 and 2010 surveys.
- The prevalence of flammable aspects within houses is decreasing.
- The cost of fire hazard mitigation averages about $500 per house and this amount is about 15% of the typical amount of other repairs needed to address immediate safety concerns in housing.

The research extracts information from several surveys and research reports on fire safety and fire safety features in houses. This information adds to our knowledge of risk factors and our ability to better target interventions to educate and also influence people's behaviours and attitudes to fire safety.

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Preface

This report was prepared during research into fire safety features in housing. It examines trends in fire safety measures and hazards in the housing stock in recent years, based on the BRANZ house condition surveys of 1999, 2004 and 2010.

Acknowledgments

This work was jointly funded by the Building Research Levy, and the NZ Fire Service Commission under their Contestable Research Fund 2012.

Fire Safety Features in Housing

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1. INTRODUCTION

The following information comes from the last three House Condition Surveys (HCS) which provide snapshots of the housing stock in New Zealand at different points in time. 465 houses were surveyed in the 1999 survey, 565 in the 2004 survey and 509 in the 2010 survey (Bucket, Marston et al).

The 2010 survey was the first to include a representative sample of rental properties. This may influence some of the results presented when comparing trends between the 1999/2004 surveys and the 2010 survey. Some rental properties may have been picked up in the previous surveys but they are very few in number as the target was owner-occupied housing. A phone survey accompanied the 2010 HCS where questions on demographics, condition of the house, smoke alarms, as well as on current and future maintenance spending, were asked.

The 1999 survey was limited to identifying smoke alarms and any other fire safety equipment. Later surveys collected data on types of fire hazard.

Figure 1 shows the distribution of house ages in the three House Condition Surveys. The decade that the house is built is used to illustrate the age of the house, and the bands used are indicative of periods of housing in New Zealand. 1890-1929 largely encompasses the Villa and Bungalow periods of housing, the 1930-1949 was the first half of the state housing period, and the 1950-1969 was the second half, 1970s housing is pre-insulation and both the 1970s and 1980s had a wide variation in styles. Since then, 20 year bands have been used.

Earlier houses, particularly those built before 1970 have decreased in prevalence in later surveys. Houses built since 1990 have increased considerably from the 1999 survey. The mixed category is used to represent houses that have had a significant alteration or addition to the house that affects the age of the house, but was not used in the 1999 survey.

The individual reports foreach HCS discuss sample selection. In general they are believed to be representative of the total stock, but it is likely there is some self-selection toward better condition houses.

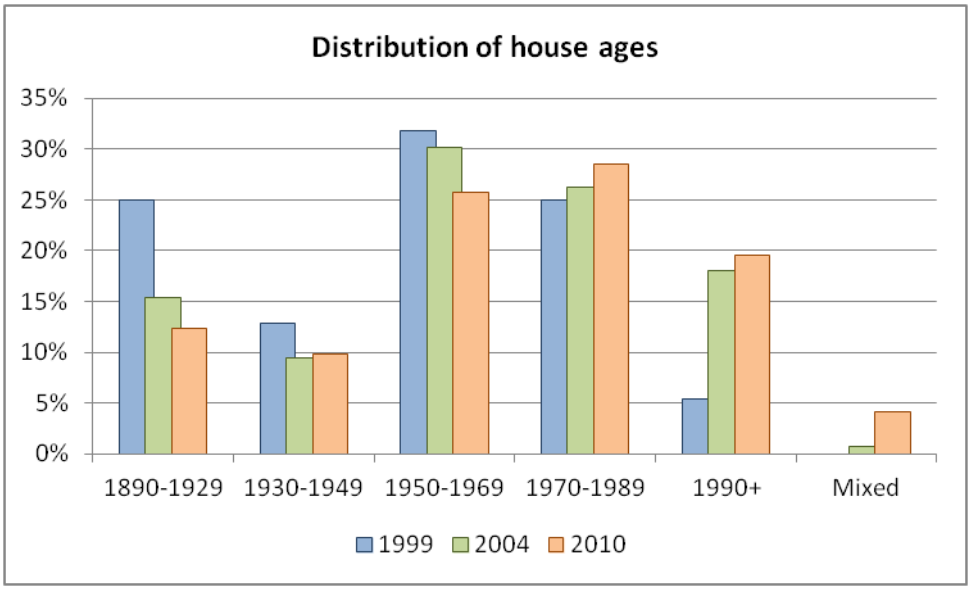

Figure 1 Distribution of House Ages

2. SUMMARY

The main findings of this research are below. It was a study of trends in fire safety features in the housing stock and the costs associated with mitigating fire hazards.

- The prevalence of smoke alarms in houses is increasing, from 85% in the 2004 survey to 93% in the 2010 survey.
- In general, renters were less likely to have smoke alarms installed than owner occupiers (11% of renters did not have smoke alarms, compared to 6% of owner occupiers).
- Households with a total income of between $10,001 and $30,000 have a lower proportion of houses with smoke alarms, compared to other income groups.
- The average number of smoke alarms per house is increasing.
- However, the proportion of houses with alarms that have at least one operational decreased from 96% in 2004 to 90% in 2010.
- Smoke alarms are most commonly located in hallways.
- 83% of houses had battery powered smoke alarms.
- 8% of smoke alarms were interconnected and this is increasing.
- 77% of houses had additional fire safety equipment installed in the latest survey. These are mainly fire extinguishers and hose reels. Readily accessible garden hoses were considered to be a hose reel.
- The proportion of houses with potential ignition sources decreased between the 2004 and 2010 surveys.
- The prevalence of flammable aspects within houses is decreasing.
- The cost of fire hazard mitigation averages about $500 per house and this amount is about 15% of the typical amount of other repairs needed to address immediate safety concerns in housing.

Data on individual houses and their occupants is confidential and has not been disclosed to parties outside BRANZ and its partner CRESA. Occupant name and address data is not included in the physical condition database so that individual responses cannot be identified by the researchers.

3. LITERATURE REVIEW

Three pieces of research on existing housing stock are discussed below. The first is a report for the NZ Fire Service written by Page and Fung (2010) on housing design changes and fire damage. The second is a report by Warren (2009) reviewing existing fire safety in homes. Finally, a BRANZ study report was done on priority repairs in housing (Page, Curtis 2013)

The first report by Page and Fung examined the NZFSC database of fires which record a wide variety of data on fire causes, extent of damage, and house age and location. As well, characteristics of housing by age group were assessed using the 2004 HCS. The survey recorded data on materials and design features which enable changing characteristics by house age group to be related to fire incidence. The findings were:

- Houses built pre-1946 are more likely than newer houses to be “severely damaged” in a fire.

- Approximately 30% of fires are due to “failure of fixed equipment (stove, wiring, power and light fittings, and heaters)”.
- Approximately 70% are due to “inappropriate behaviour by occupants” and “consumer equipment failures”.
- Design changes have increased the risk of fire spread but changes in materials and equipment has tended to offset this. The net effect is that the incidence of fires has been fairly constant at about “10 fires per 10,000 houses per year”, from the NZFS database.
- The main areas for fires are the kitchen, followed by the family room then bedrooms. The report suggests that “cooking accidents are a major cause of fires in houses” and the two most common heat sources for fires were stoves and ovens.
- The most common objects first ignited were “framing, cooking food, wiring, wall claddings, bedding and wall linings”.
- “The existence of an upper floor may also enable fire spread up the stair well”.
- “Fire severity is higher in houses with weatherboard claddings and timber based linings than with other materials”.

A notable finding from the research was that inappropriate occupant behaviour is the major cause of fires, rather than defects or failures in the physical characteristics of the house.

In the second report Warren undertook a telephone survey of 1,600 older people. The survey asked questions about fire incidences, ignition sources, deferred repairs that could increase fire risk, heating systems, and housekeeping practices that pose a risk of fire.

The key points from the second report (Warren, 2009) are:

- Vulnerability to fire risk increases as people age.
- Somewhere between 5% and 11% of people have “experienced an unintended fire in their home”.
- In a survey of people over 60 years of age, most of the fires described were “cooking-related”.
- “Around one in two households have an escape plan although home owners are almost twice as likely to have escape plans as renters”.
- An assessment tool was developed in the project for self completion risk assessment. It asks questions on the house and household characteristics including fire safety equipment.

It confirmed the NZFSC data that occupant behaviour was a major cause of fires. The two studies indicate kitchen features are a main issue in fires and that possible ignition sources need to be carefully assessed.

The last study examined the HCS for types of repairs needed, the cost and how that relates to the household income. In particular, affordability of some groups was found to be challenging and it seems likely some households will continue to live in deteriorating houses due to lack of funds. The repair costs excluded mitigating for fire hazard and some households will need to decide between fire hazard repairs and physical repairs.

In addition to the above the house condition survey reports of 1999, 2004 and 2010 have data on the incidence of fire safety measures but little analysis of trends. A study report did a condition comparison by tenure using the 2010 survey (Buckett et all, 2012) and has a brief discussion of fire safety aspects which are more fully covered in this report.

4. RESULTS

This section describes:

- A fire hazard index developed from data collected in the HCS.
- Fire safety features.
- Details of individual hazards including incidence and ages of houses affected.
- Costs of mitigating fire hazard.

4.1 Fire hazard condition score

The HCS measures a number of fire hazards including ignition sources and flammability. The results of these individual aspects are shown in following sections of the report. Also, these hazards have been added together for each house and expressed as a composite fire hazard condition.

Some hazards or faults are more dangerous than others (e.g. not having smoke alarms, use of candles, dangerous heaters, etc) and the scoring system has a higher weight for these hazards than for lower risk hazards. The fire hazard condition score therefore aims to show the risk of a fire to the housing stock. A scale of 1 to 5 was used where 1 = Serious condition, 2 = Poor, 3 = Moderate, 4= Good and 5 = Excellent condition. This system was used because it aligns with the scale used in the house condition survey where the condition of each component was assessed on the same 1 to 5 scale.

Details of the scoring are described in the appendix.

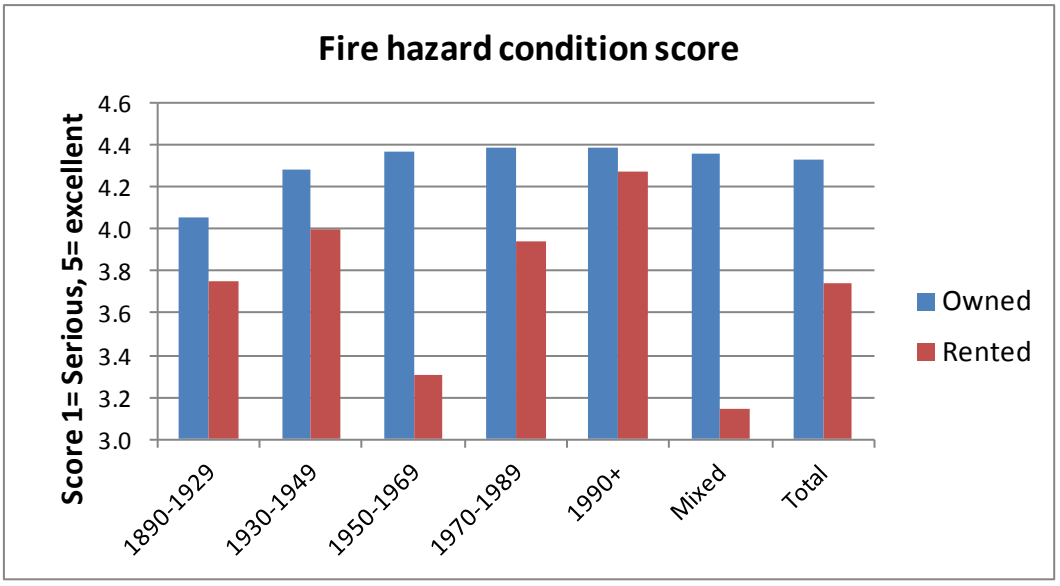

Figure 2 Fire hazards condition by house age – 2010 survey

Figure 2 shows condition score and house age, by tenure for 2010. Rentals have a lower score in all age groups, with the 1950-1969 group and the mixed group needing most attention.

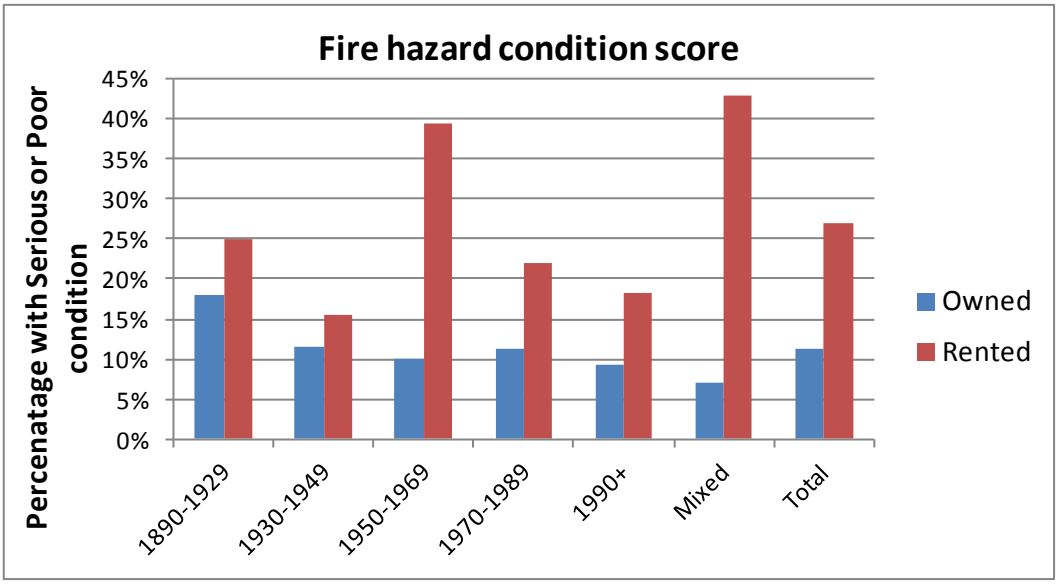

Figure 3 Fire hazards incidence needing immediate attention – 2010 survey

Figure 3 shows the percentage of houses with a serious or poor fire hazard condition for 2010. Overall about 10% of owner occupied houses have these conditions, but the situation for rentals is worse with 25% needing immediate attention, and in particular the 1950 to 1969 and mixed age groups.

