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Residential New Zealand Fire Statistics: Part 1 Initial Analysis

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Tuāpapa Rangahau Pūtaiao



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Preface

This report was prepared during the work performed for the Residential Fire Design research project and extended and completed during the work performed for the Building Safety Design-Fire Tool for Use in a Risk-Informed Regulatory Environment research project.

This report is a summary of the analysis performed on detailed New Zealand Fire Service statistics for residential structures for use in selecting scenarios for design fires in apartment buildings. This is the first report of a two report series.

The second report in this series is Residential New Zealand Fire Statistics: Part 2 Two-Level Event Tree Analysis BRANZ SR223 (Robbins & Wade, 2010).

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Fire statistics used in the analysis were provided by the New Zealand Fire Service from the Station Management System.

Note

This report is intended for researchers, fire engineers and regulatory authorities.

Residential New Zealand Fire Statistics: Part 1 Initial Analysis

BRANZ Study Report SR 222

A.P. Robbins and C.A. Wade

Reference

Robbins A.P. and C.A. Wade. 2010. 'Residential New Zealand Fire Statistics: Part 1 Initial Analysis'. BRANZ Study Report No. 222. BRANZ Ltd, Porirua City, New Zealand.

Abstract

The process of specifying design fires appropriate for apartments in New Zealand should include identification of the most common and most costly fire events that are likely to occur. This is where a fire event is a general description of the location, item ignited and/or cause of ignition.

The results summarised here are based on the analysis of available statistics. This is the first in a series of two reports that summarise the analysis of available New Zealand residential fire statistics.

There were three main objectives for this study:

- Identify the most common and the most costly fire events that occur in New Zealand residential structures.
- Determine the appropriateness of the use of New Zealand fire statistics for all residential structures to represent fire statistics for apartments.
- Determine the appropriateness of the use of New Zealand residential fire statistics to determine a selection of fire events for apartments.

An event-tree approach was used to analyse of the available data set. This report summarises the analysis of the one-level event tree approach. The results include the most common fire events, the most costly, trends over the available years and the correlations between all residential data sets and apartment data sets.

Executive Summary

The process of specifying design fires appropriate for apartments in New Zealand is complicated. This report is the first in a series that summarise the analysis of New Zealand fire incident statistics with the intention that the results are used in the development of design fires for the challenge of apartment fire designs. The summary here includes identification of the most common and most costly fire events that are likely to occur, where a fire event is in terms of a general description of the location, item ignited and/or cause of ignition.

The results summarised here are based the analysis of available statistics (mostly 1995 – 2005 statistics are utilised). This report is the first in a series of reports that summarise the analysis of available New Zealand residential fire statistics. This report uses a one level event tree analysis.

The specific objectives were to:

- identify the most common and the most costly fire events that occur in New Zealand residential structures,
- determine the appropriateness of the use of New Zealand fire statistics for all residential structures to represent fire statistics for apartments, and
- determine the appropriateness of the use of New Zealand residential fire statistics to determine a selection of fire events for apartments.

The sample sizes available for New Zealand fire incident statistics are small. For example, for the data sets considered here, there was an average of approximately:

- 230 and 3500 fires/year in apartment and residential properties, respectively,
- 4 and 24 civilian fatalities/year in apartment and residential properties, respectively, and
- 55 and 270 civilian injuries/year in apartment and residential properties, respectively.

Furthermore, each category considered had up to 211 individual classes, where a class represents specific types of the category used in the recording of the fire statistics (e.g. kitchen, living room, etc. are classes of the category of room of fire origin) :

- Room of fire origin: 74 classes
- Equipment involved in ignition: 211 classes
- First material ignited: 80 classes
- Cause of fire: 67 classes

The situation was improved by using groups of related individual classes that included a group for “information not recorded” (to provide an indication of the detail recorded) and “other” (to collate all the classes with small individual contributions to the information):

- Room of fire origin: 7 groups
- Equipment involved in ignition: 9 groups

- First material ignited: 7 groups
- Cause of fire: 9 groups

The appropriateness of the use of New Zealand residential fire statistics to identify a selection of fire events for apartments was determined by the probabilities of the yearly numbers of fires, fatalities and injuries of the data sets used being representative (within $\pm 10\%$) of the reality of the situation in New Zealand (assuming a normal distribution).

An example of this is summarised in Figure 1. The data sets used for all residential fire incidents has a good probability of being representative, whereas when considering the apartment fire incident data set there is only a reasonable probability of the number of yearly fire incidents being representative, with more doubt for fatalities and injuries. This is expected because of the small sample sizes for apartment fatalities and injuries.

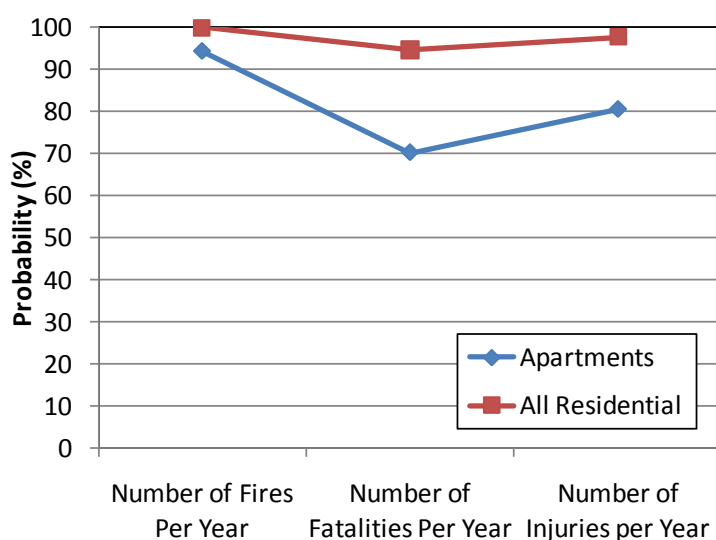


Figure 1: Probabilities of the data set for yearly averages being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

The probabilities of the data sets used in this analysis in terms of the groupings listed above being representative (within $\pm 10\%$) of the reality of the situation in New Zealand (assuming a normal distribution) are summarised. An example for the room of fire origin for the apartment data set and the all residential data set are shown in Figure 2 and Figure 3, respectively.

The results were calculated based on the averages and sample standard deviations of the percentages (rather than the numbers) of fires, fatalities and injuries for each group and the ratios of fatalities or injuries to local fires for each group. Values of zero represent situations where there were no fatalities or injuries for that group in the data sets used.

The assumption that these values can be described by a normal distribution is only for calculation purposes. It is not expected that data would provide a normal distribution for statistics per year, since historical trends are expected to be influenced by changes in building code requirements, building practices and changes in occupant behaviour that are all changeable over time. However for short time periods, the assumption of a normal distribution may be reasonable if the results are used only as indicative.

Most of the averages for the grouped categories are reasonable representations of the whole data set considered here. However the results are consistently lower for the category of equipment involved in ignition than for other categories. Also percentage of fatalities, percentages of injuries and ratios of fatalities per fire tended to have a lower probability result than the results for percentages of fires.

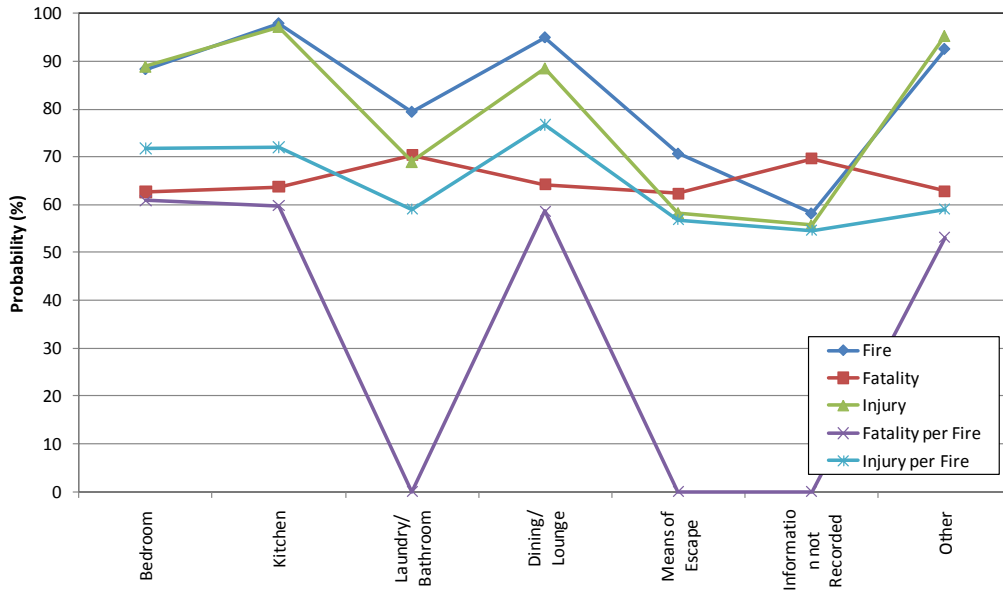


Figure 2: Probabilities of the data set for apartment room of origin being representative (within ±10%) of the situation in New Zealand (assuming a normal distribution).

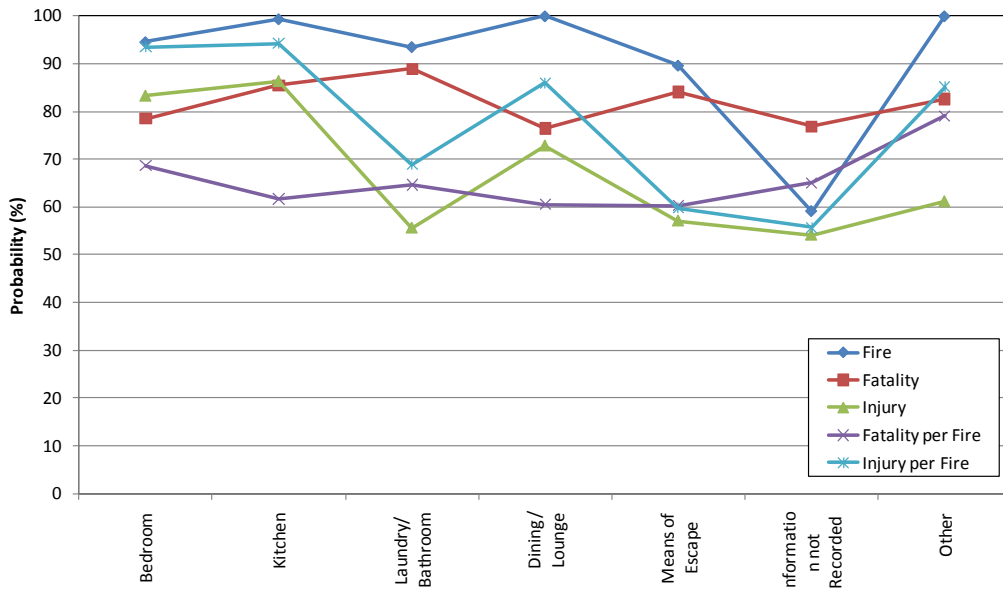


Figure 3: Probabilities of the data set for residential room of fire origin being representative (within ±10%) of the situation in New Zealand (assuming a normal distribution).

In conclusion, the probabilities of the yearly data sets used in this analysis in terms of the groupings listed above being representative (within ±10%) of the situation in New Zealand (assuming a normal distribution) is reasonable to

low. This is attributed to the small sample sizes available and that the assumption of the yearly statistics not being accurately described by a normal distribution. Therefore the results based on these statistics are recommended to be use as a general indication only.

The appropriateness of the use of New Zealand fire statistics for all residential structures to represent fire statistics for apartments was estimated here using linear correlations between the two data sets for the range of categories and groups within these.

The results of the linear correlations between apartment and all residential data sets are summarised for all entries of each category and for the grouped categories.

The summarised data for individual entries for each category has a wide variation in the linear correlations between apartment and all residential data sets. The category of equipment involved in ignition consistently has the lowest correlations, which is reasonable because of the data being spread over 211 entries, and a large proportion being listed with no information recorded. The fatalities per fire and injuries per fire also have consistently low linear correlations across the categories considered, which is attributed to the data being spread across a large number of potential outcomes for consideration.

The summarised data for grouped entries for each category, as shown in the example in Figure 4, has consistently good linear correlations between apartment and all residential data sets. This is attributed to the smaller number of potential outcomes for the grouped entries versus all the individual entries for each category. The number of fatalities and the number of fatalities to local fires are associated with the lowest linear correlations. This is attributed to the small sample size available for NZ fire fatalities. Use of these results are particularly cautioned. It is recommended that use these results are used in terms of a general indication of trends only.

In conclusion, based on the sample sizes available and the good linear correlations, it is reasonable to estimate the general proportions of the grouped categories considered here for apartments based on the data set for all residential fire incidents. It is recommended that these results are used as a general indication, because of the low significance attributed to the small sample sizes available for both data sets, and especially the apartment fire incident data set. In addition, it is noted that information regarding fire incident fatalities must be applied with care, because of the extremely small sample size available for NZ.

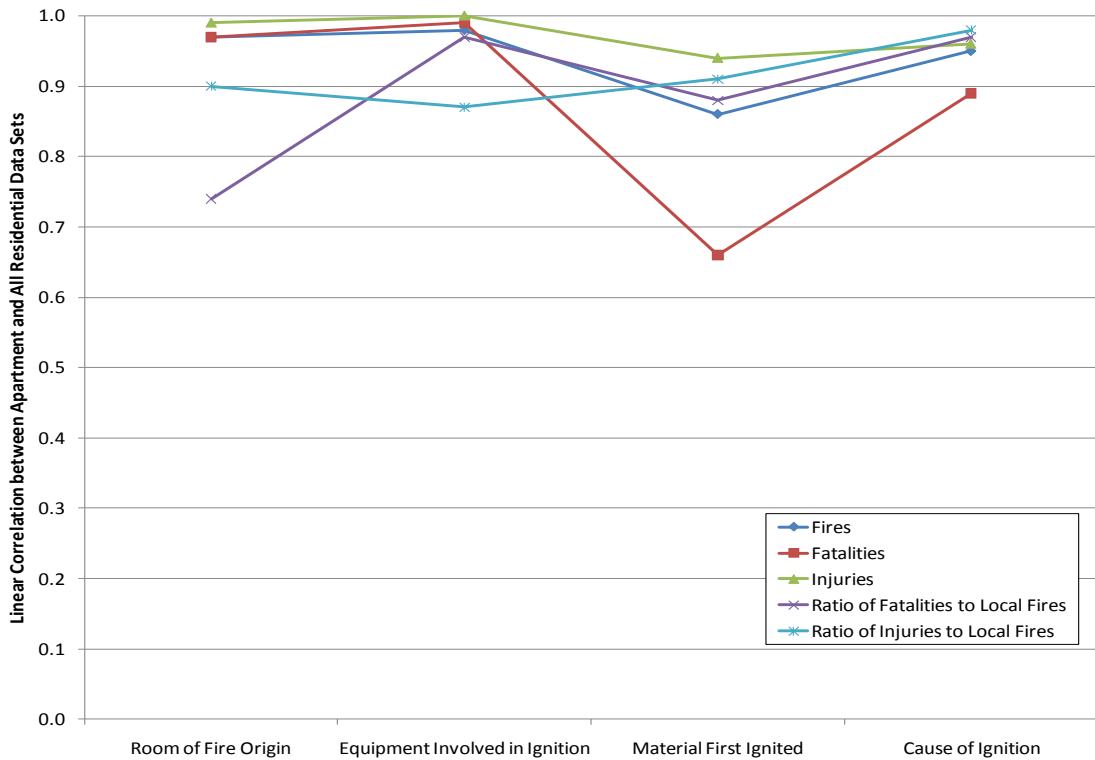


Figure 4: Summary of correlations between apartment and all residential data sets (without structure damage) for cumulative totals and casualties per fire for groups of each category.