Figure 4 shows the average fire hazard repair costs by household income. Costs are in two categories, all inclusive, and excluding the expensive repairs. The latter include replacing all flammable linings, installing an external stairway escape and replacing all synthetic carpets. In the scoring system described in the appendix these three items do not have a high weighting. So they can be omitted without having a large effect on the hazard score for any particular house. Hence for most income groups the required repair cost averages about $500.

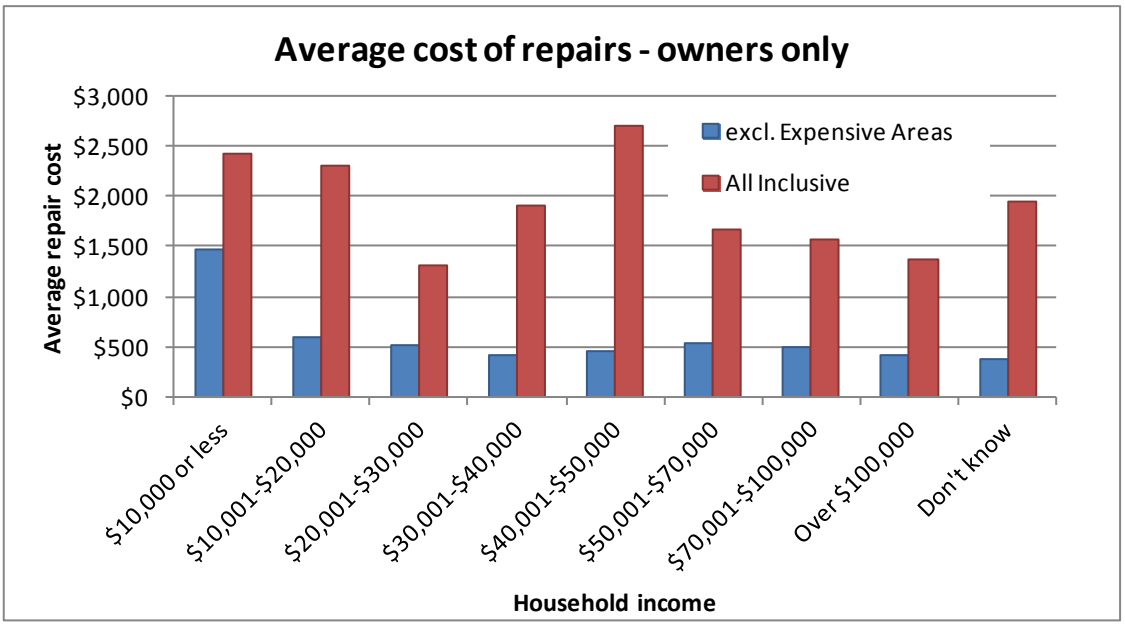

Figure 4 Repair costs for owners by household income – 2010 survey

What is the trend in overall condition scores? In the 2010 survey approximately 11% of owner-occupied houses were in a poor or serious fire hazard condition. This is down from 2004 when 18% of houses were in the same condition. Also the percentage of houses rated Excellent has increased significantly since 2004. So in general the incidence of fire hazard appears to be decreasing.

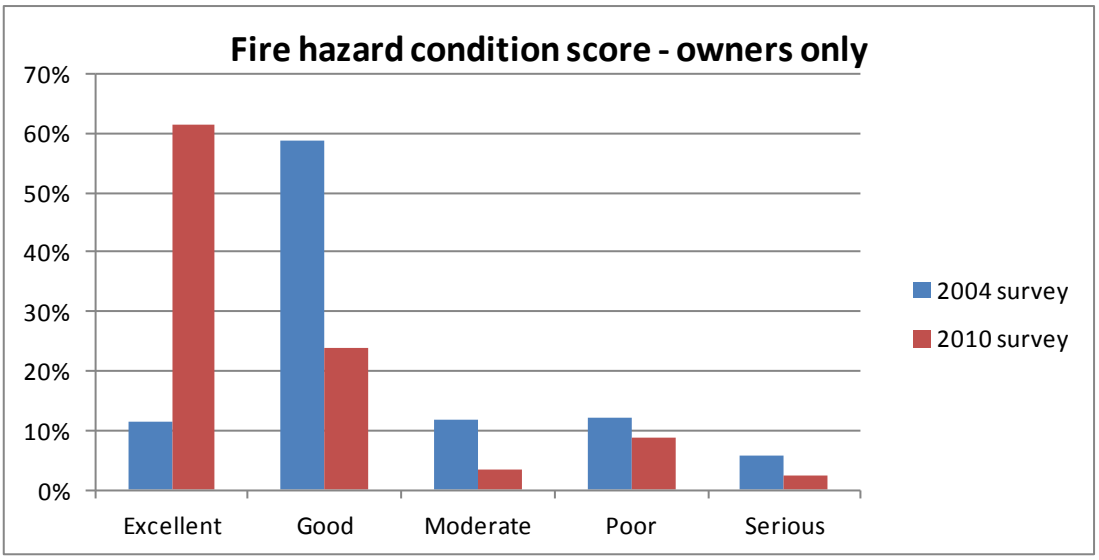

Figure 5 Trends in the hazard condition score

4.2 Fire risk factors

Fire protection issues that cause a hazard include ignition sources, lack of smoke alarms, limited means of egress, flammability of materials and clutter and flame spread potential. Data on many of these items was recorded in the last two condition surveys and most houses have one or more hazards. Generally, the incidence of hazards has declined between 2004 and 2010.

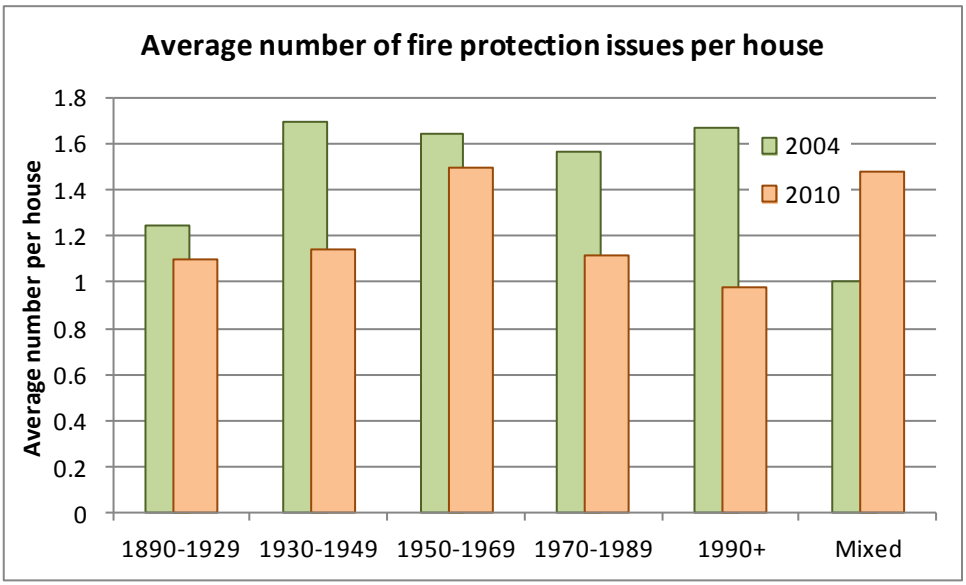

Figure 6 Average fire hazards per house

4.2.1 Ignition Sources

Ignition sources are the biggest fire protection issue. Potential ignition sources are heaters sited dangerously, cooker sited dangerously, fireplace sited dangerously, use of candles/naked flames, dangerous heaters, inadequate/poorly sited power points and overloaded power points. In the 2004 HCS, 10% of houses surveyed had potential ignition sources. This was down in the 2010 survey to 3.9%, despite an increase for the 1890-1929 age group.

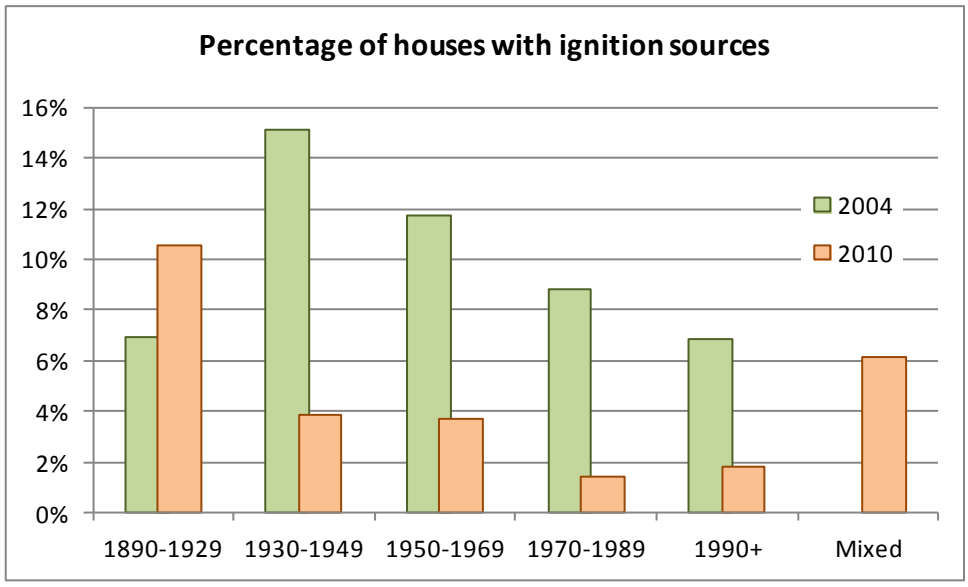

Figure 7 Percentage of houses with ignition sources

A large reason for the high proportion of houses with ignition sources in the 2004 survey was the amount of houses using candles/naked flames. At 8% of houses surveyed, this was by far the most common ignition source. In the 2010 survey, this was down to 0.4%. The following were present in over 1% of houses surveyed in 2010:

- Cooker sited dangerously
- Inadequate/poorly sited power points
- Overloaded power points

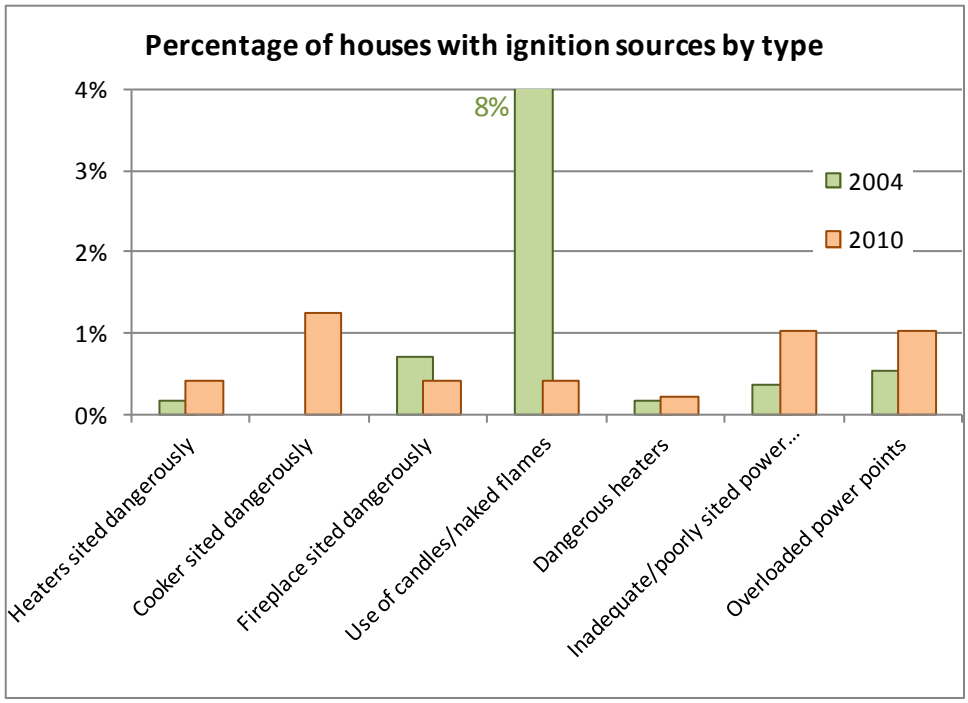

Figure 8 Percentage of houses with ignition sources by type

Ignition sources were much more common in rented houses than owner occupied housing. 8% of rented housing surveyed had potential ignition sources and was most common in earlier housing (prior to 1970) and houses of mixed age. The most common sources of potential ignition in these houses were both heaters and cookers sited dangerously and the use of candles/naked flames which were prevalent in over 1% of rented housing surveyed.