The most common and the most costly fire events that occur in New Zealand residential structures were identified for each of the categories and groups within these that were considered.

The most common fire incidents were determined in terms of the percentage of fires for each group of each category. An example of the results for room of fire origin is shown in Figure 5.

The results for the most costly fire incidents were determined in terms of ratios of fatalities or injuries to fires for each group. An example of the results for room of fire origin is shown in Figure 6.

In conclusion, the results for most common and most costly fire incidents can be estimated for the grouped categories considered in this analysis. The results are recommended to be used only as indicative.

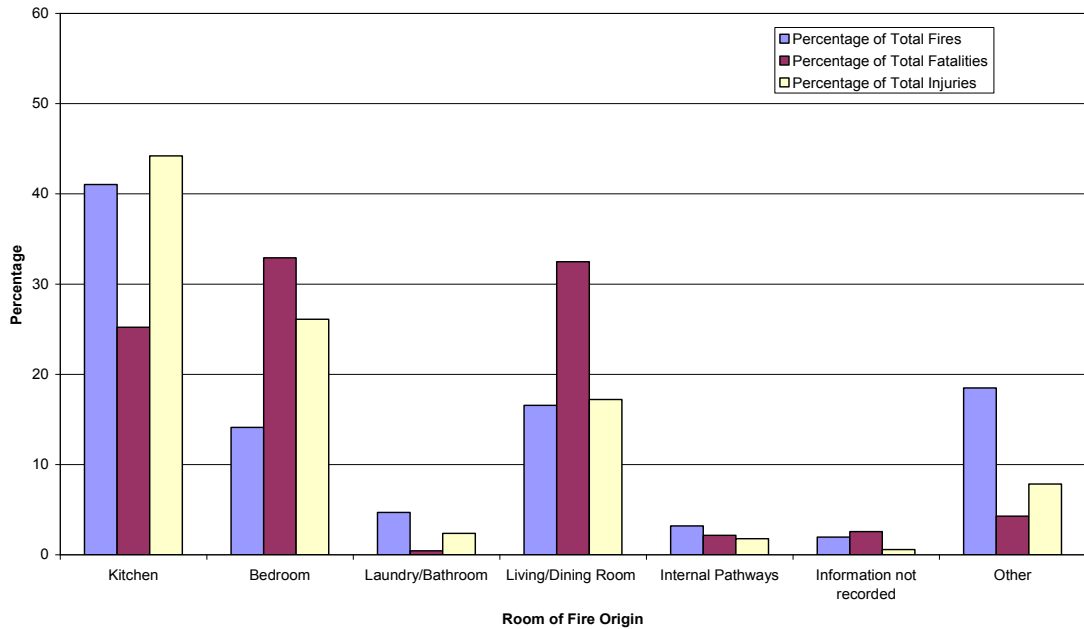


Figure 5: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of room of fire origin (1995-2005).

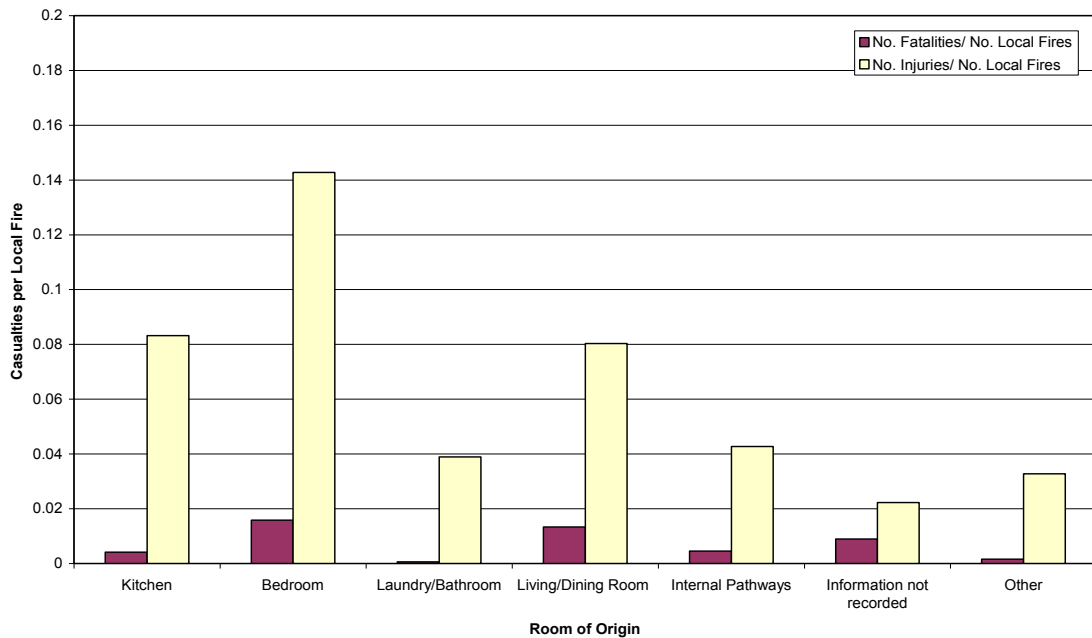


Figure 6: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of room of fire origin (1995-2005).

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Acronyms

NZ	New Zealand
NZFS	New Zealand Fire Service
SMS	(NZFS) Station Management System

Abbreviations

apt	apartments only
BRANZ	BRANZ Ltd
CAU	cause of ignition
EQU	equipment involved in ignition
FD	flame damage
MAT	material first ignited
res	all residential structures
ROO	room of fire origin
wd	with structure damage (consistent with NZFS SMS description)
wod	without structure damage (consistent with NZFS SMS description)

1. INTRODUCTION

1.1 Motivation

In order to specify design fires appropriate for apartments in New Zealand, one part of the procedure should include identification of the most common and most costly (e.g. in terms of financial loss, casualties, or extent of damage) fire events that are likely to occur, where a fire event is a general description of the location, item ignited and/or cause of ignition. One approach is to analyse the statistics available to determine the historical trends. Then determine the applicability of these results to the present and future as well as the specific use of the building under consideration. However the population size of the New Zealand fire statistics for apartments is small, which has inherent problems for the application of any results. Therefore this issue must be addressed.

1.2 Objectives

The objectives were to:

- identify the most common and the most costly fire events that occur in New Zealand residential structures
- determine the appropriateness of the use of New Zealand fire statistics for all residential structures to represent fire statistics for apartments.
- determine the appropriateness of the use of New Zealand residential fire statistics to determine a selection of fire events for apartments.

1.3 Outline

This is the first in a series of reports that summarise the analysis of available New Zealand residential fire statistics and applicability of the results for use in the development of apartment design fires for New Zealand. This report summarises the analysis of the one-level event tree approach.

The use of an event-tree approach to the analysis of the available data set is firstly discussed. A summary of the results of the analysis of the four categories considered for this investigation is then presented. The results include the most common fire events, the most costly, trends over the available years and the correlations between all residential data sets and apartment data sets.

2. BRIEF DESCRIPTION OF NZFS DATA SET

Apartment fire statistics were of particular interest, however the associated data set size is statistically small. All residential fire statistics were also considered and compared. Fires with and without structure damage were considered separately. The number of fire events, fatalities, injuries and extent of flame damage were considered for the room of fire origin, material of the first item ignited, equipment involved in ignition and cause of ignition.

The data set of fire events used for this analysis is from 1986 to 2005 for the categories considered here. The data set of civilian casualties used is from 1995 to 2005. The data sets used for this analysis are included, in MS Excel 2003 format, on the DVD at the end of this report. When cumulative numbers of fires are compared to numbers of casualties over a number of years, years before 1995 are not considered.

Table 1: Numbers of fire events 1986 – 2005.

Building Type	Apartments	All Residential Properties
With Structure Damage	3223	32296
Without Structure Damage	4045	24906
Total	7268	57202

Table 2: Numbers of fire events 1995 – 2005.

Building Type	Apartments	All Residential Properties
With Structure Damage	1813	15327
Without Structure Damage	499	19213
Total	2312	34540

Table 3: Numbers of civilian fire fatalities 1995 – 2005.

Building Type	Apartments	All Residential Properties
With Structure Damage	34	225
Without Structure Damage	1	9
Total	35	234

Table 4: Numbers of civilian fire injuries 1995 – 2005.

Building Type	Apartments	All Residential Properties
With Structure Damage	300	1568
Without Structure Damage	246	1100
Total	546	2668

3. BRIEF DESCRIPTION OF EVENT TREE APPROACH

An event-tree approach was used to analyse the data. That is, the historical results for different ignition scenarios that were dependent on one or more categories (e.g. room of fire origin or equipment involved in ignition), where each category was represented by one level of the event tree. Each category representing each level of the event tree has several possible classes (e.g. the classes of kitchen, bedroom or lounge room, etc, for the category “room of fire origin”). The details within each category are called classes, representing specific types of the category used in the recording of the fire statistics (e.g. kitchen, living room, etc. are classes of the category of room of fire origin)

Four categories of fire classification were considered:

1. Room of fire origin (74 classes)
2. Equipment involved in ignition (211 classes)
3. First material ignited (80 classes)
4. Cause of fire (67 classes)

The number of levels of an event tree correspond to the number of these categories considered in the analysis. The classes used were consistent with the classes used for reporting by the NZFS and are listed in Appendix A.

Three event outcomes were considered:

1. Fire occurrence
2. Civilian casualties
 - Fatalities
 - Injuries
3. Extent of flame damage
 - No flame damage
 - Flame damage confined to item first ignited
 - Flame damage confined to room of fire origin or firecell
 - Flame damage spread outside of room of fire origin or firecell
 - Unknown – not recorded

Initially all combinations of classes were considered for each category (one-level event tree) and for combinations of two categories (two-level event tree). This analysis was used to identify the most common and the most costly (in terms of fatalities, injuries or extent of flame damage) classes and combinations of classes within each category. This was performed because of the relative ease of analysis of the results for the large data set. Then adjustable event trees were developed that allowed user control to investigate a smaller (more manageable) number of specific classification combinations.

3.1 One-Level Event Tree

Firstly a simple analysis was performed to get an overview of the data set. A schematic of a one-level event tree for sorting fire events by room of fire origin, equipment involved in ignition, material first ignited or cause of ignition is shown in Figure 7. An

example of a one-level event tree for fires that have occurred in apartments (1995 – 2005) is shown in Figure 152 in Appendix C.

The results for this approach are summarised here.

3.2 Two-Level Event Tree

A schematic of a two-level event tree for sorting combinations of 2 categories is shown in Figure 8. An example of a two-level event tree for fires that have occurred in apartments (1995 – 2005) is shown in Figure 153 in Appendix C.

The results for this approach are summarised in BRANZ SR223 (Robbins & Wade, 2010).

3.3 Higher-Level Event Trees

Higher-level (i.e. more than two levels) event trees were not developed, since the small sample sizes for each combination of categories further decreases with the increase of the number of levels. However for more populated data sets, higher-level event trees would be of higher statistical significance.

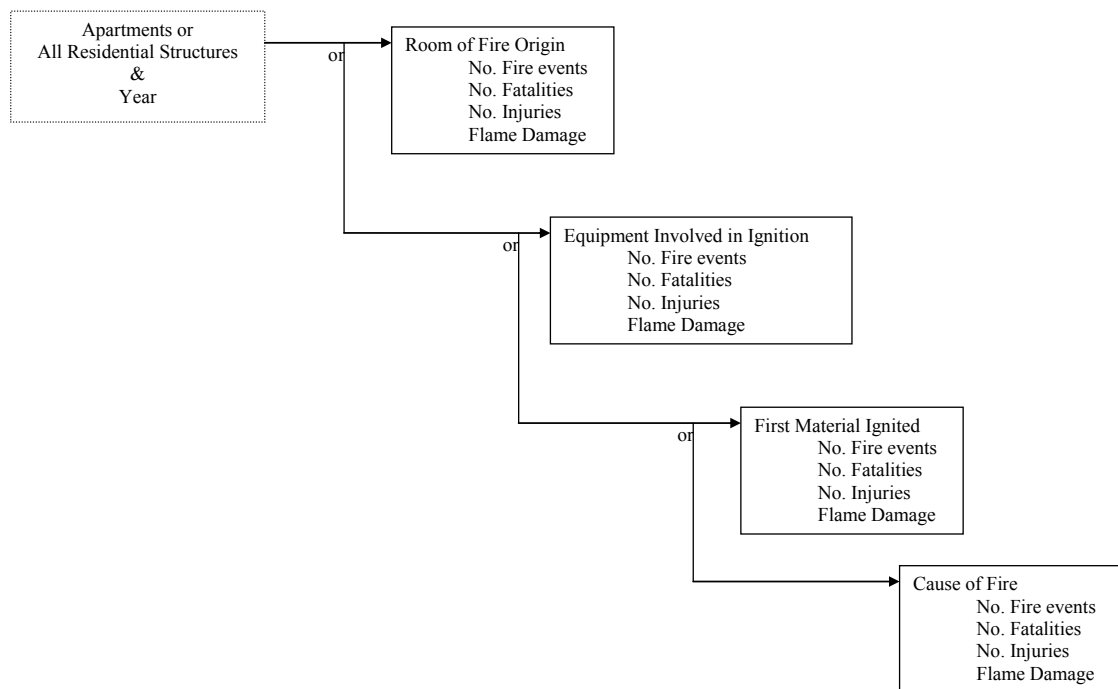


Figure 7: Schematic of a one-level event-tree for the fire events considered.