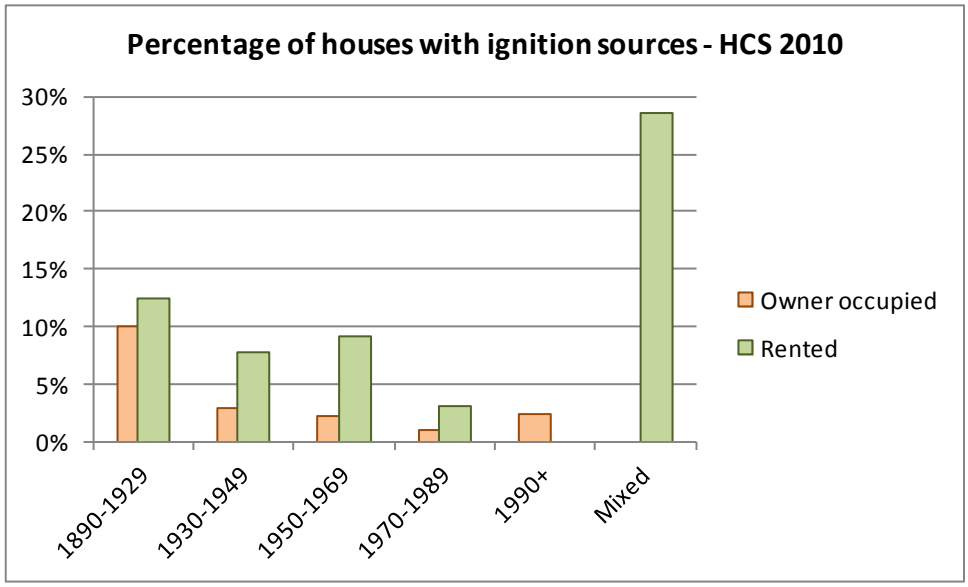

Figure 9 Percentage of houses with ignition sources by tenure

4.2.2 Smoke Alarms

The prevalence of smoke alarms in houses has increased between surveys. 29% of houses in the 1999 survey did NOT have any smoke alarms installed. This had decreased significantly to just 15% by the 2004 survey. It was further reduced in the latest survey to 8% (or 6% if rental houses are excluded), see Figure 10.

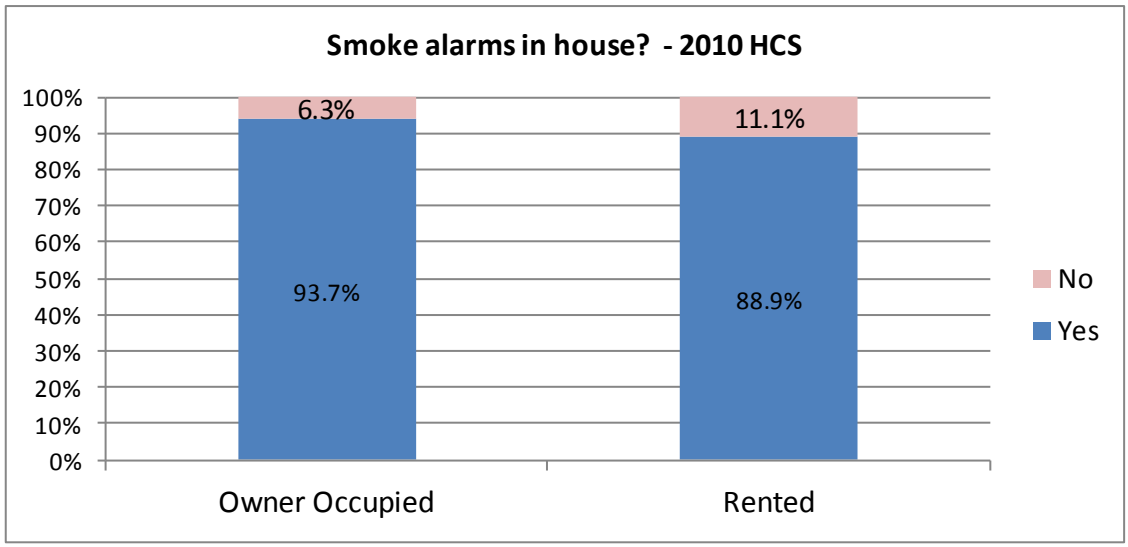

Figure 10 Percentage of alarms by tenancy

In the 2010 survey, the house age groups where smoke alarms were least prevalent were for houses built between 1890 and 1929 and houses of mixed age. There were no houses of mixed age in the 1999 survey, and very few in the 2004 survey.

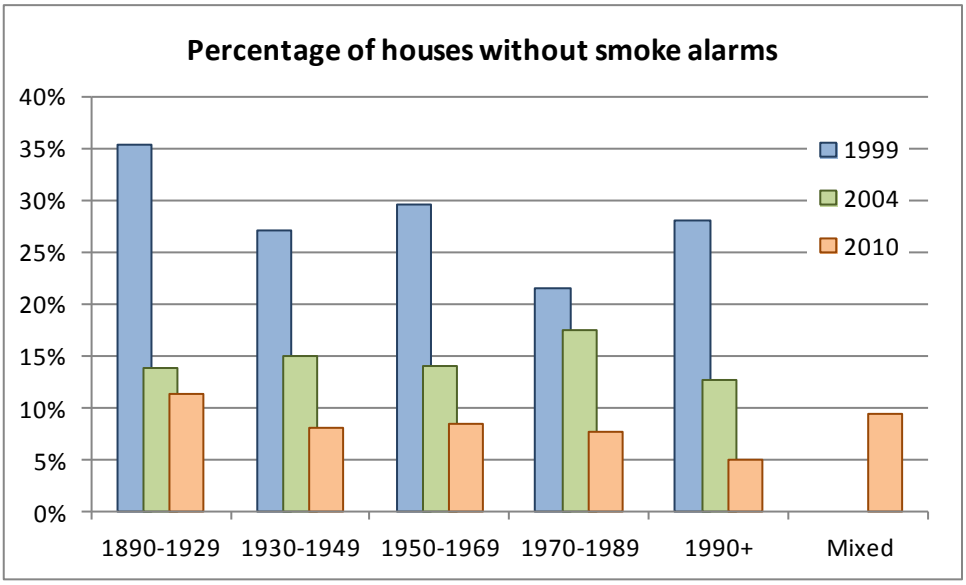

Figure 11 Percentage of houses without smoke alarms

The under-25 occupant age group have the lowest prevalence of smoke alarms. 38% of houses occupied by people under the age of 25 did not have smoke alarms in the 2010 survey (no houses occupied by people in this age group were surveyed in 2004). Only 1.6% of houses surveyed in the 2010 survey were occupied by people under the age of 25, with the majority living in rented houses.

The major improvement between surveys has been for those aged 50 years or older. In the 2004 survey, 19% of houses occupied by people 50 years or older did not have smoke alarms. By the 2010 survey, this was down to 8.5%.

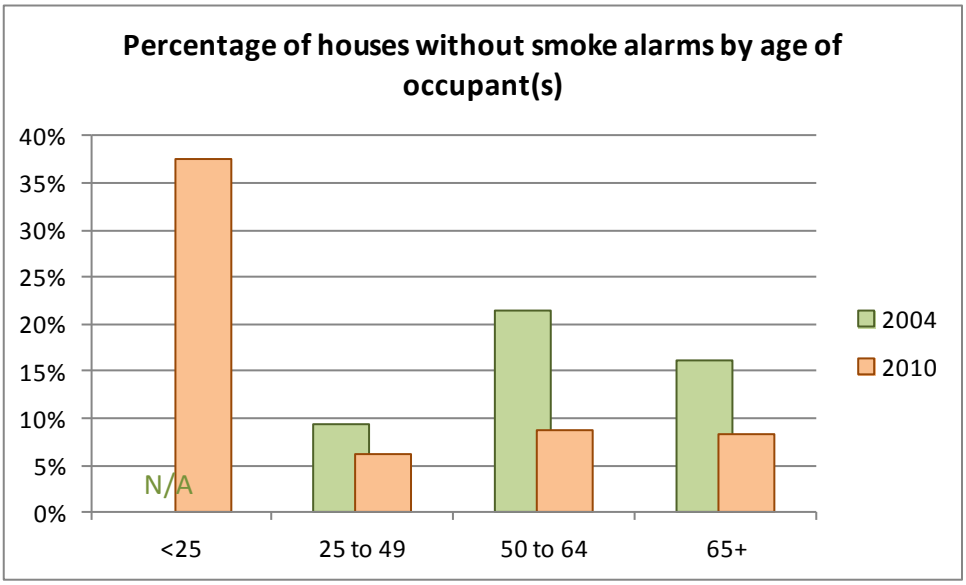

Figure 12 Percentage of houses without smoke alarms by age of occupants

Rented houses were less likely to have a smoke alarm than owner occupied houses. Renters aged less than 25 years old performed worst, with just fewer than 40% of houses surveyed not having smoke alarms installed.

Renters were also significantly worse in houses occupied by 50 to 64 year olds. 17% of these houses surveyed did not have a smoke alarm installed. Of the owner occupied houses in the same age group, only 7% did not have smoke alarms installed.

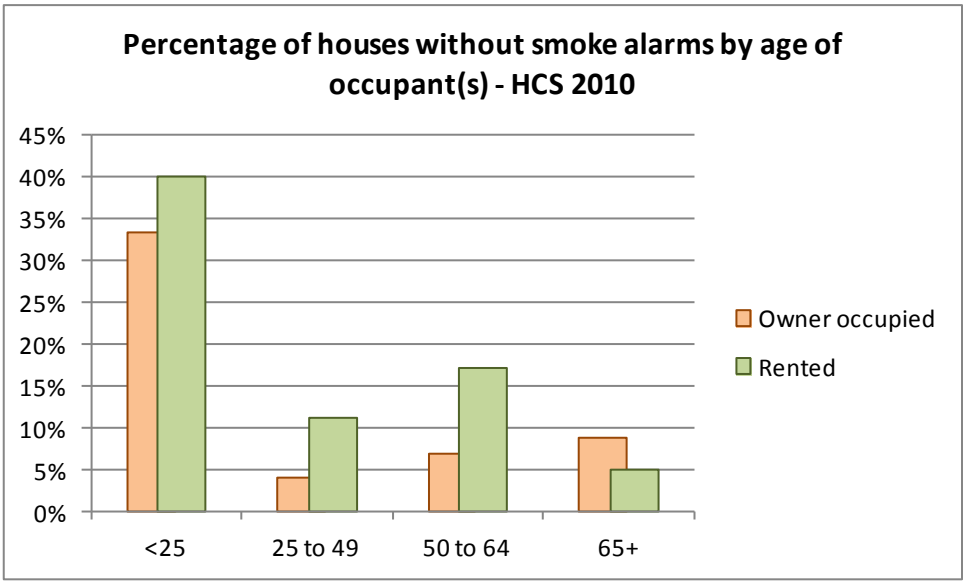

Figure 13 Percentage of houses without smoke alarms by age of occupants and tenure

Whilst the proportion of houses without smoke alarms has decreased overall between surveys, this has not been the case for all income bands. The proportion of houses without smoke alarms in the 2010 survey increased from the 2004 survey for incomes lower than $20,000 and incomes between $70,001 and $100,000.

10% of houses with a combined occupant income of less than or equal to $50,000 and 6% of houses with a combined income of more than $50,000 did not have smoke alarms installed in the 2010 survey. Very few houses with household income of $10,000 or less were surveyed, and all of them had at least one smoke alarm installed.

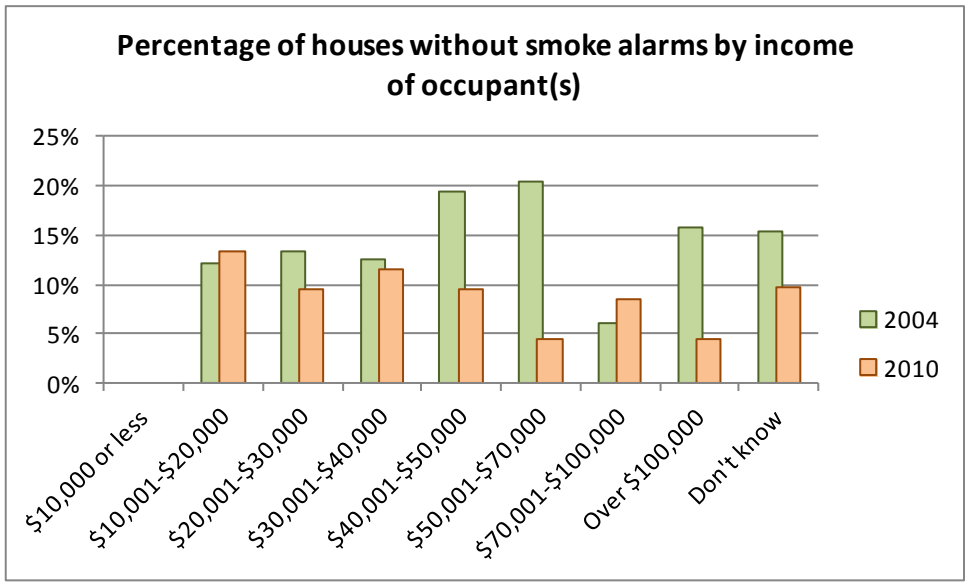

Figure 14 Percentage of houses without smoke alarms by household income

The operational status of smoke alarms installed was generally positive. However, the proportion of houses with operational alarms decreased in the 2010 survey. Of the 92% of houses that had smoke alarms installed, 90% had working smoke alarms. That is, just 83% of houses surveyed in 2010 had working smoke alarms installed.