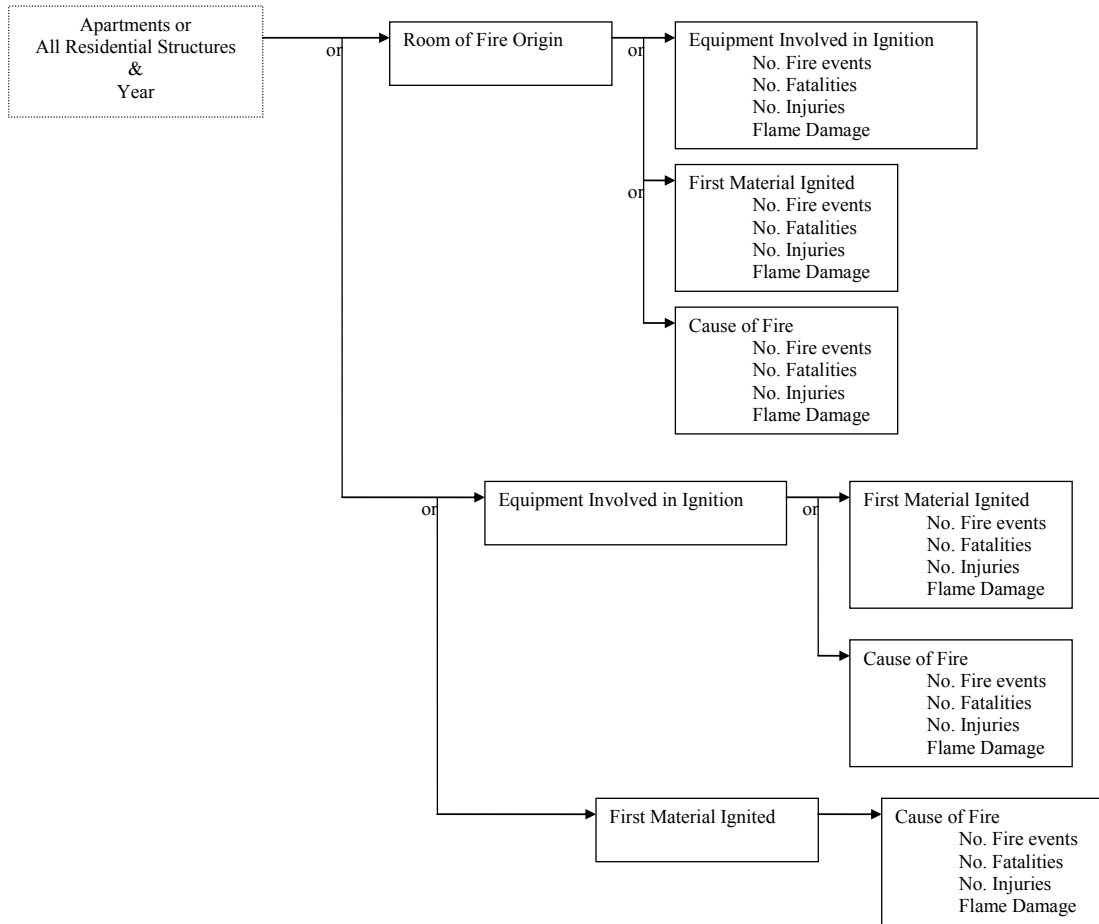


Figure 8: Schematic of a two-level event-tree for the fire events considered.

4. RESULTS OF ONE LEVEL EVENT TREE ANALYSIS

The lines joining data points of Figure 154 to Figure 295, in Appendices F to I, are included as a visual aid to improve clarity and are not intended to indicate any trend. It should be noted that the small sample sizes, may initially provide misleading results and therefore care must be applied. For example, when considering casualties per fire, ratios may approach unity; because there has been one incident and that happened to cause a casualty.

4.1 Room of Fire Origin

The numbers of fires that have occurred collectively from 1986 to 2005 on residential structures are shown in Figure 154. The ranking of the most common room of fire origin (up to the first 10 classes) by number of fire events for each type of property and structure damage are presented in Table 20. The numbers of civilian fatalities and injuries that have occurred collectively from 1995 to 2005 on residential structures are shown in Figure 158 and Figure 161 respectively. The ranking of the most common room of fire origin (up to the first 10 classes) by number of fatalities and injuries for each type of property and structure damage are presented in Table 22 and Table 24 respectively. The ratios of the number of fatalities and number of injuries to the number of fires that occurred in each room of fire origin (using the collective data from 1995 to 2005) are shown in Figure 164 and Figure 165 respectively. The top 10 ratios of numbers of fatalities and injuries to numbers of fires for each room of fire origin for each type of property and structure damage are presented in Table 26 and Table 28 respectively. The ratios of the percentage of total fatalities and the percentage of total injuries to the percentage of total fires that occurred in each room of fire origin (using the collective data from 1995 to 2005) are shown in Figure 166 and Figure 167 respectively. The top 10 ratios of percentage of total fatalities and total injuries to the percentage of total fires for each room of fire origin for each type of property and structure damage are presented in Table 30 and Table 32 respectively. The number of fires according to the extent of flame damage for fire events recorded for each room of fire origin is shown in Figure 168.

4.1.1 All Classes

All classes of the room of fire origin were initially analysed individually in order to gain an initial feel for the important aspects of the data set. A full listing of each of the classes for the room of fire origin category is presented in Appendix A. The results from this analysis were then used to select the most important and appropriate groupings of the classes to be used in finer analysis. Following is a brief discussion of the results of the analysis using the individual classes for room of fire origin. The associated tables and figures are included in Appendix F.

4.1.1.1 Most Common

The three most common rooms of fire origin for fire events, for fire fatalities and for fire injuries in both apartments and all residential structures are the bedroom, kitchen and lounge (Table 20, Table 22 and Table 24). This is considering the incident data with and without structure damage and for the total number of fire events from 1986 to 2005 for fire events and 1995 to 2005 for fire casualties.

The top three rooms of fire origin for events (that occurred in either apartments or all residential structures) with structure damage were of approximately the same proportions (Table 20). However, for fire events without structure damage, the proportion of fires that originated in the kitchen were approximately 5 to 10 times

greater than the proportion of fires that originated in either the bedroom or lounge room.

The top three rooms of fire origin for fatalities that occurred in all residential structures (with or without structure damage) were of approximately the same proportions (Table 22). For fire fatalities that occurred in apartments with structure damage, the proportion of fires that originated in the lounge room were approximately twice that of fires that originated in either the bedroom or kitchen. However the total number of fatalities resulting from fire events in New Zealand is statistically small, therefore care should be used when drawing conclusions.

The top three rooms of fire origin for injuries that occurred in either apartments or all residential structures with or without structure damage were, in descending order, the kitchen, bedroom and lounge room (Table 24).

4.1.1.1 Historical Trends

The number of apartment fires for each room of fire origin for each year, during the period from 1986 to 2005, is shown in Figure 174. The number of all residential fires for each year, during the period from 1986 to 2005, is shown in Figure 175. An obvious increase in the number of fires originating in the kitchen can be seen for both apartments and all residential property.

The number of apartment fatalities for each room of fire origin for each year, during the period from 1986 to 2005, is shown in Figure 176. The number of all residential fatalities for each year, during the period from 1986 to 2005, is shown in Figure 178. No trends are obvious. This is expected, due to the very small population sizes.

The number of apartment injuries for each room of fire origin for each year, during the period from 1986 to 2005, is shown in Figure 180. The number of all residential injuries for each year, during the period from 1986 to 2005, is shown in Figure 182. Again no trends are obvious.

4.1.1.2 Correlations

The numbers of fire events for the range of rooms of fire origin that were considered had a strong correlation for apartments and all residential structures with structure damage (0.985) and without structure damage (0.990). Only general correlation exists between the numbers of fire events that occurred in apartments with and without structure damage (0.753) and in all residential structures with and without structure damage (0.773).

The numbers of fire events has general correlation to the number of fatalities for the range of rooms of fire origin that were considered for each combination of the property and structure damage that were considered. For apartments with and without structure damage, the sample linear correlation between fire events and fatalities was 0.920 and 0.102 respectively. Low correlation between fire events and fatalities for apartments without structure damage is expected, because of the very small sample population size (i.e. only 1 fatality). For all residential structures with and without structure damage the sample linear correlation was 0.958 and 0.756 respectively. Only general correlation existed between the numbers of fire fatalities for apartments with and without structure damage (0.693) and all residential structures with and without structure damage (0.818).

The numbers of fire events has a strong correlation to the number of injuries for the range of rooms of fire origin that were considered for each combination of the property and structure damage that were considered. For apartments with and without structure damage, the sample linear correlation was 0.988 and 0.987 respectively. For all residential structures with and without structure damage the sample linear correlation

was 0.960 and 0.982 respectively. There is also good correlation between the number of injuries for apartments and all residential structures with structure damage (0.993) and without structure damage (0.942). There was also good linear correlation between the numbers of injuries from apartment fires with and without structure damage (0.963) and the numbers of injuries from all residential property fires with and without structure damage (0.975).

4.1.1.2 Most Costly

The “cost” of a fire has been assumed to be apportioned by the number of resulting fatalities or injuries.

The ratios of the number of fatalities to the number of fires in each room of fire origin are shown in Figure 177 and Figure 179 for apartments and all residential structures respectively. For both apartment and all residential property fires the most costly room of fire origin, in terms of civilian fatalities, was primarily the living room, lounge or common room.

The ratios of the number of injuries to the number of fires in each room of fire origin are shown in Figure 181 and Figure 183 for apartments and all residential structures respectively. For apartment fires the most costly rooms of fire origin, in terms of civilian injuries, for any single year were stairs, lobby, dining area and passageway. Whereas fires originating in the bedroom, kitchen and lounge consistently resulted in civilian injuries, with higher cumulative totals for over all the years considered.

4.1.1.2.1 Historical Trends

There are no obvious trends showing for the ratios of numbers of casualties to fires, as shown in Figure 181 or Figure 183.

4.1.1.2.2 Correlations

The average percentage of fires for each room of fire origin and one standard deviation are shown in Figure 157, Figure 160 and Figure 163 for fires, fatalities and injuries respectively. It is obvious that the smaller population size associated with civilian fatalities is consistent with the larger values for standard deviation from the average percentage. However the average percentages of fires, fatalities and injuries per room of fire origin are reasonably consistent between the apartment and all residential structures. A summary of the correlations between parameters for numbers of events, casualties and casualties per fire are presented in Table 5.

Table 5: Summary of correlations for cumulative totals and casualties per fire between apartment and all residential data sets for 1-level event-tree for all rooms of fire origin.

Categories	Building Types Compared ^c	No. Fires ^a	No. Fires ^b	No. Fatalities ^b	No. Injuries ^b	Fatality per Fire ^b	Injury per Fire ^b
Including “information not recorded”	apt wd to res wd	0.985	0.986	0.968	0.991	0.682	0.327
	apt wod to res wod	0.990	0.993	0.569	0.995	0.759	0.224
	apt to res	0.977	0.984	0.977	0.998	0.728	0.242
Excluding “information not recorded”	apt wd to res wd	0.988	0.986	0.969	0.991	0.684	0.327
	apt wod to res wod	0.995	0.993	0.569	0.995	0.759	0.230
	apt to res	0.982	0.984	0.978	0.998	0.729	0.244

Notes:

^a Number of fires considered is for years 1986 to 2005.

^b Number of fires and/or casualties considered is for years 1995 to 2005.

^c ‘apt’ refers to apartment buildings and ‘res’ refers to all residential buildings, ‘wd’ refers to with structure damage and ‘wod’ refers to without structure damage.

4.12 Grouped Classes

The results from the analysis of the individual classes was used to select the most important and appropriate groupings of the classes to be used in finer analysis. A listing of each of the classes that form each grouped classification for the room of fire origin category is presented in Appendix B. Following is a discussion of the results of the analysis using the grouped classes for room of fire origin.

4.12.1 Most Common

The most numerous fires occurred in the kitchen for both apartments and all residential structures, as shown in Figure 9 and Figure 10. For both apartments and all residential properties, for the combinations of rooms of fire origin considered, the next most common rooms of fire origin were the bedroom, living/dining room, laundry/bathroom then internal pathways (Figure 13 and Figure 14). Except for the cumulative total for the years of 1995 to 2005, where the order of the bedroom and living/dining room were reversed. The proportion of total fires where the room of fire origin was not recorded decreased from the cumulative results for years 1986 to 2005 to the results for years 1995 – 2005.

For all residential properties, the rooms of origin that is associated with the most fatalities are the bedroom followed closely by the living/dining room, as shown in Figure 11, Figure 13 and Figure 14. For apartments, the order is reversed. For both apartments and all residential properties, the next most common room of fire origin that resulted in fatalities was the kitchen.

For all residential properties and apartments, the rooms of origin that is associated with the most injuries are the kitchen, bedroom and then the living/dining room, as shown in Figure 12, Figure 13 and Figure 14.

4.12.1.1 Historical Trends

For apartments and all residential properties, the numbers of fires by year (1986 – 2005), originating in the kitchen or lounge and dining areas have increased (Figure 29 and Figure 30). For apartments, the numbers of fires originating in the bedroom, internal pathways or laundry and bathroom areas have slightly increased over the years considered. However for all residential properties, these areas of bedroom, internal pathways or laundry and bathroom show a very slight decrease.

For apartments and all residential properties, the proportion of fires each year (1986 – 2005) that ignited in a bedroom has generally decreased (Figure 23 and Figure 24). The proportion of fires that ignited in the kitchen has generally increased. It should be noted that the decrease of the proportion of fire events with information not recorded that occurred about 1992 is attributed to a change in the process of data collection. All other groups of rooms of fire origin considered did not show a clear trend over the period data was available.

For fatalities and injuries (1995 – 2005), for apartments and all residential properties, considering the percentage of fatalities each year that occur in each of the groups of rooms of fire origin, no clear trend was evident for the data available (Figure 25 and Figure 26). Similarly, no clear trend is evident for the yearly percentages of injuries over the same period for apartments (Figure 27). This is attributed to the small sample sizes.

For all residential properties, the yearly proportion of injuries resulting from fires that ignited in a bedroom slightly decreased over the years considered and slightly increased for the kitchen (Figure 28). For each other group of rooms of fire origin considered no trend is clear over the years for which data were available.

4.1.2.1.2 Correlations

For apartments (1995 – 2005), for the combination of rooms of fire origin, the linear correlation between fires and fatalities is poor (0.47). The linear correlation between numbers of fires and injuries is good (0.92). Moderate linear correlation exists between fatalities and injuries for the combined rooms of origin considered (0.71). The correlation between numbers of fires where the flame damage was confined to the room of origin and fatalities is low (0.67) and injuries is moderate (0.86). The correlation between numbers of fires where the flame damage extended beyond the room of origin and fatalities is moderate (0.76) and injuries is low (0.51).

For all residential properties (1995 – 2005), for the combination of rooms of fire origin, the linear correlation between fires and fatalities is poor (0.57). The linear correlation between numbers of fires and injuries is good (0.91). Moderate linear correlation exists between fatalities and injuries for the combined rooms of origin considered (0.718). Low correlation exists between numbers of fires where the flame damage was confined to the room of origin and fatalities (0.54) and injuries (0.66). Low correlation also exists between numbers of fires where the flame damage extended beyond the room of origin and fatalities (0.69) and injuries (0.53).

4.1.2.2 Most Costly

Assuming the 'cost' of a fire is apportioned by the number of resulting fatalities or injuries. The term 'local' fire or casualty is used to refer to data pertaining to the group of interest within each category.

The ratios of the number of casualties to the number of local fires in each group of rooms of fire origin are shown in Figure 17 and Figure 18 for apartments and all residential structures respectively. For apartment fires the most costly room of fire origin, in terms of civilian fatalities, was primarily the living/dining room (0.023) followed by the bedroom (0.013) and kitchen (0.003). For fires in all residential structures the most costly room of fire origin, in terms of civilian fatalities, was primarily the bedroom (0.016) followed by the living/dining room (0.013) then internal pathways (0.005) and kitchen (0.004). Except for the lounge/dining areas, where the ratio of fatalities to fires was significantly higher for apartments (0.023) than all residential structures (0.013), the values for the ratios for apartments and all residential structures were similar.

In terms of civilian injuries, for apartment fires the most costly room of fire origin was the bedroom (0.180) followed by the living/dining room (0.159), internal pathways (0.137), kitchen (0.087) then laundry/bathroom (0.041). For all residential structure fires the most costly room of fire origin, in terms of civilian injuries, was again the bedroom (0.143) followed by the kitchen (0.083), living/dining room (0.080), internal pathways (0.043) then laundry/bathroom (0.039). Except for the different ranking of the kitchen area, the rankings of the areas for apartments and all residential structures are similar. However the values for the ratios of fatalities to fires are consistently higher for apartments than for all residential properties.

Another approach to apportioning 'cost' to a fire is in terms of the resulting flame damage. However the proportion for which no information for the level of flame damage was recorded is consistently high (30 – 80% of fires that occurred at each group of areas of fire origin for apartments and 23 – 74% for all residential structures), as shown in Figure 19 and Figure 20. With such a large amount of data lacking detail, it is difficult to perform a useful analysis. However to provide a general indication, one approach is to assume that the fires with less detailed data attributed to them were relatively small fires and to use the detailed data available. Excluding data with no information recorded (for either the room of origin or the amount of flame damage), the flame damage for fires of the grouped rooms of origin are shown as percentage of total fires

with recorded details in Figure 21 and Figure 22, for apartments and all residential structures respectively. For both apartments and all residential structures, of the detailed data available for the groups of rooms of fire origin considered, the ranking of areas from the highest proportion of fires with flame damage beyond the room of origin occurred was the bedroom, living/dining area and then the kitchen (Figure 21 and Figure 22). However the ratio of fires with flame damage to the total number of fires with detailed information recorded was consistently higher for all residential structures than apartments only. For both apartments only and all residential structures, of the fires that started in each area of fire origin considered, the ranking from the highest proportion of local fires resulting in flame damage beyond the room of fire origin was from the bedroom, living/dining, internal pathways, laundry/bathroom and then kitchen areas (Figure 19 and Figure 20).

4.12.2.1 Historical Trends

For ratios of numbers of fatalities to local fires (1995 – 2005), there are no obvious trends for either apartments only (Figure 35) or all residential structures (Figure 36). For apartments only, for ratios of numbers of injuries to local fires (1995 – 2005), there is a slight increase in values for the bedroom and kitchen, a slight decrease in values for the lounge/dining and internal pathway areas, and no obvious trends for the other areas considered (Figure 37). For all residential structures, for ratios of numbers of injuries to local fires (1995 – 2005), there is a slight increase in values for the kitchen and laundry/bathroom areas, and no obvious trends for the other areas considered (Figure 38).

4.12.2.2 Correlations

The correlation between ratios of numbers of fatalities to local fires for apartments and for all residential structures is moderate (0.74) (Table 18).

The correlation between ratios of numbers of injuries to local fires for apartments and for all residential structures is high (0.90).

The correlation between ratios of numbers of fatalities to local fires for apartments and ratios of numbers of injuries to local fires is low for both apartments (0.60) and for all residential structures (0.65). The correlation for all residential structures between ratios of numbers of fatalities to local fires and ratios of numbers of injuries to local fires is low (0.60). The correlation between the ratios of numbers of injuries to local fires for apartments and the ratios of numbers of fatalities to local fires for all residential structures is low (0.62).

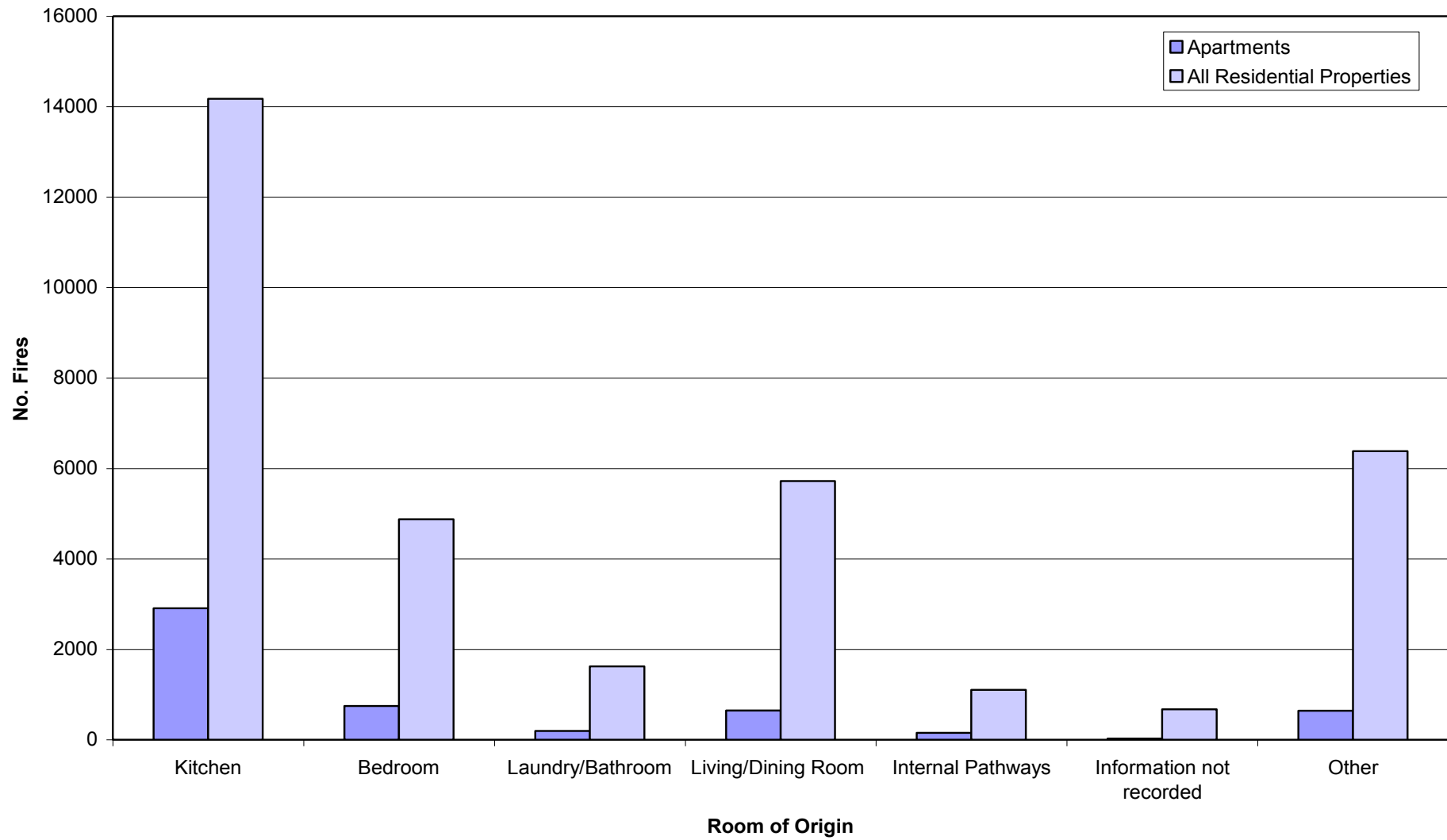


Figure 9: Number of fires by room of fire origin (1995 – 2005).

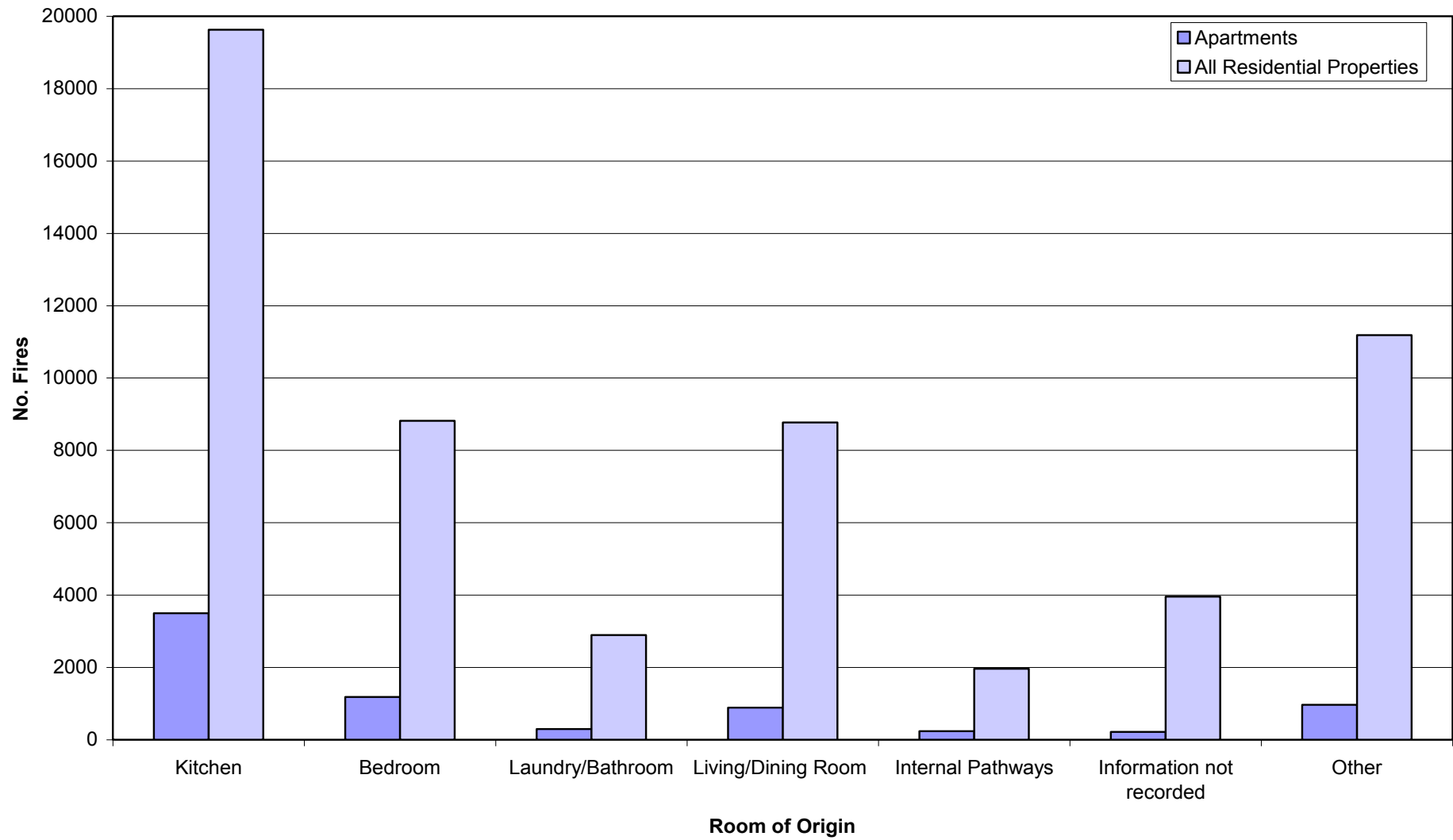


Figure 10: Number of fires by room of fire origin (1986 – 2005).