In the 2004 survey 96% of smoke alarms were operational. This was up from the 1999 survey from 92%.

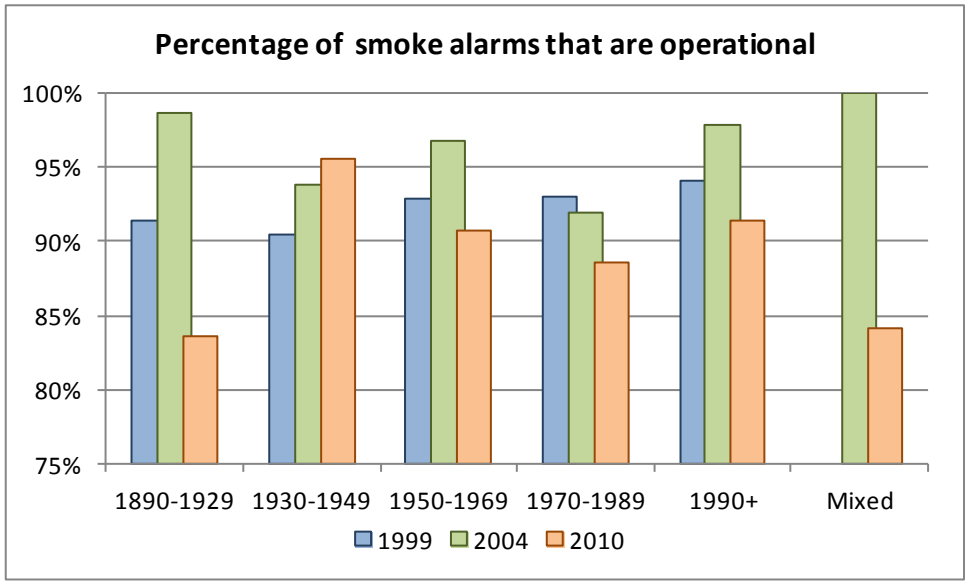

Figure 15 Percentage of smoke alarms that are operational

In the 2010 survey, renters were more likely to have operational smoke alarms than owner occupiers, despite the proportion of owner occupiers having smoke alarms being higher.

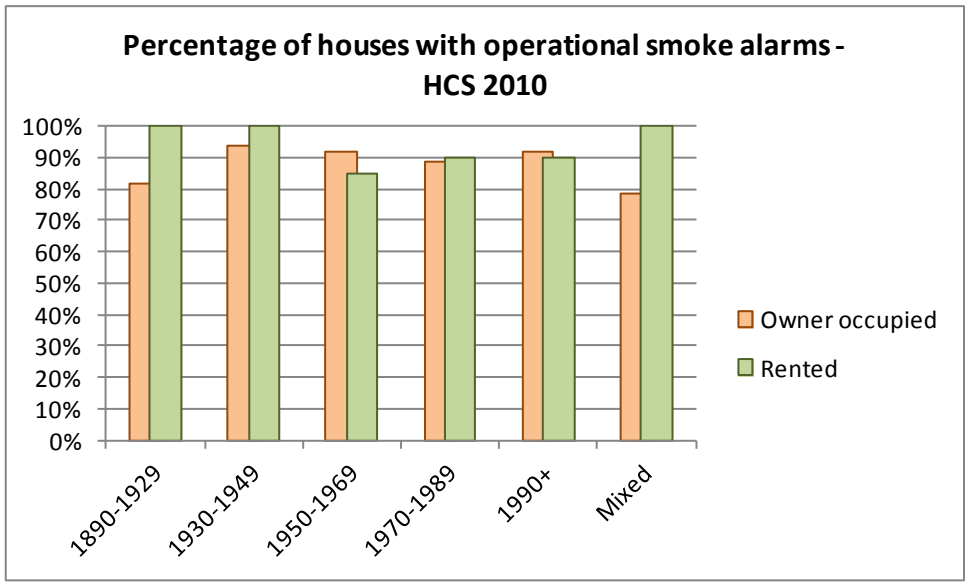

Figure 16 Percentage of smoke alarms that are operational HCS 2010

As well as a physical inspection of houses the HCS carried out a phone survey of occupants with a series of socio-economic questions. One of these asked how often households checked whether the smoke alarms were operational and also how often the batteries were changed. About 80% of households said that they checked the operation at least once a year. This quite good response probably reflects the annual reminder campaign carried out by the fire service and reflects the proportion of houses that have working smoke alarms installed.

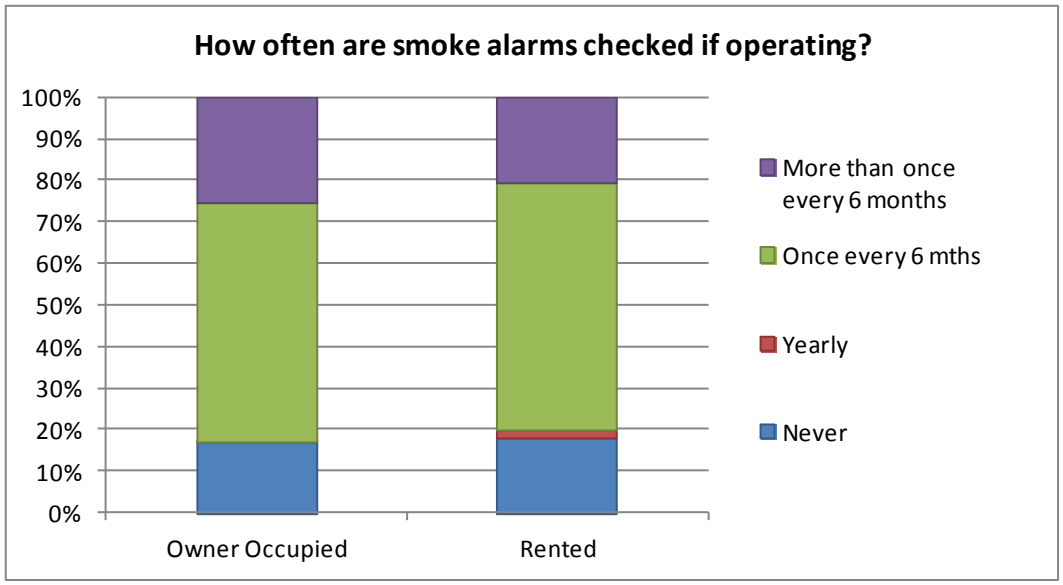

Figure 17 How often are smoke alarms checked for operation?

Old style batteries last about a year so it is not surprising a quite high percentage (about 60%) said they changed the batteries at least once a year. New alkaline batteries last longer, so in the future the replacement rate may decline.

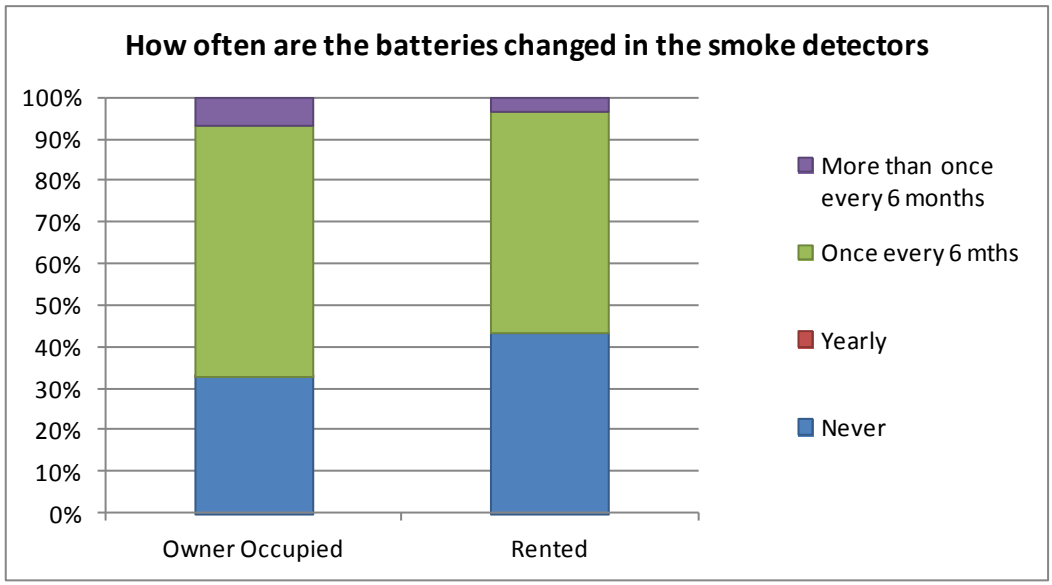

Figure 18 How often are smoke alarm batteries changed?

4.2.3 Means of Egress

This section measures the occupants' ability to escape the fire. 8% of houses surveyed in 2010 did not have at least two doors to outside from the ground floor. This is needed to offer an alternative escape route if one door is blocked by fire. This proportion was much higher in houses built between 1930 and 1949, as well as the mixed category.

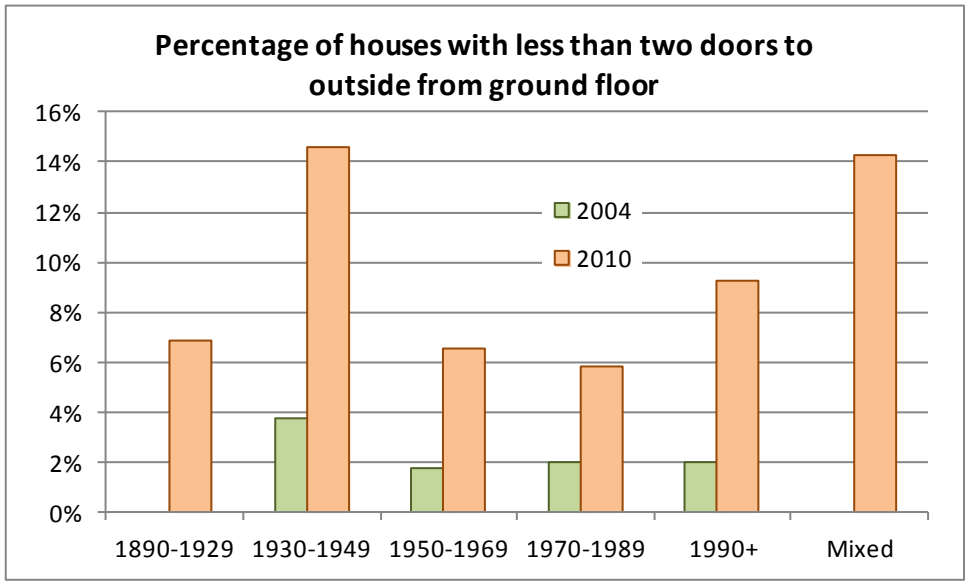

Figure 19 Percentage of houses with less than two doors to outside from ground floor

The proportion of houses in the 2004 survey that did not have an alternative means of escape from upper floors was 11%. In the 2010 survey, this had increased to 22%. It was particularly prevalent in houses built between 1890 and 1929, as well as the mixed category.

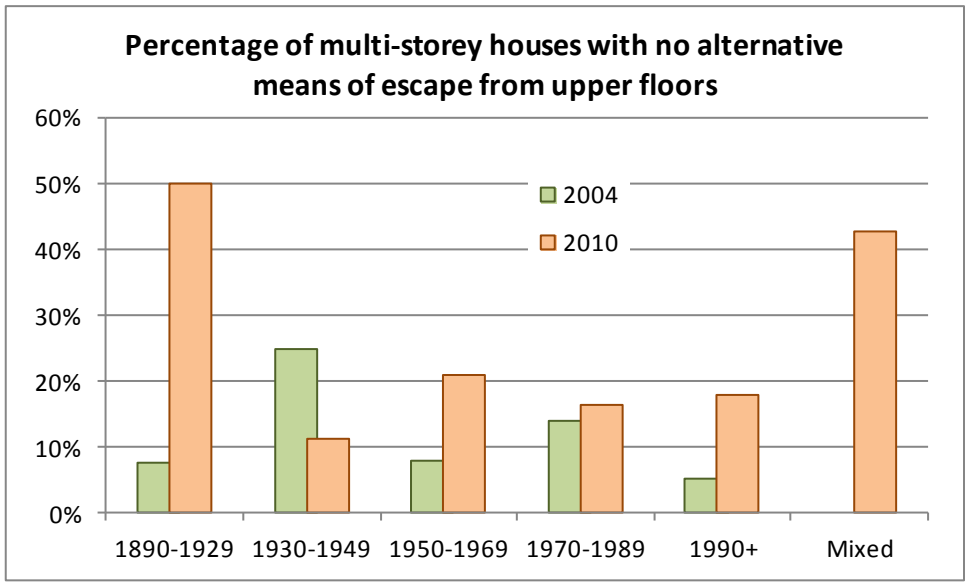

Figure 20 Percentage of multi-storey houses with no alternative means of escape from upper floors

4.2.4 Flammability

This section measures the house contents contribution to the potential fire intensity or fire load.

The proportion of houses with flammable contents has decreased. 44% of houses surveyed in 2004 had flammable aspects compared to just 19% in 2010. These flammable aspects are flammable wall linings, flammable ceiling linings, combustible room contents – clutter, combustible subfloor clutter and a large amount of upholstered furniture. These items were less common in newer houses in the 2010 survey.