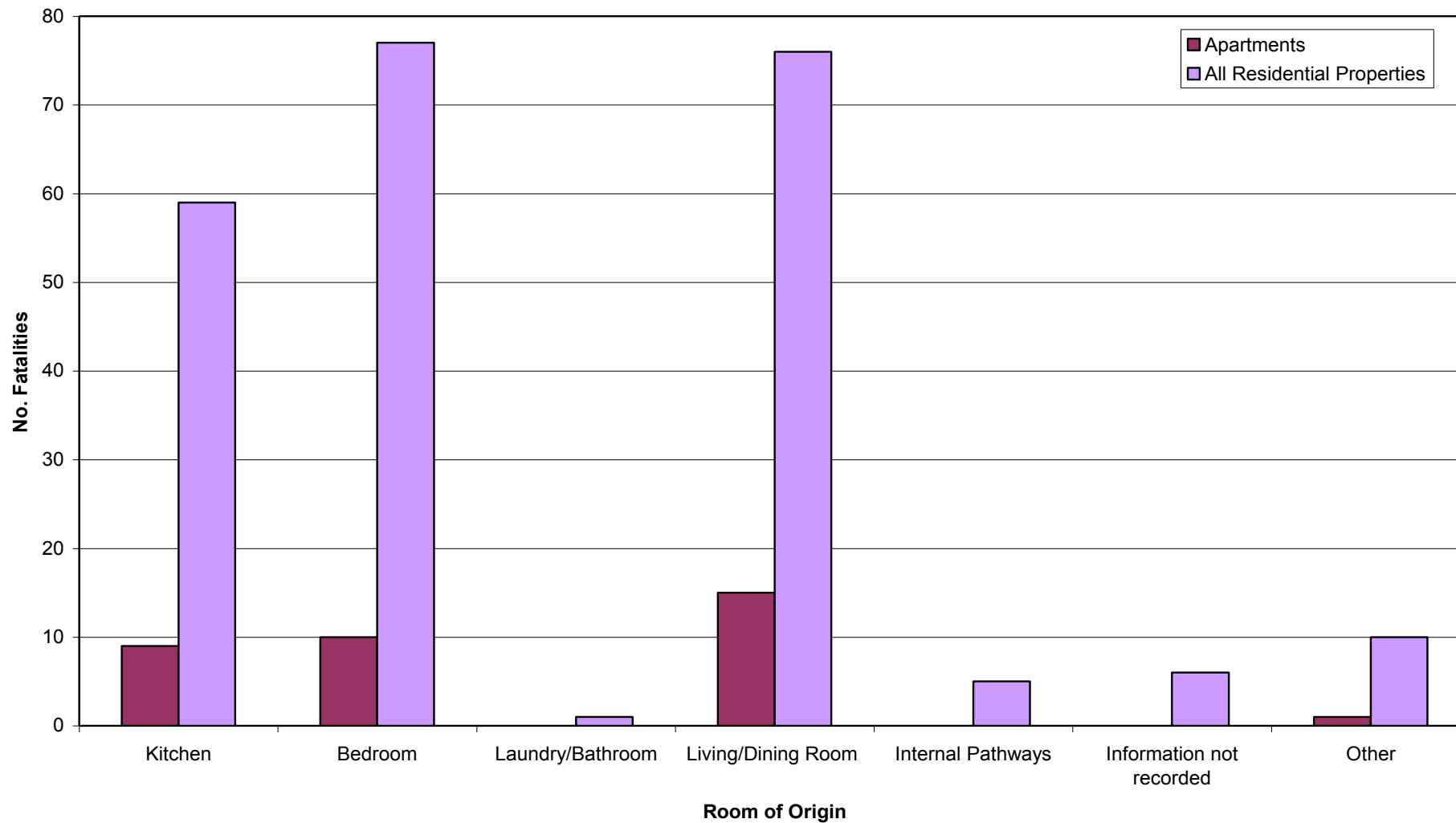


Figure 11: Number of fatalities by room of fire origin (1995 – 2005).

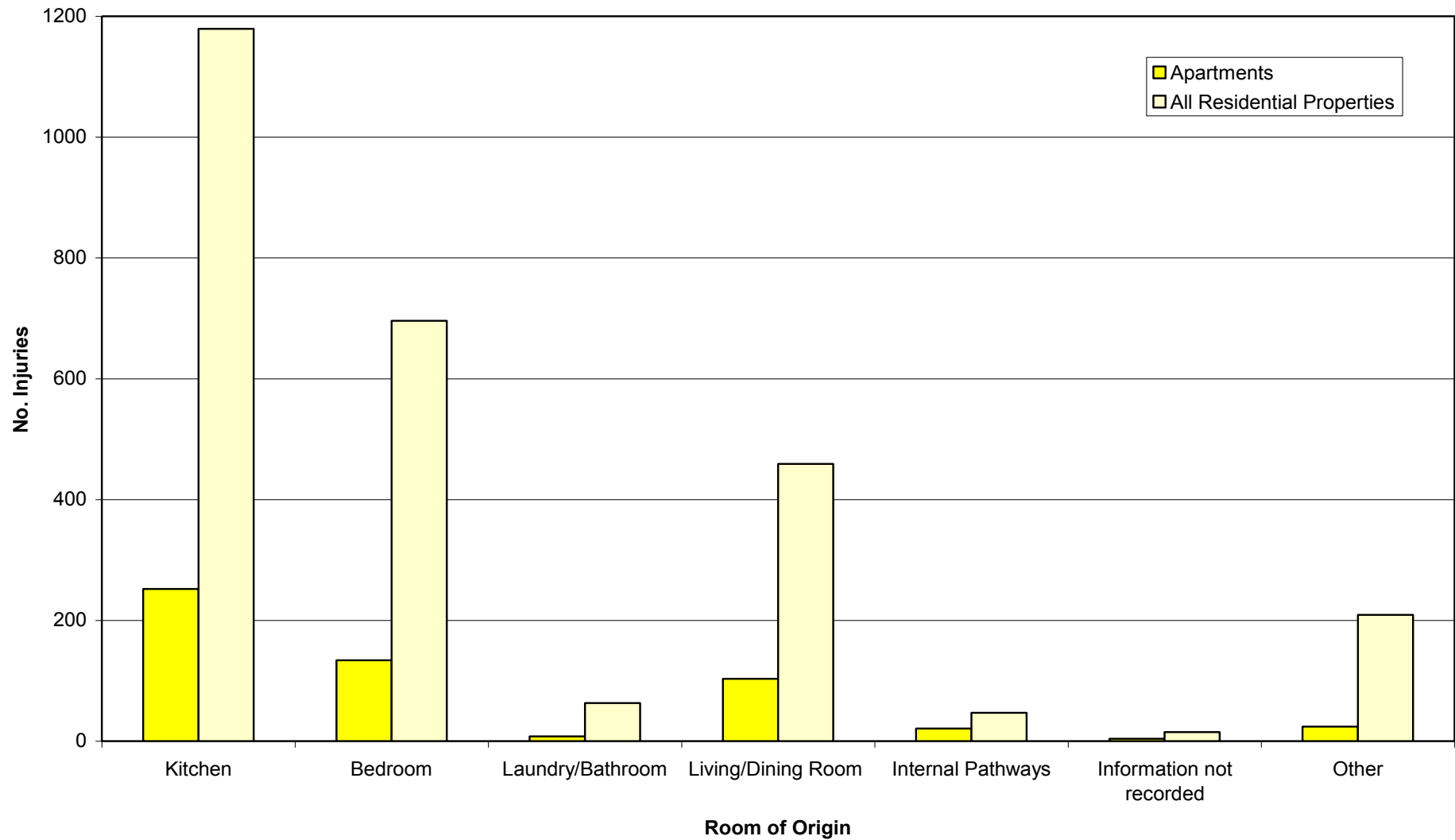


Figure 12: Number of injuries by room of fire origin (1995 – 2005).

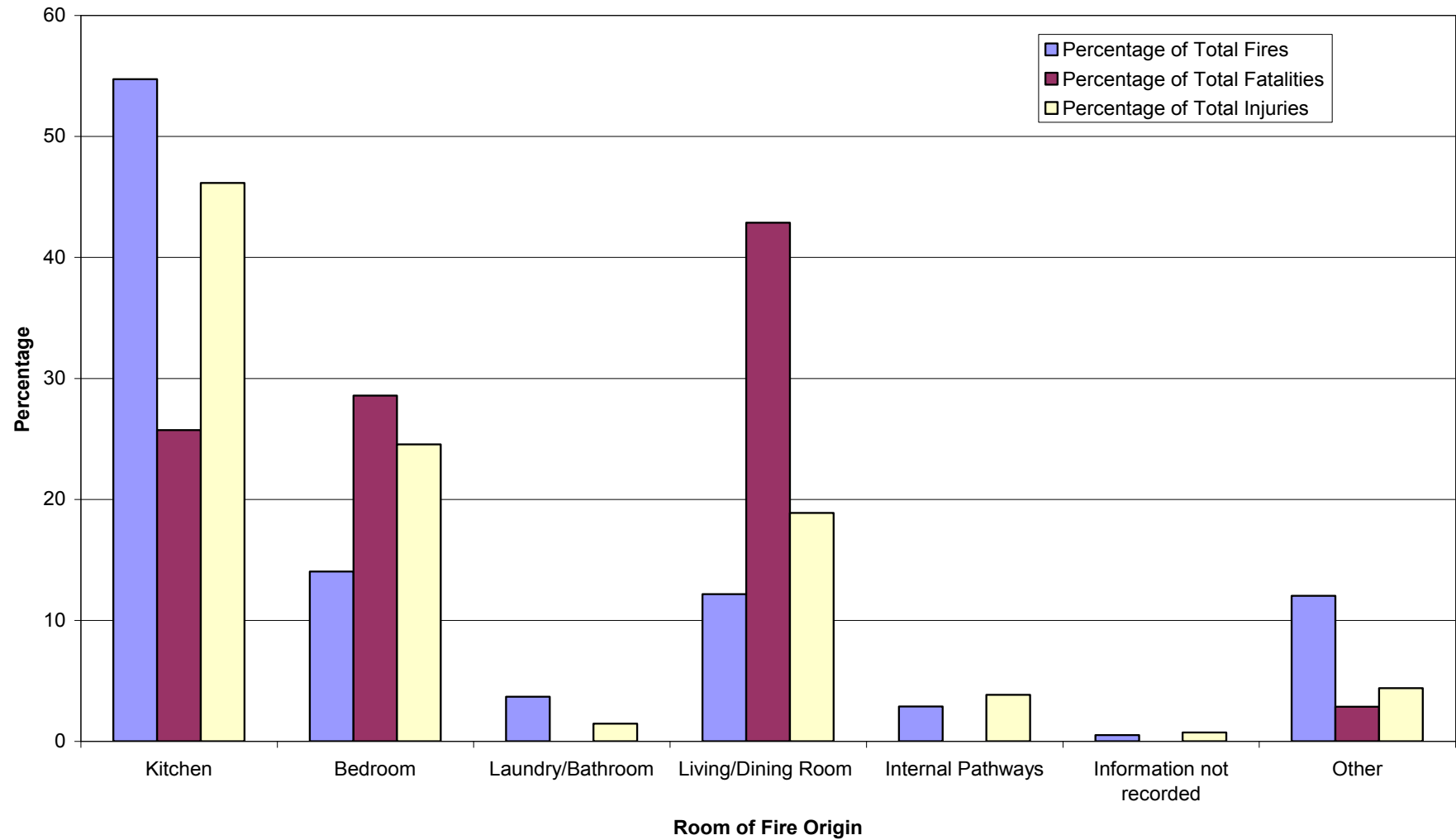


Figure 13: Percentage of totals for fires, fatalities and injuries that occurred in apartments as recorded for each group of room of fire origin (1995-2005).

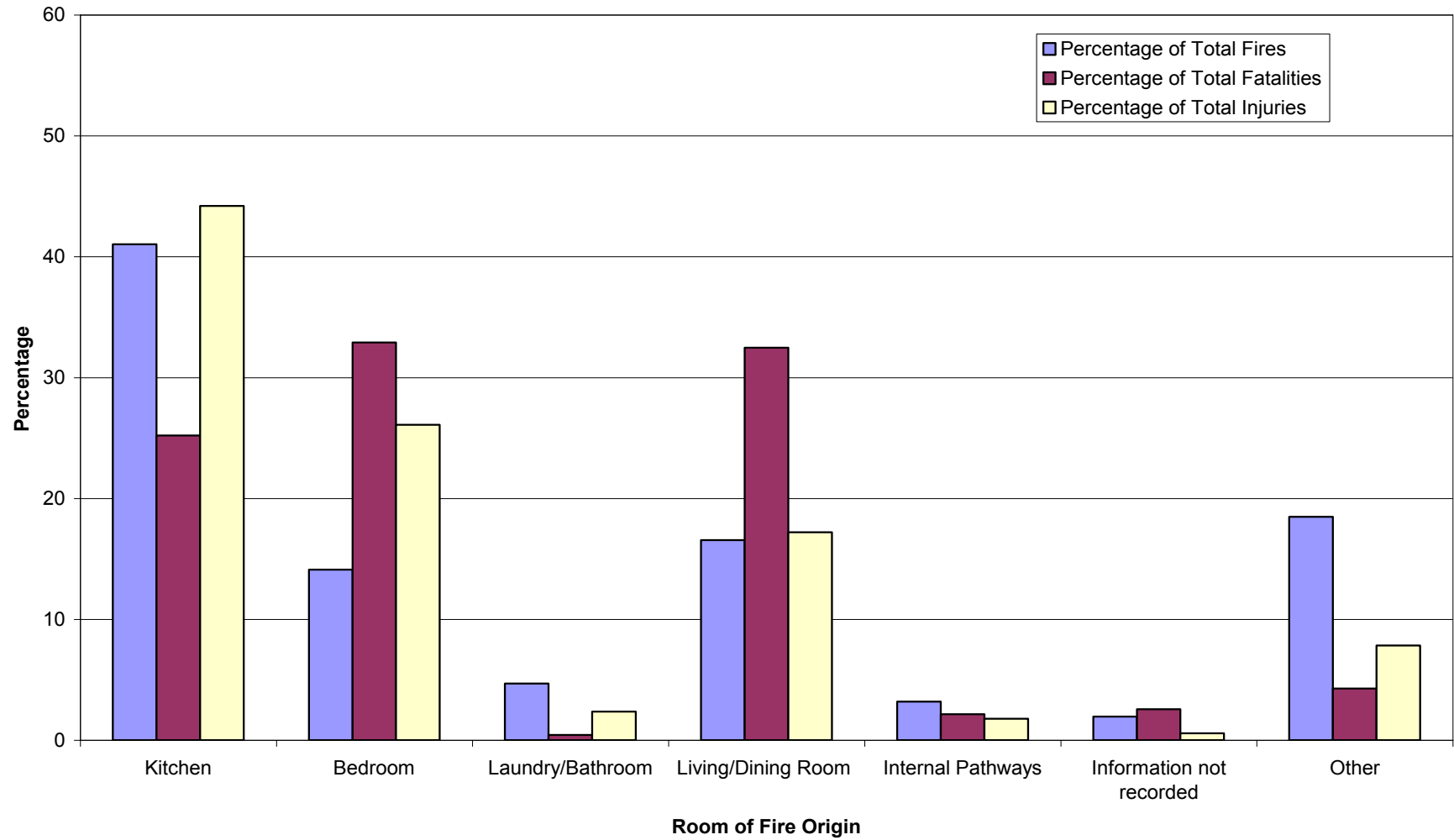


Figure 14: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of room of fire origin (1995-2005).