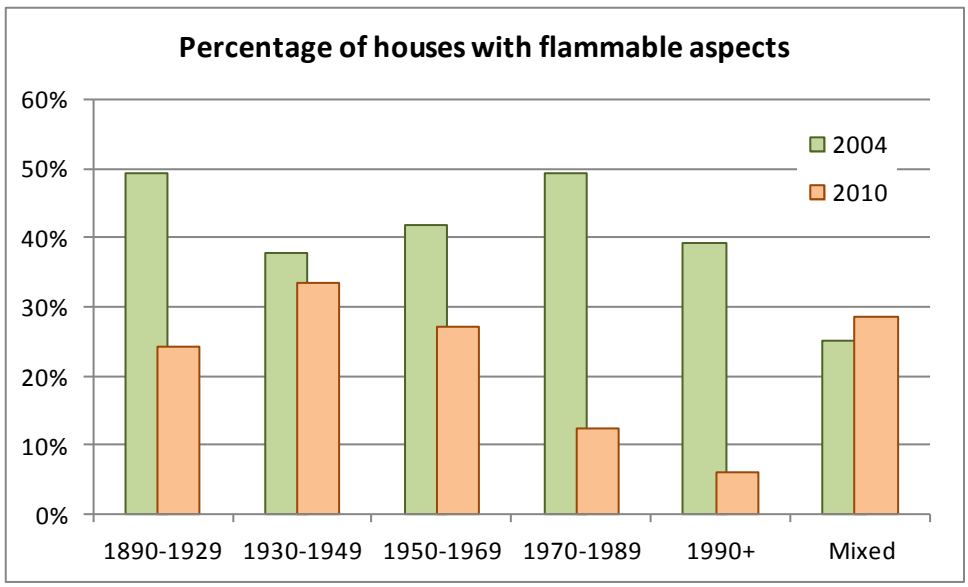

Figure 21 Percentage of houses with flammable aspects

Both combustible room contents clutter and combustible subfloor clutter were more prevalent in the 2010 survey than the 2004 survey. 10% of houses in the 2010 survey

had combustible room contents, and 3% had combustible subfloor clutter. Each of the flammable aspects was more prevalent in the 2010 survey for rented housing than owner occupied housing (see Figure 23). This was particularly the case for combustible room contents – clutter, which was prevalent in 26% of rented housing surveyed.

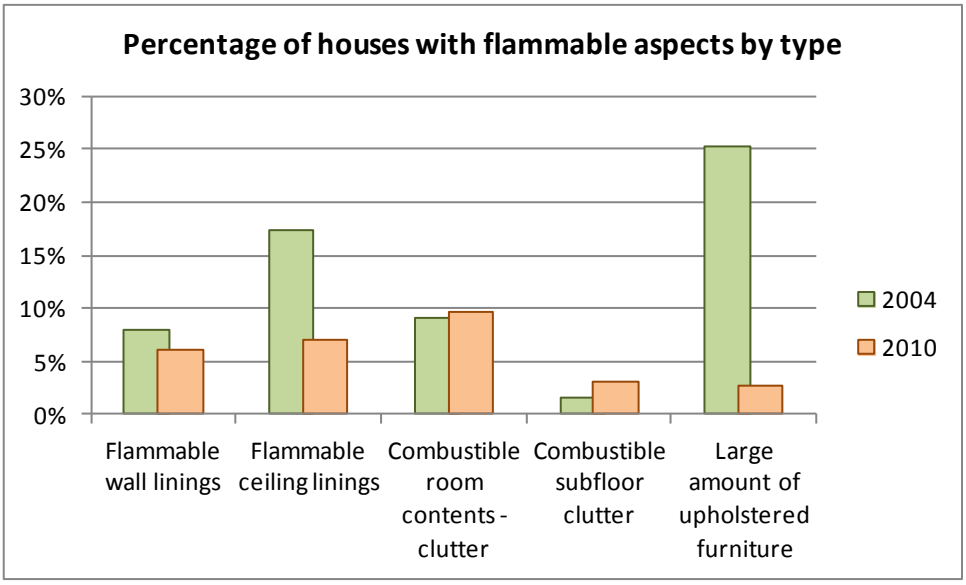

Figure 22 Percentage of houses with flammable aspects by type

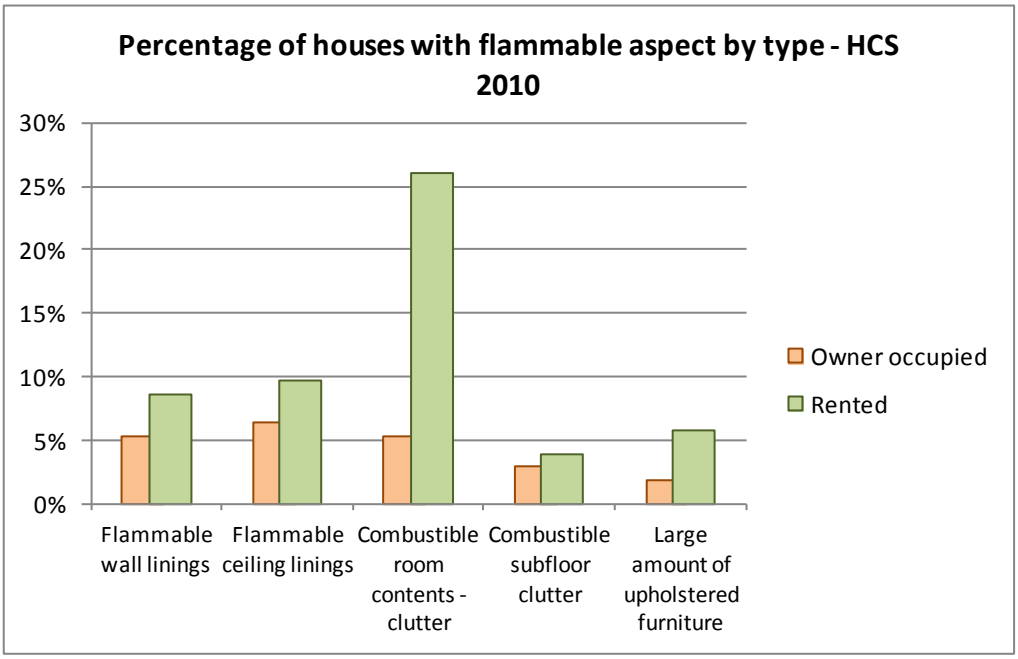

Figure 23 Percentage of houses with flammable aspects by type HCS 2010

4.2.5 Flame spread

This section measures features that allow fires to spread after ignition within a localised space.

The proportion of houses with mostly hollow core doors has decreased between the 2004 and 2010 surveys. 56% of houses surveyed in 2010 had mostly hollow core doors, down from 76% in 2004. Hollow core doors were much more common in houses built since 1950. They were also more common in rented housing than owner occupied housing in the 2010 survey.

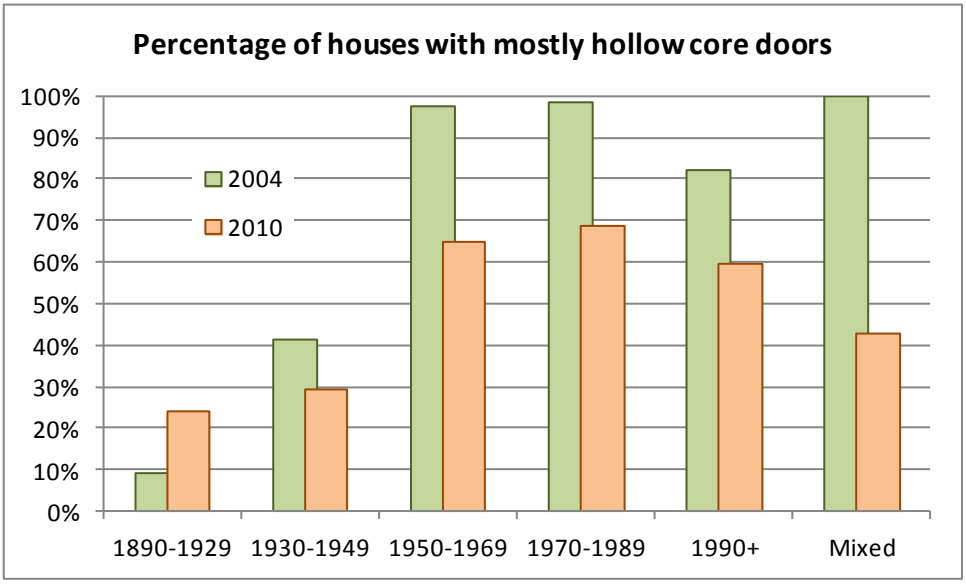

Figure 24 Percentage of houses with mostly hollow core doors

10% of houses surveyed in 2010 had synthetic carpets. This was up from 7% in 2004's survey. The synthetic carpets identified in the 2010 survey were largely for rented houses. The presence of synthetic carpets was largest in houses built in 1950-1969 at just under 16% in the 2010 survey. It is also particularly prevalent in recent houses built since 1990.

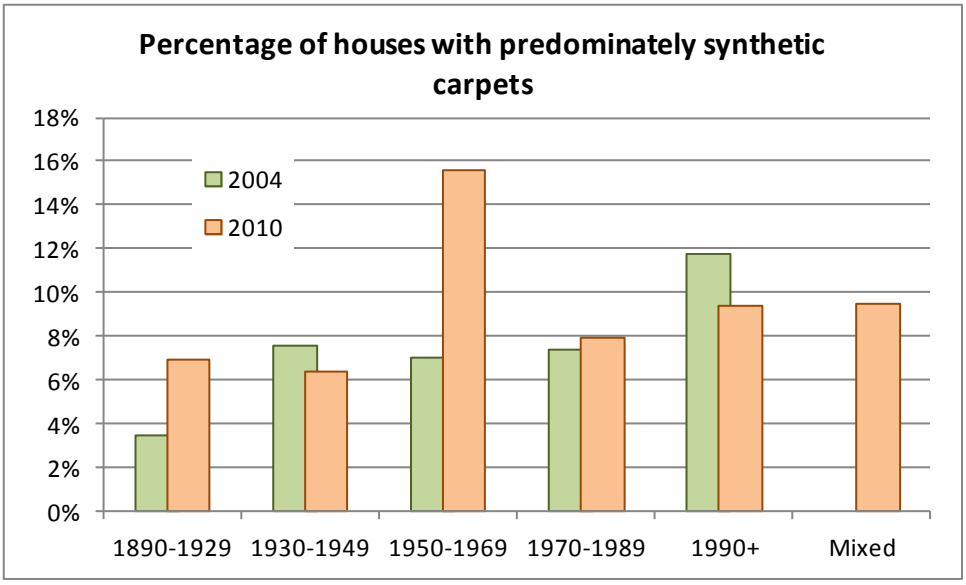

Figure 25 Percentage of houses with predominately synthetic carpets

4.2.6 Additional Equipment

The proportion of houses with additional fire safety equipment has increased significantly between surveys. Figure 26 shows a large increase in prevalence of additional fire safety equipment across all house ages, particularly between the 2004 and 2010 surveys. Overall, 77% of houses had additional fire safety equipment installed in 2010, up from 38% in 2004 and 20% in 1999.

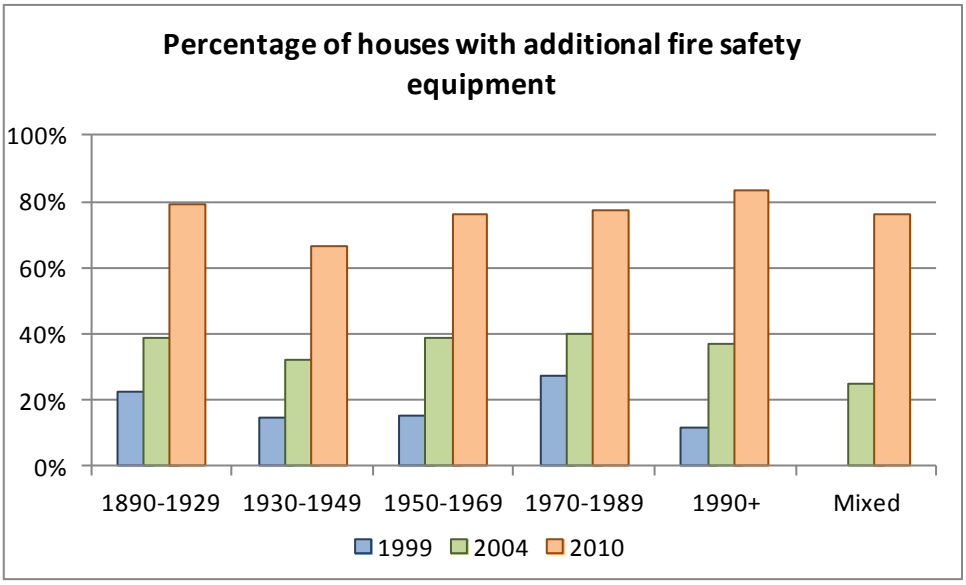

Figure 26 Percentage of houses with additional fire safety equipment

The additional fire safety equipment looked for were fire extinguishers, hose reels, fire blankets and sprinklers, although sprinklers were not included in the 1999 survey. Figure 27 shows the prevalence of each fire safety item. Hose reels were the most common feature included in the 2010 after only being included in a few homes in both the 1999 and 2004 surveys. 59% of houses had a hose reel in 2010, up from just 0.5% in 2004. Fire extinguishers were less common in the 2010 survey than the 2004 survey.

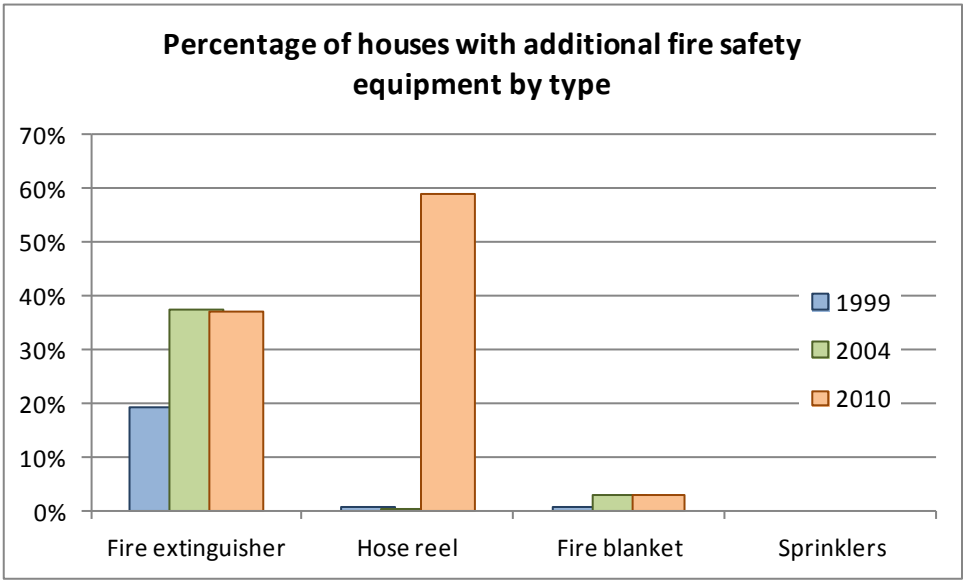

Figure 27 Percentage of houses with additional fire safety equipment by type

In general, additional fire safety equipment was more common in owner occupied houses than rented houses; therefore the introduction of rented houses may be responsible for the decrease in prevalence of fire extinguishers. Hose reels were prevalent in 71% of owner occupied houses, and fire extinguishers in 45%.

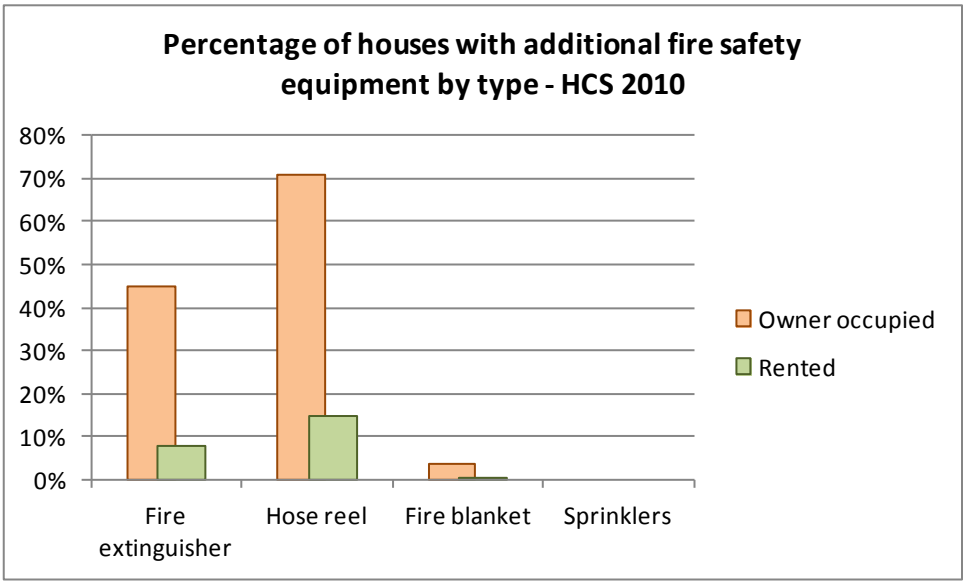

Figure 28 Percentage of houses with additional fire safety equipment by type HCS 2010

In the 2010 survey, the proportion of houses with additional fire safety equipment increased with household income up until $50,000. Apart from the less than $10,000 income band, all income bands have seen an increase in the proportion of houses with additional fire safety equipment.

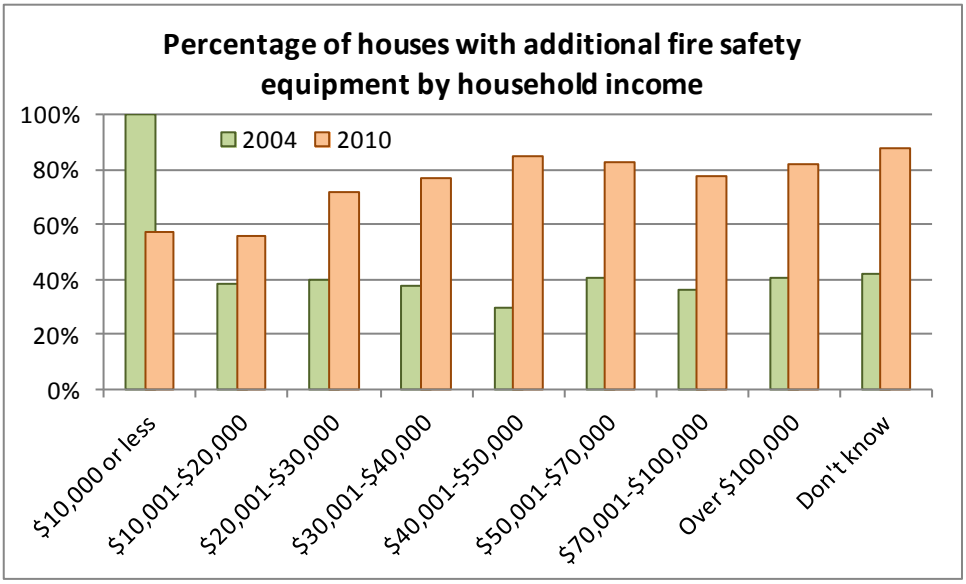

Figure 29 Percentage of houses with additional fire safety equipment by household income

4.3 Heating

The following chart shows the propensity of different heating sources by age of the house. It shows what heating sources are present, and does not take into account whether the particular source is in use or not. Open fires appears both in solid fuel, and as a separate line overlaid on the chart as it poses particular fire risk.

The presence of fixed electric heating (such as heat pumps, wall fans, panel heaters and underfloor heating) has increased in newer houses. This has largely been at the expense of LPG heaters. The presence of portable electric heaters is fairly static, representing about 35% of heating sources available in houses surveyed. This is a large proportion of heating sources that could be sited dangerously by unknowledgeable or careless people.

The presence of open fires is trending downwards. The HCS estimates that they represent approximately 4% of heating sources available in housing.

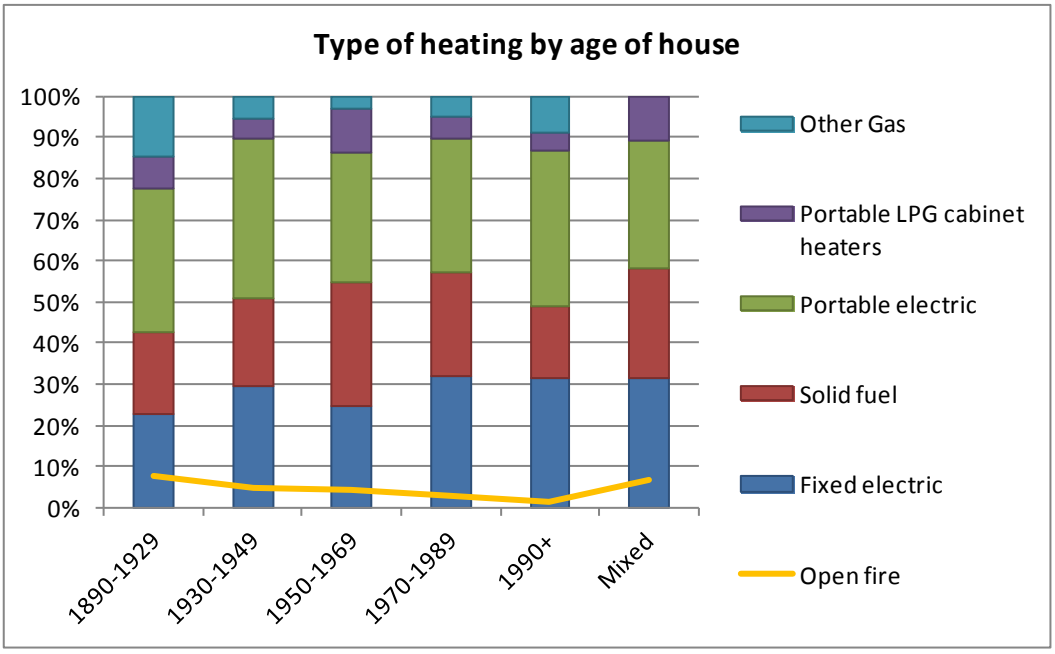

Figure 30 Type of heating by age of house

4.4 Cooking

The majority of cookers are electric powered. The prevalence of electric cookers increased between 1890 and 1970. However, since 1970, the prevalence of electric cookers has been trending downwards. This has coincided with fewer houses having free standing ovens as the prevalence of both built-in ovens and separate cooktops has increased.

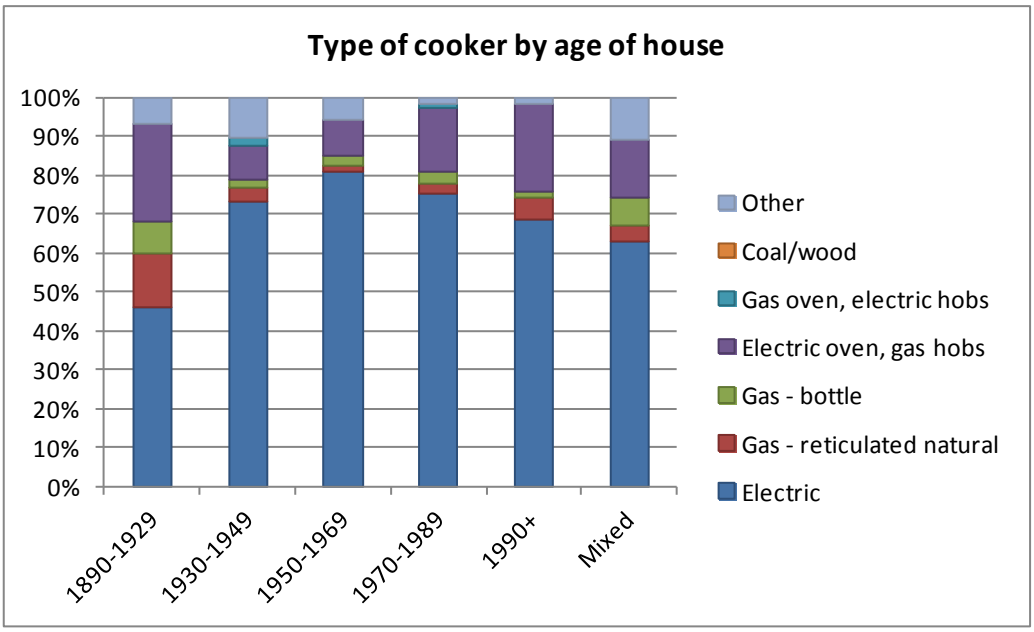

Figure 31 Type of cooker

4.5 Costs to Reduce Fire Hazards

There is a cost involved in reducing/removing many of the fire hazards from the home, and the average dollars amounts by household income were shown in Figure 4. The same data, but by house age instead of income is shown in Figure 32. The average cost has been separated into two categories; the red bars showing the average total cost, and the blue bars showing the average costs excluding the high cost items mentioned next.

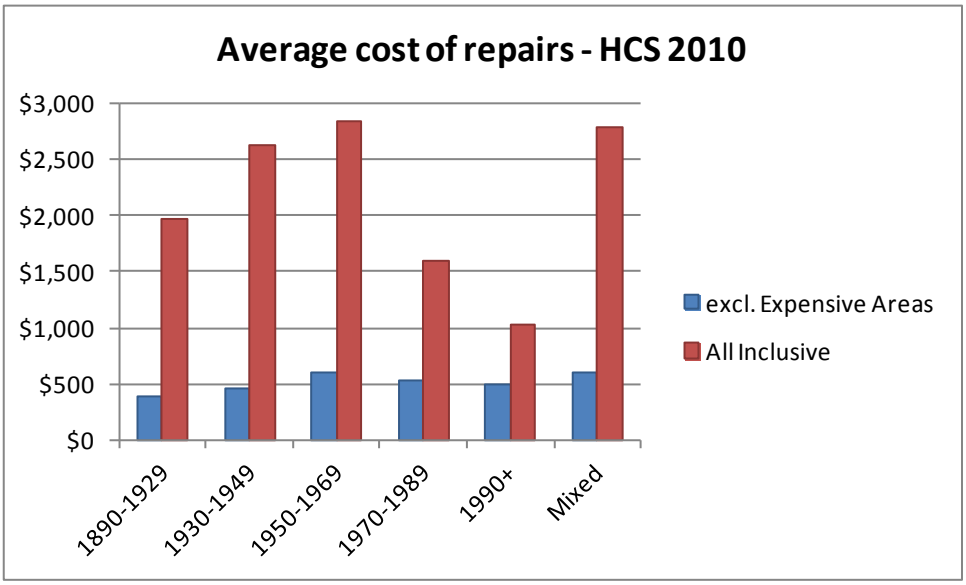

Figure 32 Average cost of repairs

The unit costs for each repair are contained in the appendix, Table 2. Most are fairly low cost but some are “big ticket” items, such as no alternative means of escape from an upper storey, or houses with flammable linings and/or synthetic carpet, both

requiring replacement as the mitigation measure. These three occurrences increase risk but are rated less of a danger than other factors relating to ignition sources. So when funds are limited it is preferable to address ignition hazards first.