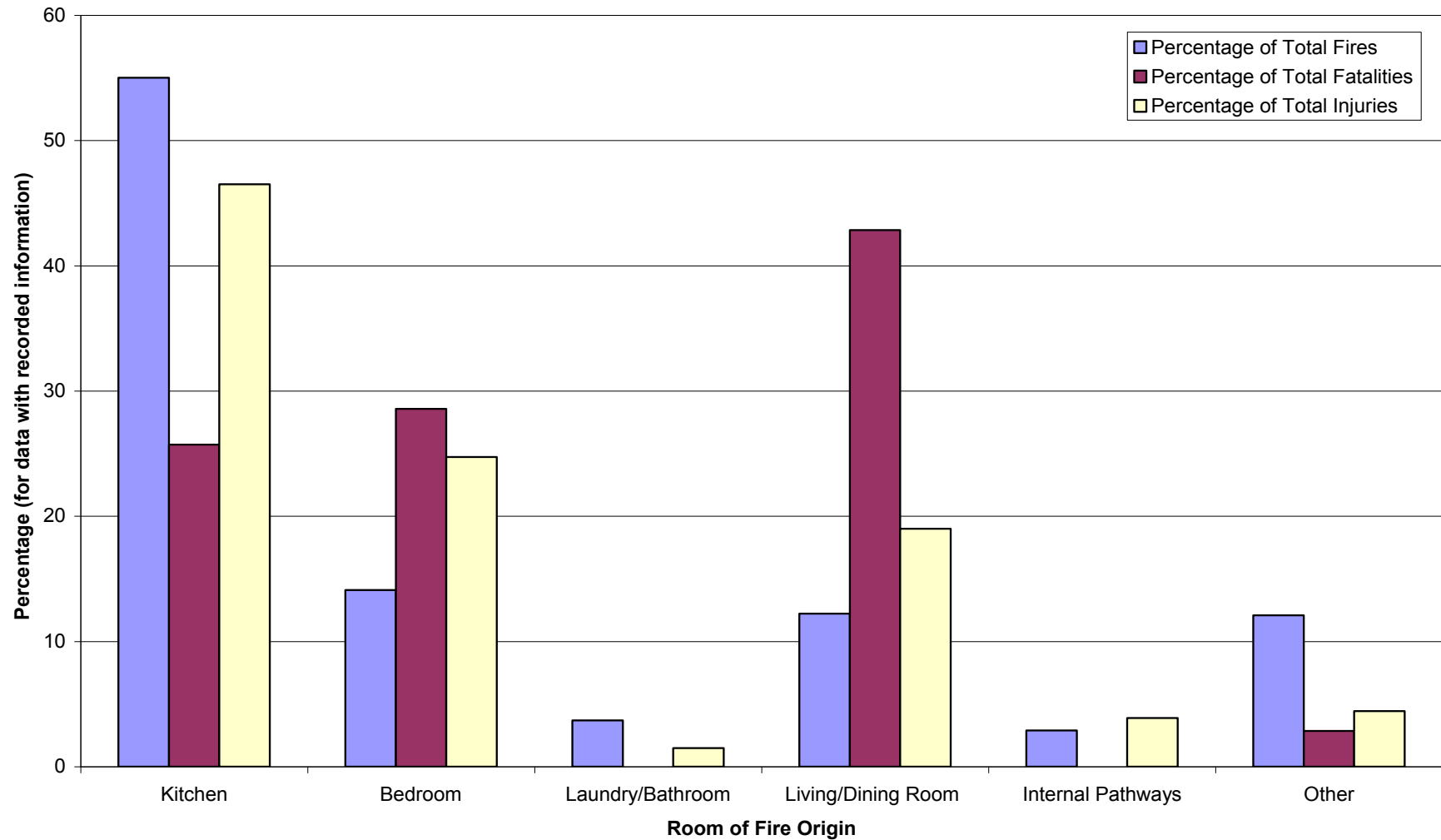


Figure 15: Percentage of totals, excluding data where information was not recorded, for fires, fatalities and injuries that occurred in apartments as recorded for each group of room of fire origin (1995-2005).

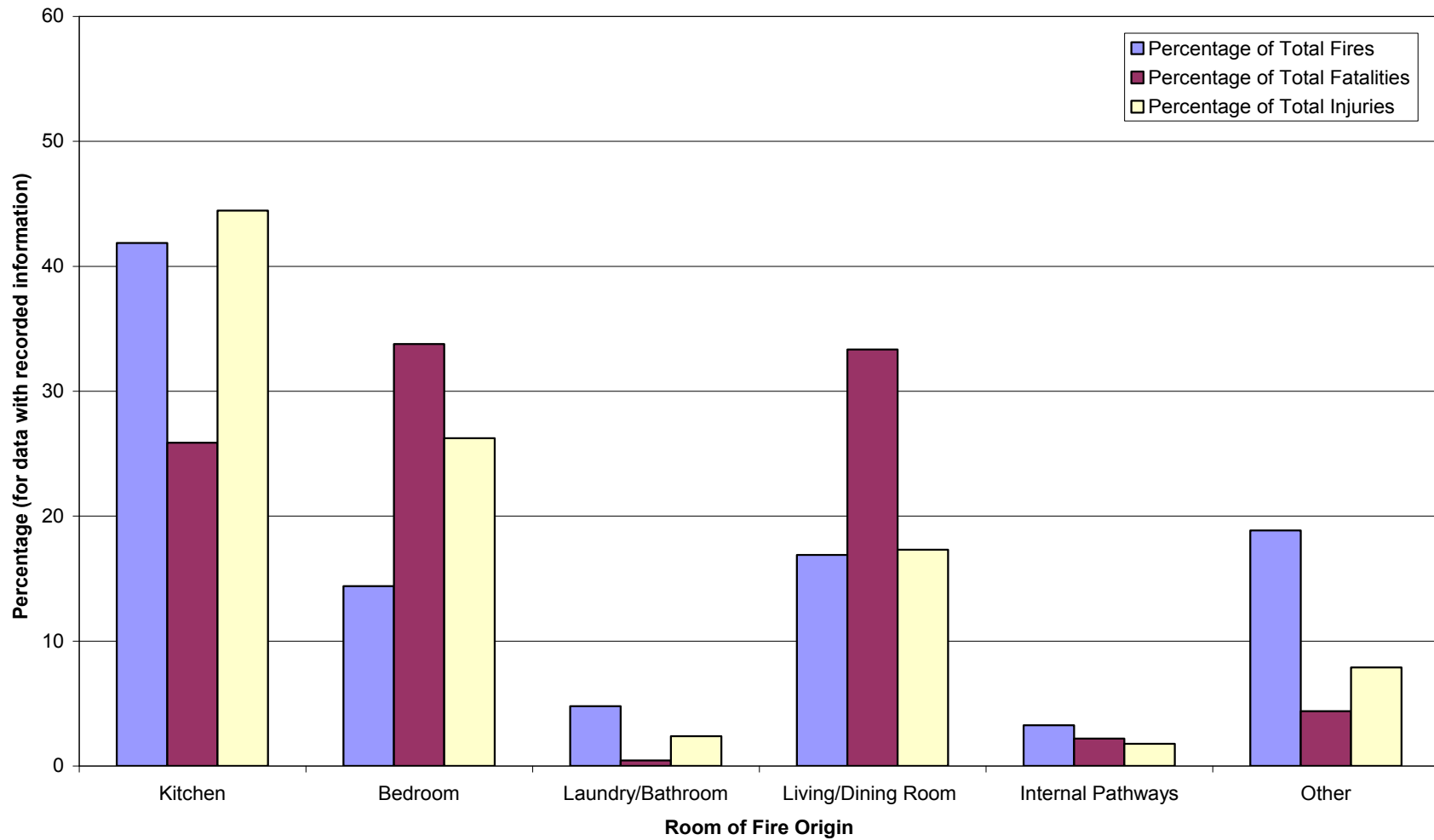


Figure 16: Percentage of totals, excluding data where information was not recorded, for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of room of fire origin (1995-2005).

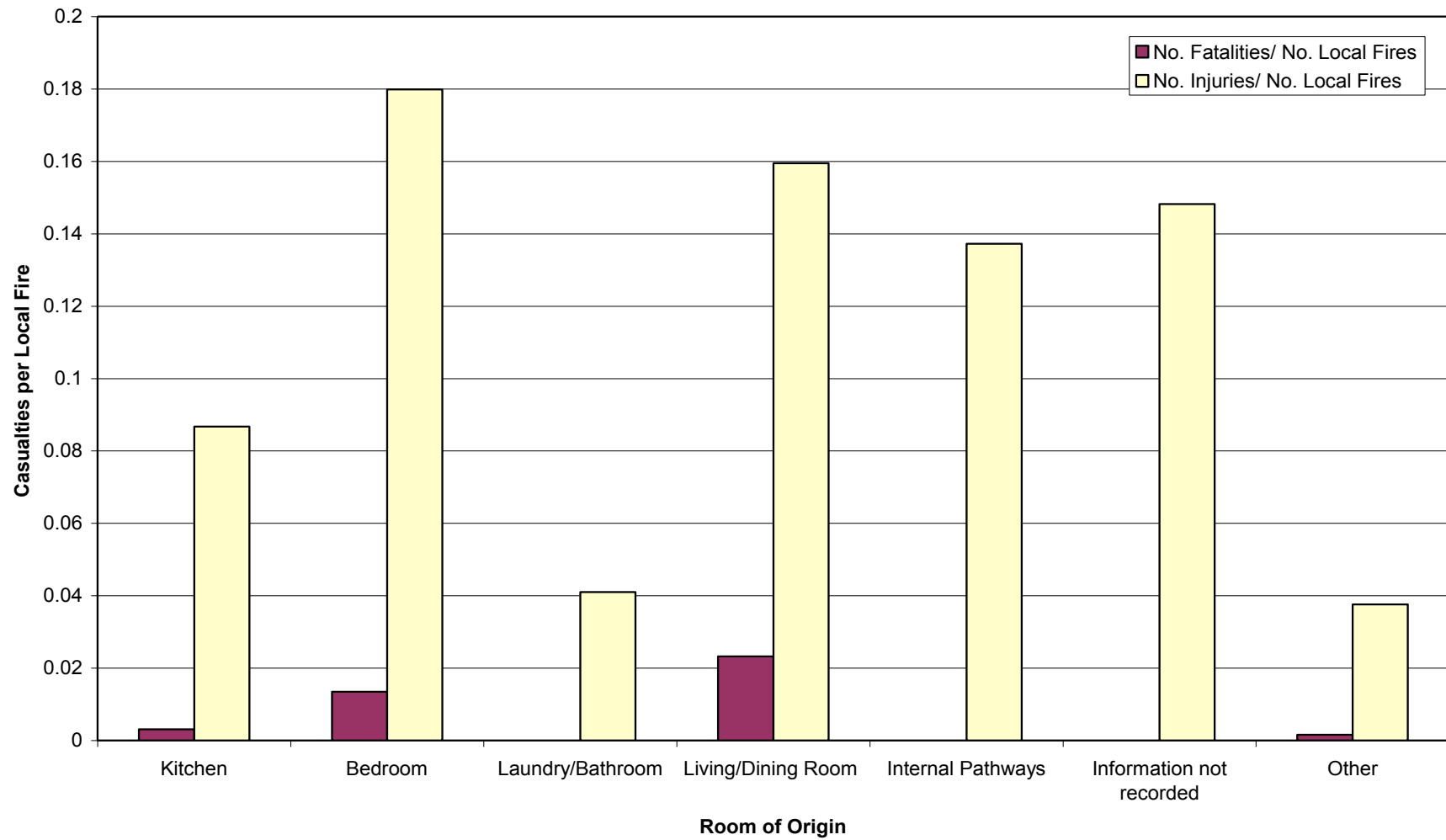


Figure 17: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in apartments as recorded for each group of room of fire origin (1995-2005).

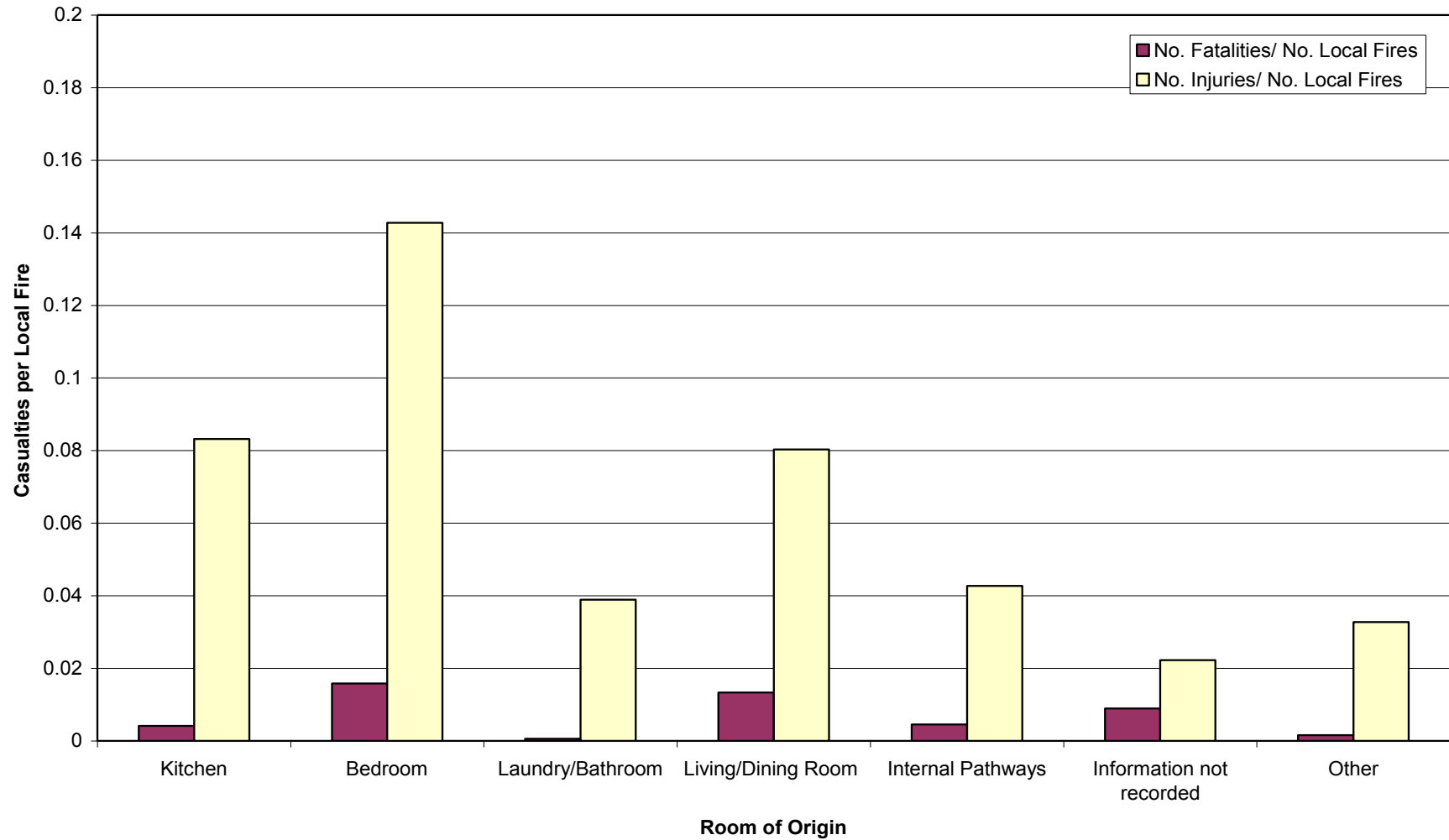


Figure 18: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of room of fire origin (1995-2005).