The repair costs, ignoring the expensive items, are shown in Table 1 against other repair costs needed on the house. The first column is average fire hazard repair costs for all households by income group. The second column is the average fire hazard repair cost only for houses with fire hazards. The third column is the repair cost of other components (e.g. claddings, foundations, etc, obtained from earlier work). The latter were assessed from inspection of over 30 components in each house and only the immediately needed repairs (i.e. condition 1 and 2) are included. (Page, Curtis, 2013) The last column in the table indicates the fire hazard repairs are an extra 11% to 21 % on top of the repairs to the other components.

Table 1 Fire hazard repair costs compared to other repair work

Fire hazard repair costs					
	Owners only				
		All houses	**Repair costs only for houses needing repair**		
		Fire hazard	Fire hazard	All components	
		ave repairs $	ave repairs $	Cond 1 &2 $	% extra
$10,000 or less		$1,466	$1,466	$10,591	14%
$10,001-$20,000		$592	$822	$5,683	14%
$20,001-$30,000		$506	$659	$3,437	19%
$30,001-$40,000		$411	$606	$4,121	15%
$40,001-$50,000		$458	$725	$6,641	11%
$50,001-$70,000		$540	$803	$4,968	16%
$70,001-$100,000		$492	$733	$5,305	14%
Over $100,000		$418	$612	$5,174	12%
Don't know		$367	$756	$3,637	21%
Fire hazard costs excludes the 3 expensive items (new linings & carpet, ext stairway).					

The table shows average repair costs across all owners in each income group. However some owners have no hazards and the average cost of mitigation only for those needing repair is higher, typically about $750 as shown in the third column of the table. Most households should be able to afford this expenditure and it should have first priority before non-fire hazard related repairs.

5. DISCUSSION

The rising trend in installation of smoke alarms since 1999 is encouraging with just 8% of housing without alarms. But only 90% of these alarms were operational in the last survey and this percentage is lower than the previous survey. So it is important to encourage occupants to check their alarms at least once a year.

In the 2004 survey questions were first included on type of fire hazard, under the main headings of ignition, means of egress, flammability, and flame spread.

The 2004 survey found a high percentage of houses using candles and it is pleasing to see a sharp drop in these in 2010. However some other ignition sources including

overloaded and poorly situated power points have increased slightly to 1% of housing. Dangerous siting of the cooker was also up, to over 1% of houses, and it is known from NZFS data that this is a major cause of house fires. In general rental houses had about 3 times the incidence of ignition sources compared to owner occupied. This suggests education programmes on fire safety need to be directed toward the rental stock, both owners and landlords.

The 2010 survey recorded an increase in egress hazards. This is a surprising result since it occurred in all house age groups and we would not expect the exits to change significantly between the 2 surveys. It is suspected this is survey measurement anomaly probably due to the omission of sliding glass doors in the later survey. The incidence of upper floors is increasing as more new housing is added to the stock, so we would expect to see a small increase in upper floor escape hazards. However the increase occurred across almost all house age groups and may be partly explained by the addition of upper storeys to the existing housing stock.

Flammability loads decreased in the 2010 survey probably due to the replacement of some old timber based lining materials with plasterboard. Also, furniture fashions have changed with less clutter and less heavy upholstered chairs and sofas.

Flame spread decreased on average with replacement of hollow core doors by more solid MDF type doors. There was also a trend away from synthetic carpets in some house age groups to polished timber floor finishes.

The 2010 survey indicated a big increase in additional fire safety equipment. This occurred mainly in the incidence of hose reels. It is believed these were under-counted in earlier surveys because inspectors at the time were not all aware they needed to include them as safety equipment. The other safety items, extinguishers, blankets and sprinklers show no increase in incidence in the 2010 survey. So it is mainly a measurement anomaly that has lead to an increase in additional fire safety equipment in the most recent survey.

The change in the distribution of scores in the composite hazard condition score was encouraging. Between 2004 and 2010 the percentage of houses in poor and serious condition fell from 18% to 11%. These are houses needing immediate attention and their average repair cost of about $750 should be within reach of most households. The work includes installing an alarm(s), moving cupboards near cookers, removing clutter, replacing upholstered furniture, and installing more power points. Most owners should now be aware that smoke alarms saves lives, but are they aware of hazards in the kitchen, overloaded power points, and the need to remove clutter so that fire spread is reduced?

6. REFERENCES

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7. APPENDIX

This appendix contains:

- Costs for fire hazard repairs
- Additional charts and tables

7.1 Fire hazard repair costs

Table 2 shows the types of fire hazards that were recorded in the 2010 house condition survey. The inspectors tick boxes where the hazard was present, for each house. Not all hazards have the same contribution to fire damage potential and the table shows BRANZ assessment (or "penalty points") of the importance of each hazard. For example, lack of a smoke alarm, and most ignition sources, are rated as having the greatest contribution to hazard. In contrast individual hazards under egress, flammability and flame spread are rated less of a danger compared to ignition sources.

The points are added for each house and the more points a house has the higher its hazard. The house condition survey recorded the physical condition of over 30 components on a five point scale. The fire hazard points have been converted to the same scale, and the method for doing this is shown in the table. Five or more fire hazard points give a condition score of poor or serious which means the hazard(s) should be attended to immediately for the safety of the occupants. Almost always a score of 5 or more for any house includes an ignition source hazard.

The table also shows the cost to repair or mitigate the hazard. Most are fairly low cost, for example replacing heaters, moving cupboards above stoves, installing heat resistant linings near solid fuel burners, etc. The high cost items, such as an upper floor exterior escape path are beyond most households' budgets and in any case tend to have lower penalty points ratings.

The condition score depends crucially on the penalty points and the values shown in the table are a BRANZ assessment of each hazard. They may not accord with other expert's opinions but are believed to approximately represent the relative danger to occupants of each hazard.

Assessment of fire hazard						
Type of hazard				Penalty		Remedial
				Points		cost $
Smoke alarms not present				5		300
Alarms not working				2		100
Ignition sources						
	Heaters sited dangerously			5		397
	Cooker sited dangerously			5		267
	Fireplace/ burner sited dangerously			5		270
	Use of candles			5		200
	Dangerous heaters			5		397
	Poorly sited power points			3		180
	Overloaded power points			3		180
Means of egress						
	Ground floor < 2 doors to outside			1		1557
	Upper floors no alternative escape			1		2900
Flammability						
	Flammable linings			2		9874
	Combustible room clutter			2		100
	Combustible subfloor clutter			1		250
	Large amount upholstered furniture			2		1500
Flame spread						
	Hollow core doors			1		502
	Predominatly synthetic carpets			1		3738
		Serious	Poor	Moderate	Good	Excellent
Fire hazard condition		1	2	3	4	5
Total penalty points		>6	5,6	3,4	1,2	0

Table 2 Assessment of fire hazard from the 2012 HCS

7.2 Additional data

Additional figures are shown below with minimal comment.

Ignition sources were much more common in rented houses than owner occupied housing. 8% of rented houses had potential ignition sources.

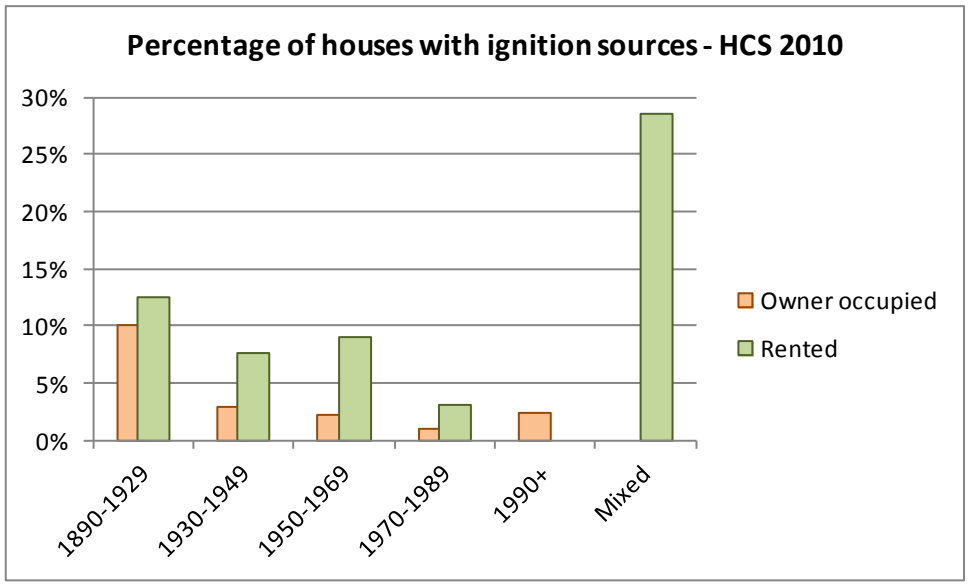

Figure 33 Percentage of houses with ignition sources own/rent age of house

The following figure shows the percentage of houses without smoke alarms by household composition. Houses with children are more likely to have smoke alarms than those without children.

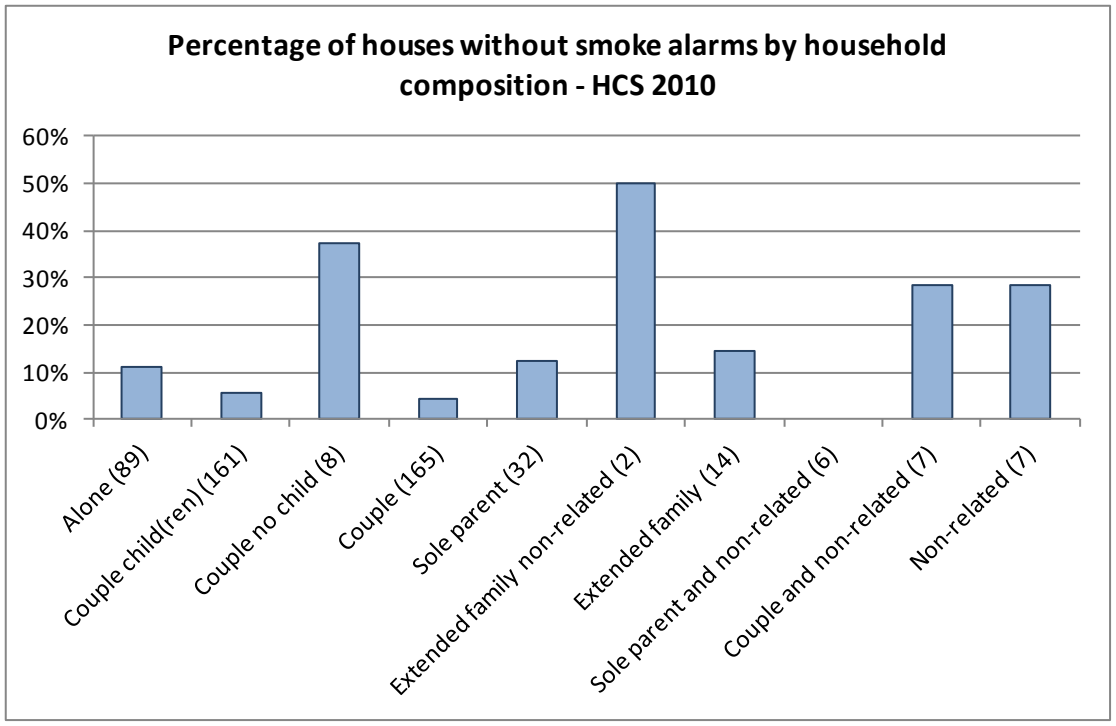

Figure 34 Percentage of houses without smoke alarms by household composition

The most common type of smoke alarm is battery powered. The prevalence of battery powered smoke alarms has increased in all of the house age categories in every survey. In the 2010 survey, 83% of houses had battery powered smoke alarms

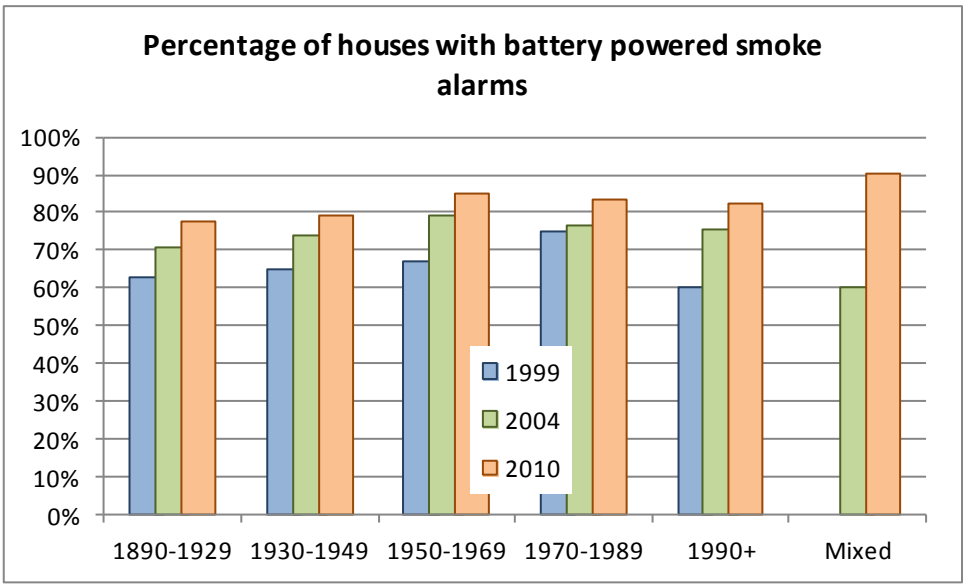

Figure 35 Percentage of houses with battery powered smoke alarms

The survey allowed for houses to have both battery-powered and mains-connected smoke alarms. Mains connected smoke alarms were present in 8% of houses in the 2010 survey. This includes 4% of houses that had both types of smoke alarms present.

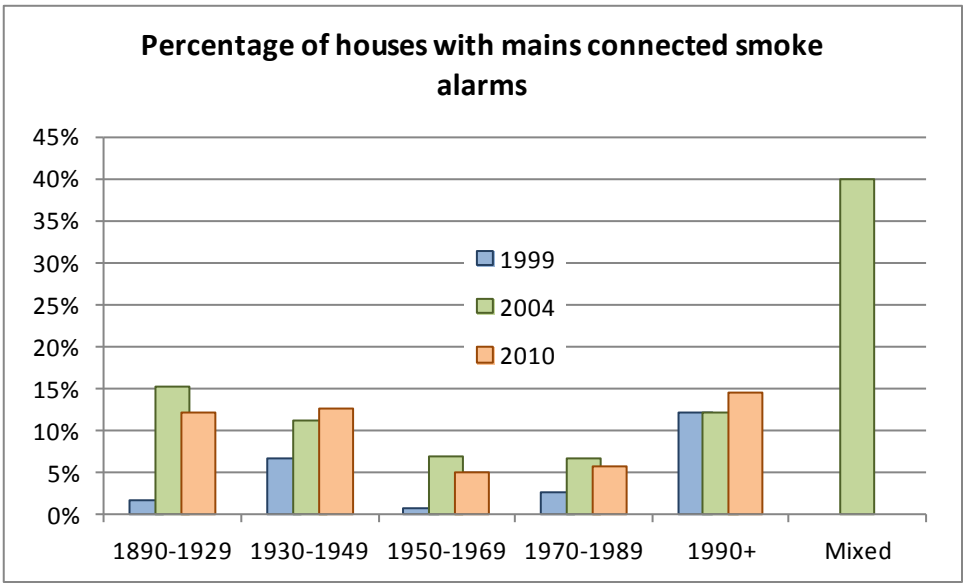

Figure 36 Percentage of houses with mains connected smoke alarms

Owner occupiers were more likely to have mains-connected smoke alarms than renters. 10% of smoke alarms installed in owner occupied housing was mains-connected, whereas this was just 5% in rented houses.

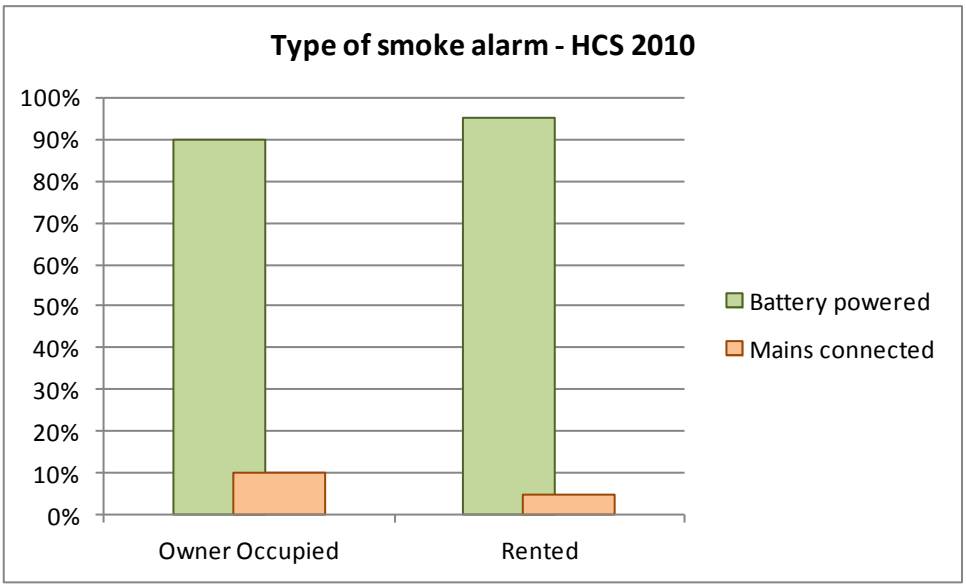

Figure 37 Type of smoke alarm own/rent

In general, very few smoke alarms were interconnected. However, the proportion of smoke alarms that were interconnected increased between surveys. In the latest survey, 8% of houses surveyed had interconnected smoke alarms. Mains-connected smoke alarms were more likely to be interconnected.

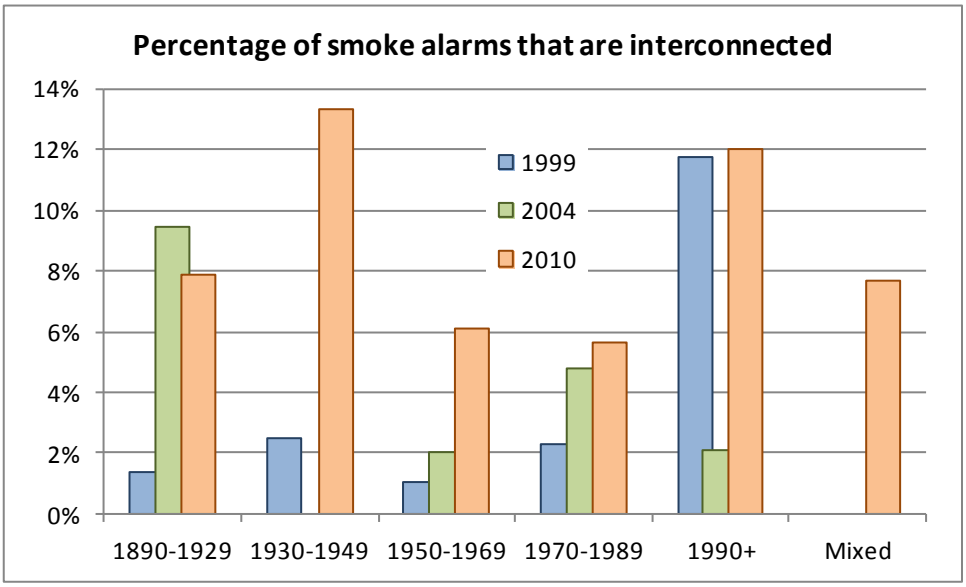

Figure 38 Percentage of smoke alarms that are interconnected

Figure 39 shows where smoke alarms are located and the number. Smoke alarms are being located in more places around the house, with the most common place for smoke alarms being the hallway. There is a high percentage of houses without alarms in the kitchen or bedrooms where fires are most likely to start.

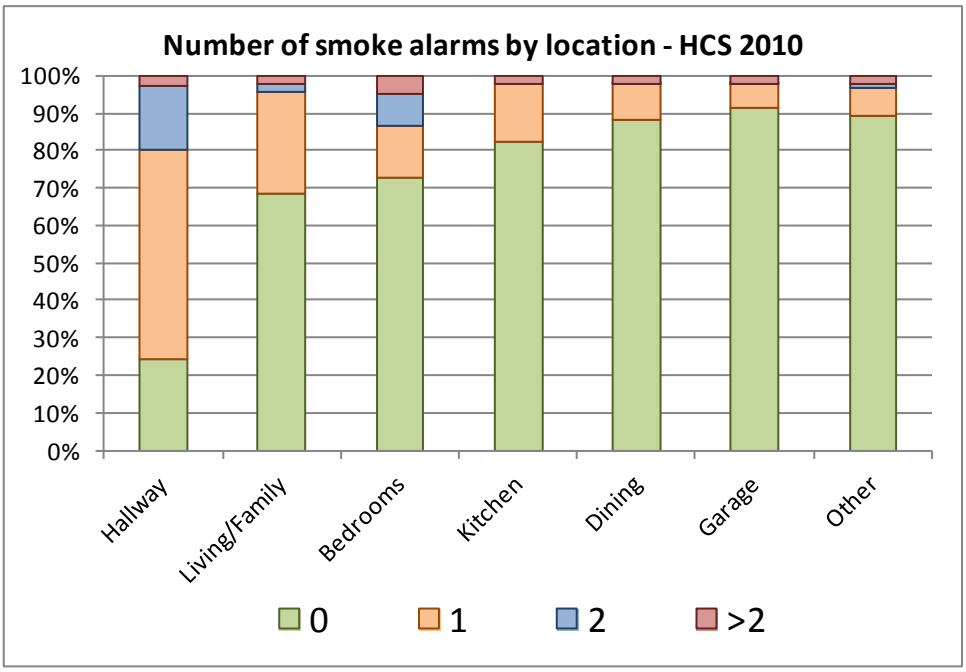

Figure 39 Number of alarms by location

Figure 40 shows how often the smoke detectors were checked by the household work status.

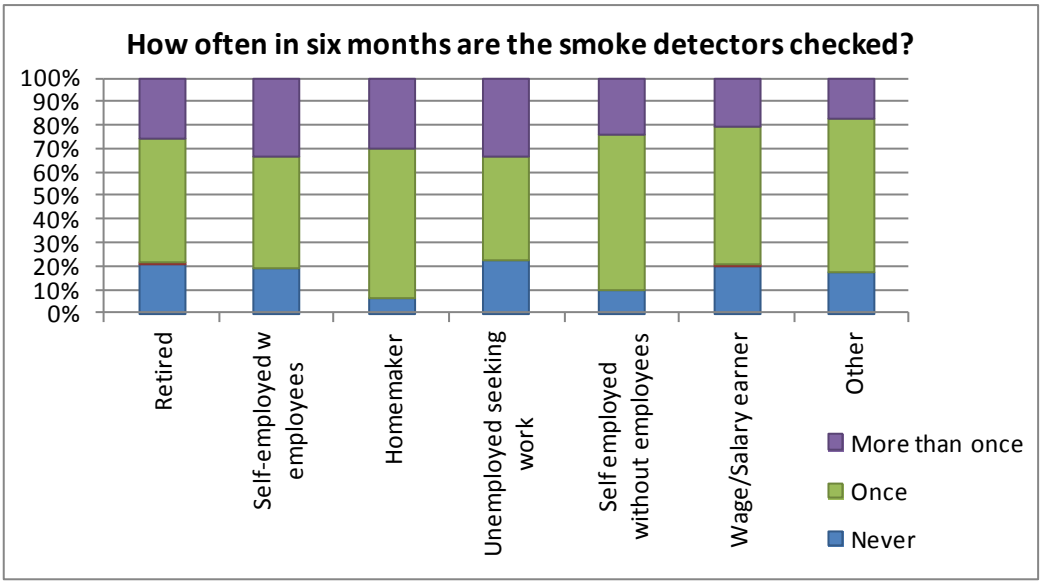

Figure 40 Smoke detector checking by work status

Synthetic carpets are more common in rented houses than owner occupied housing.

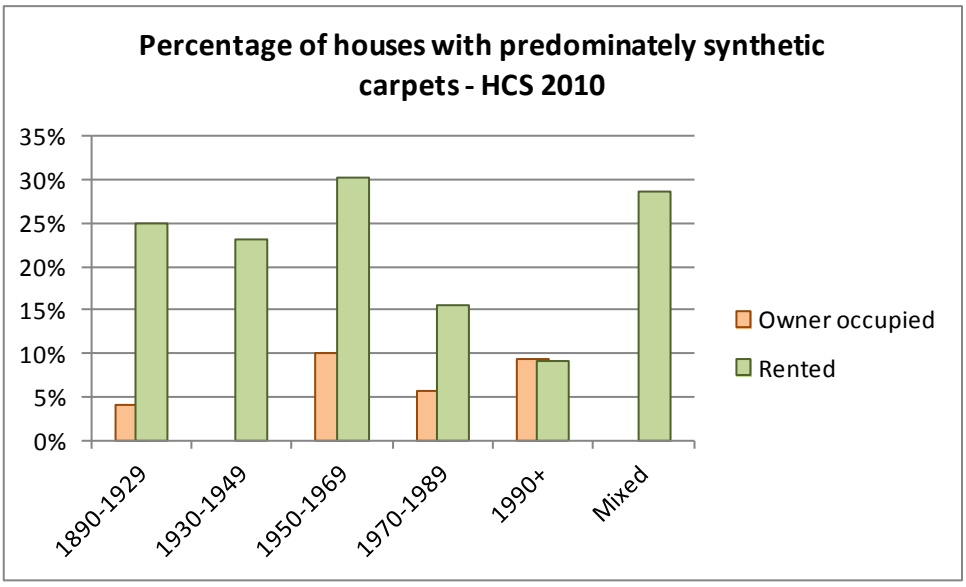

Figure 41 Percentage of houses with predominately synthetic carpets own/rent