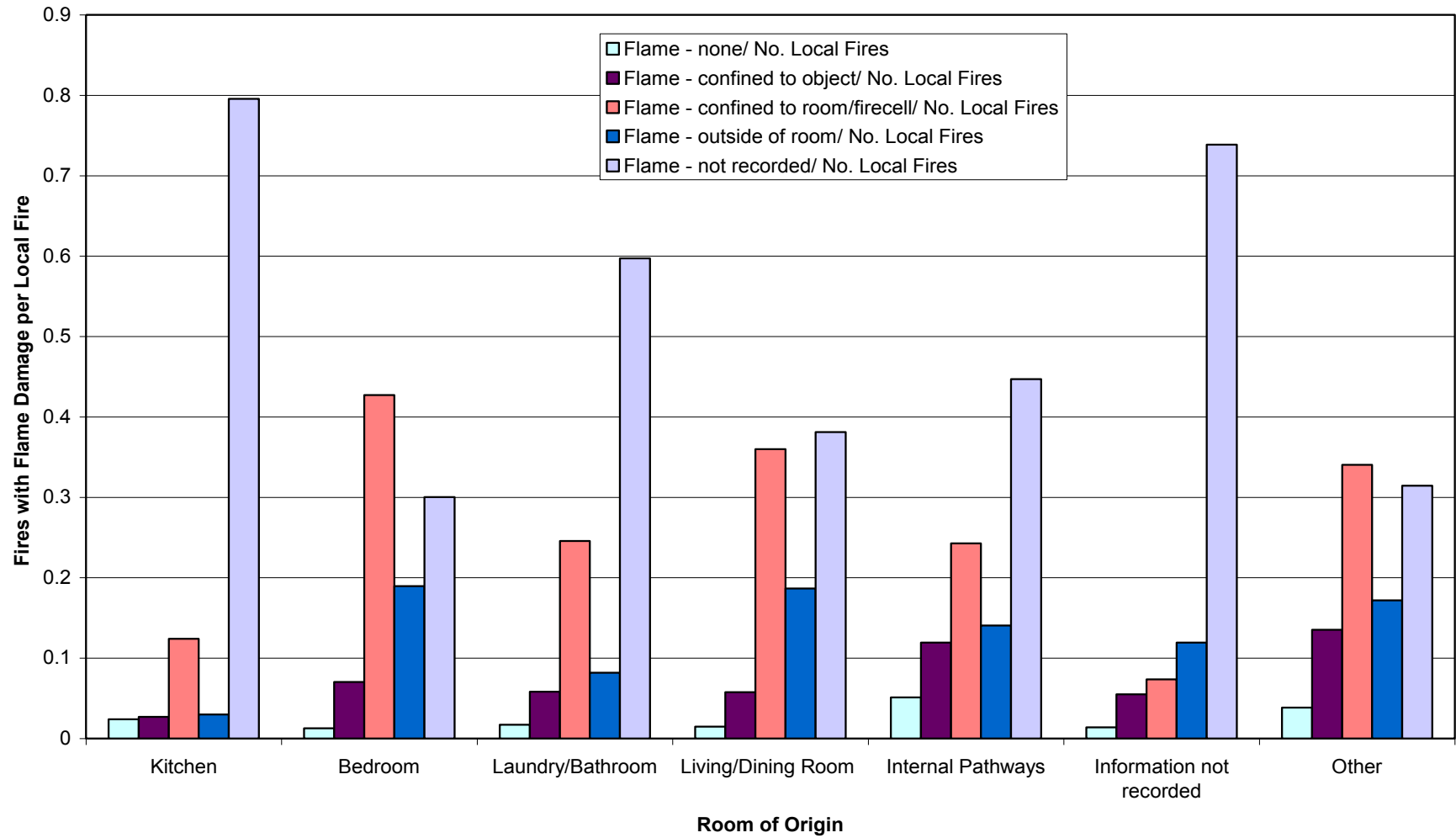


Figure 19: Ratios of numbers of fires with flame damage to numbers of total local fires that occurred in apartments as recorded for each group of room of fire origin (1986-2005).

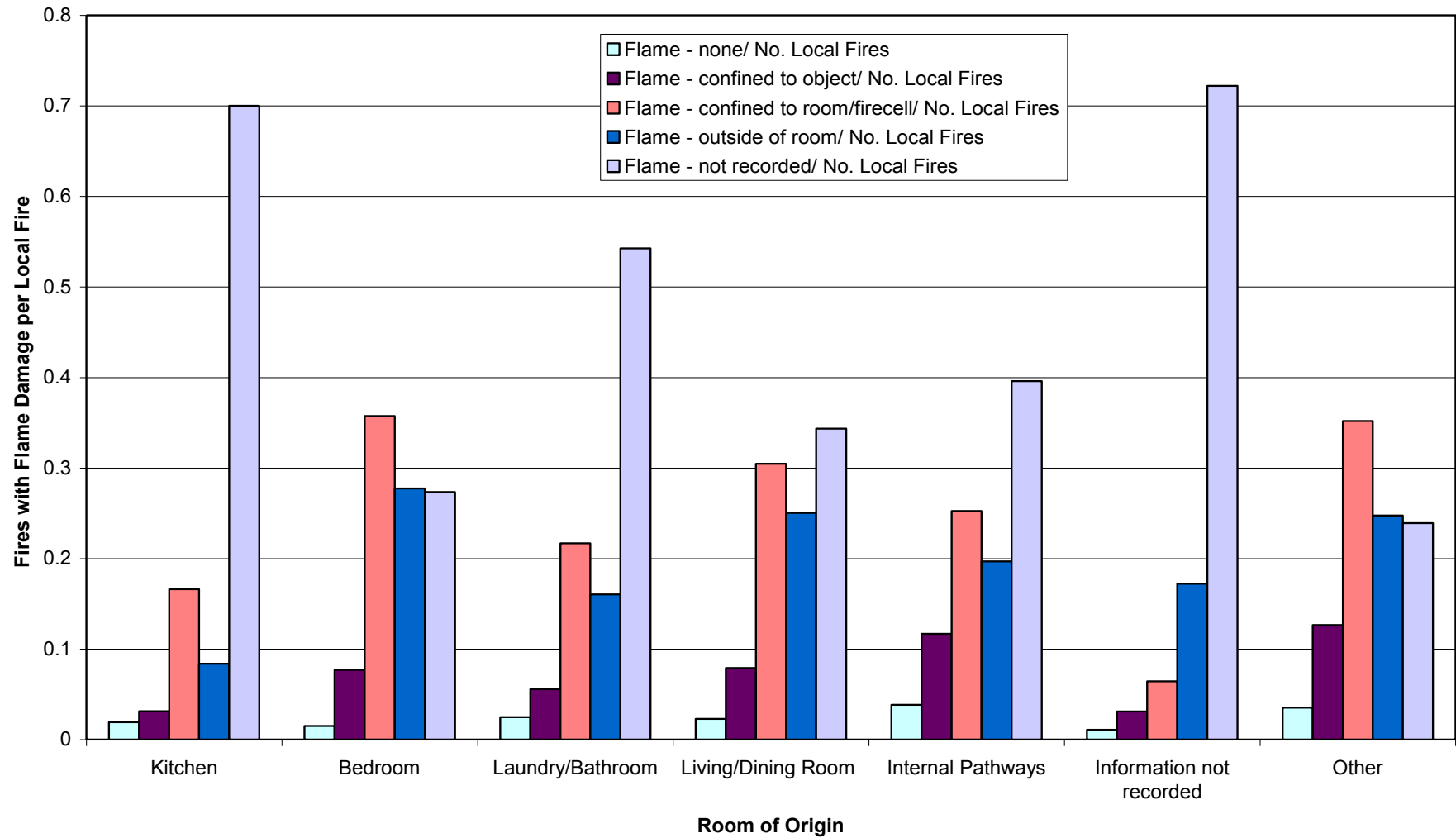


Figure 20: Ratios of numbers of fires with flame damage to numbers of total fires that originated in each group of areas considered in all residential structures as recorded for each group of room of fire origin (1986-2005).

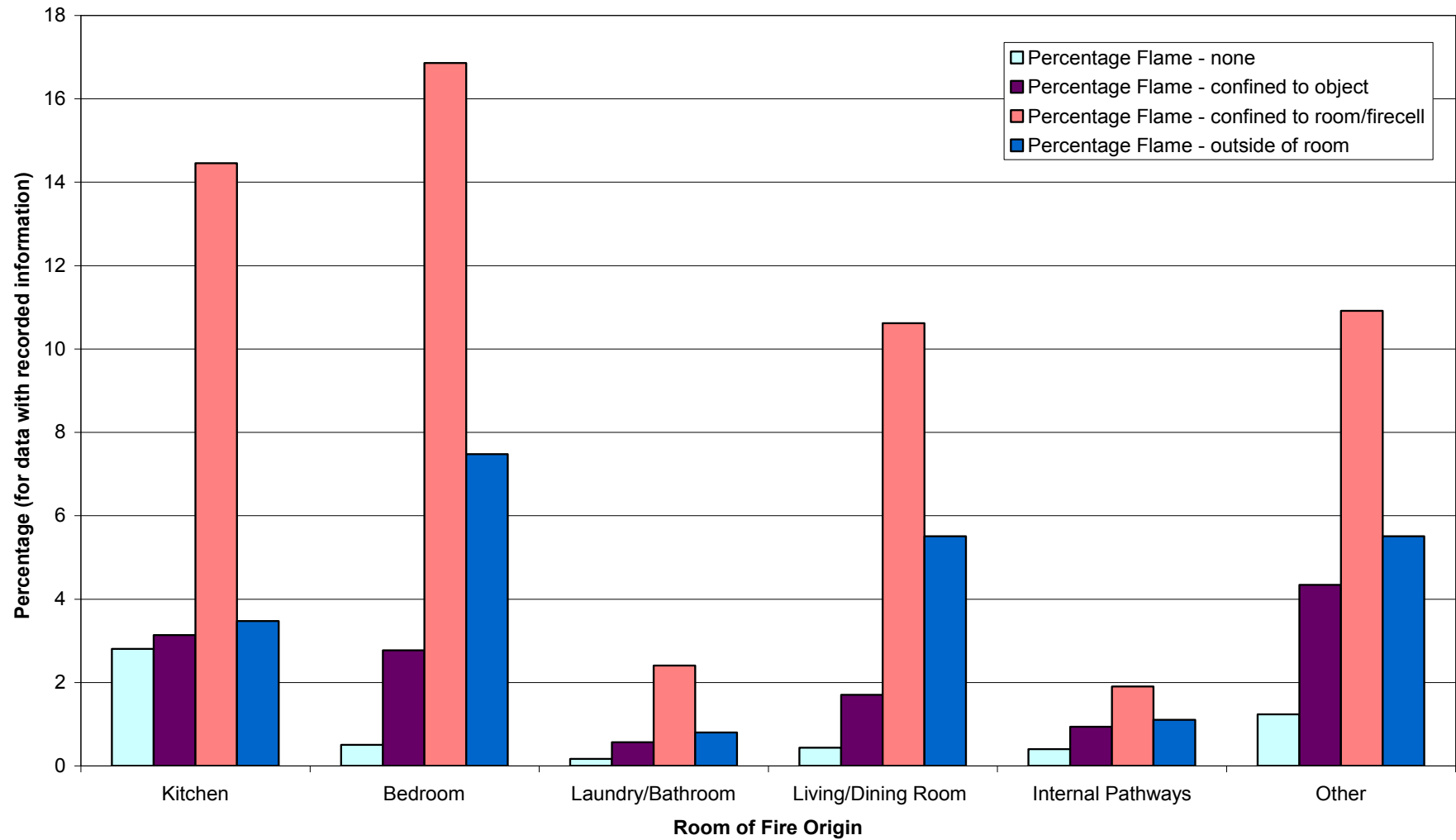


Figure 21: Percentage of total fires, excluding data where information was not recorded, for flame damage that occurred in apartments as recorded for each group of room of fire origin (1986-2005).

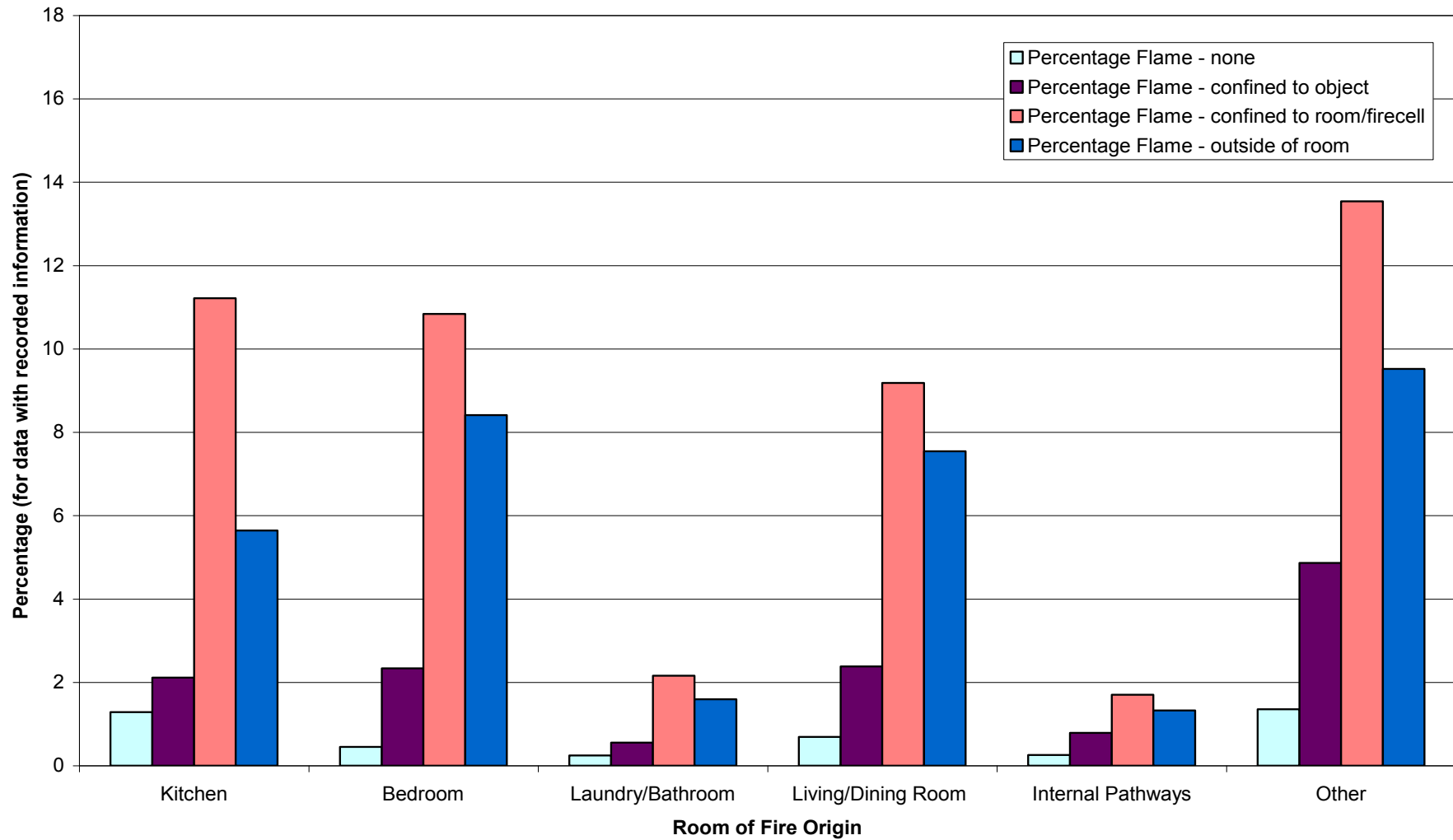


Figure 22: Percentage of totals, excluding data where information was not recorded, for fires with flame damage that occurred in all residential structures as recorded for each group of room of fire origin (1986-2005).

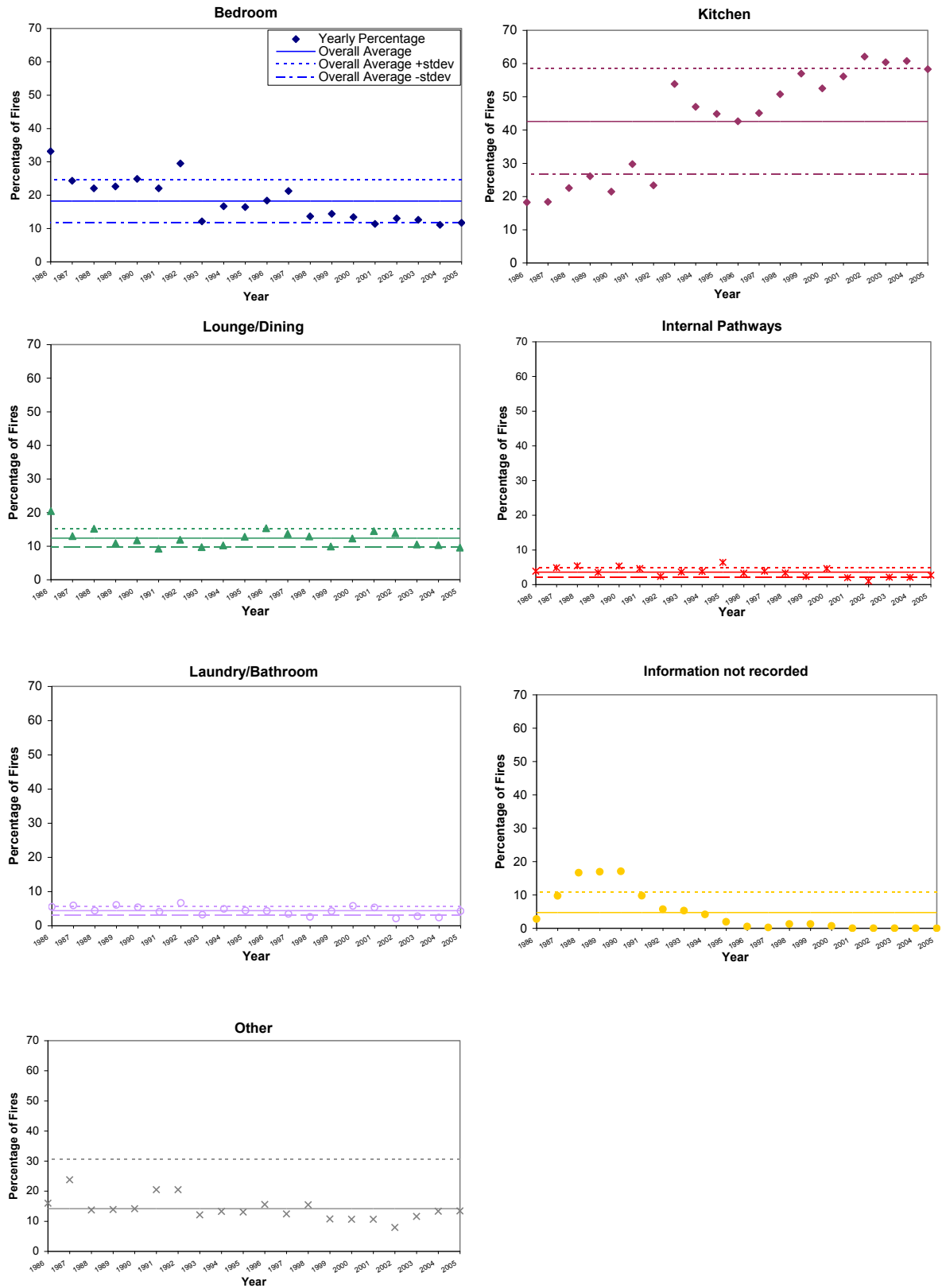


Figure 23: Percentage of fires for each room of fire origin for each year for apartments.

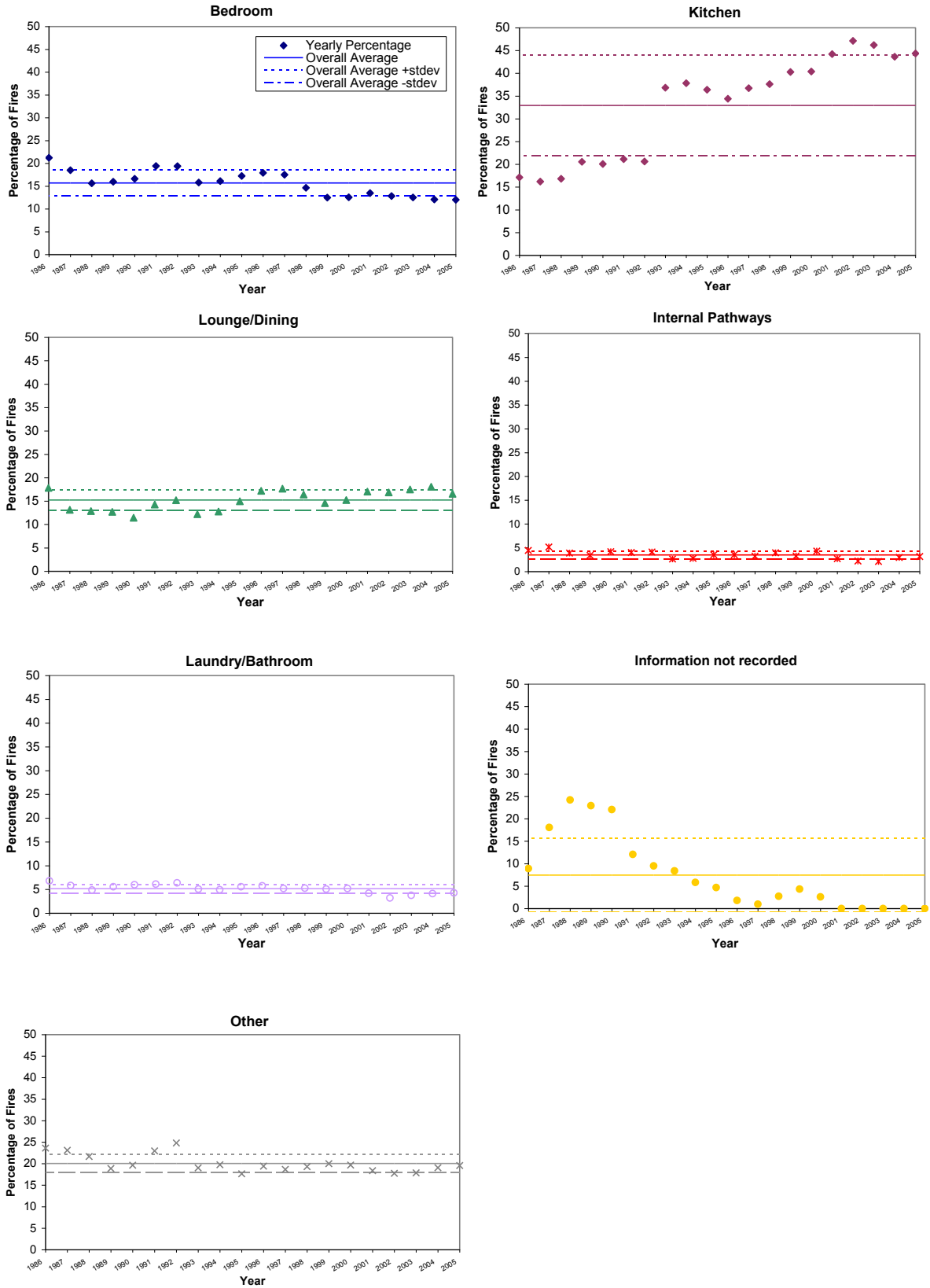


Figure 24: Percentage of fires for each room of fire origin for each year for all residential properties.

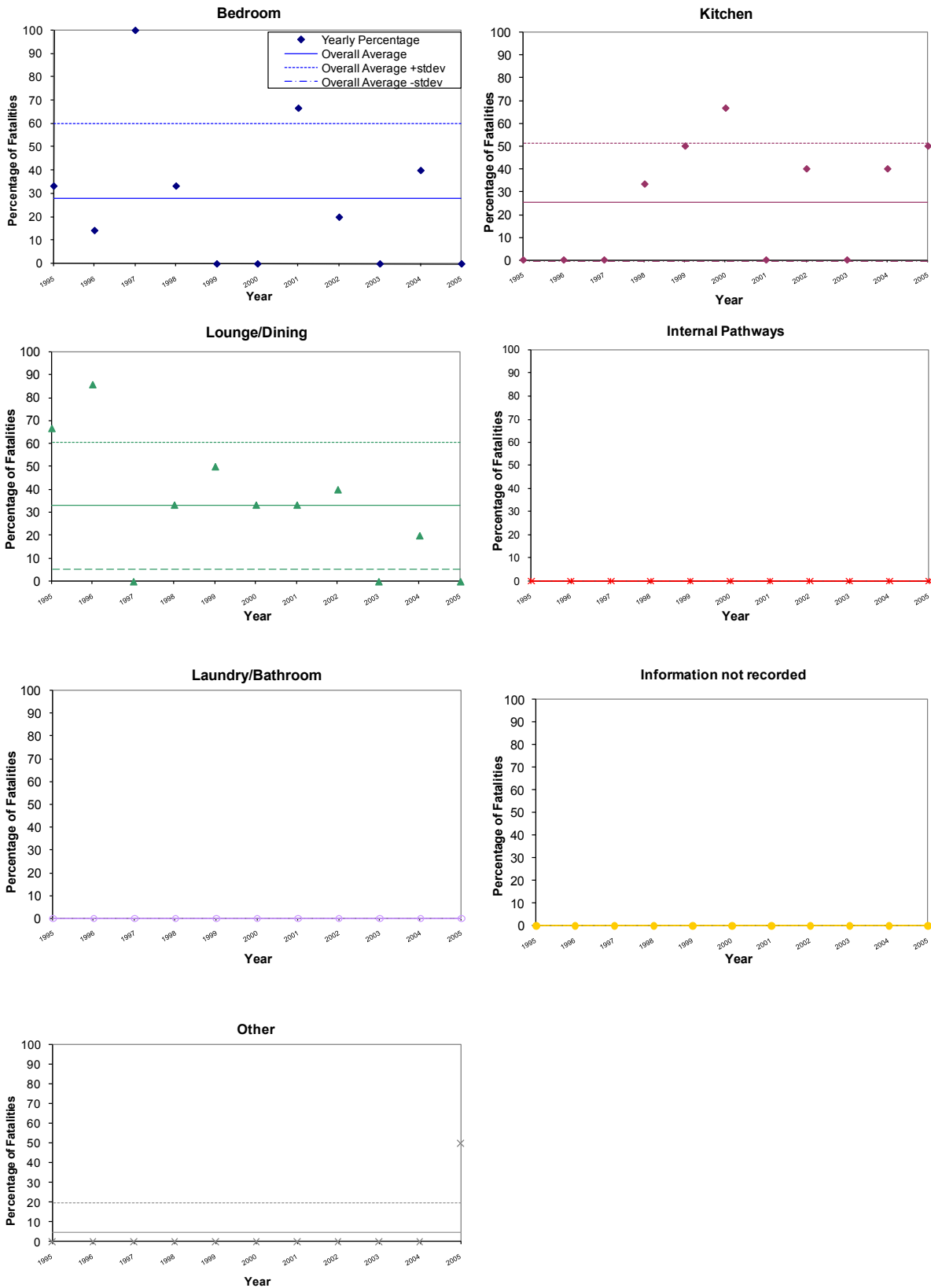


Figure 25: Percentage of fatalities for each group of rooms of origin considered each year for apartments.

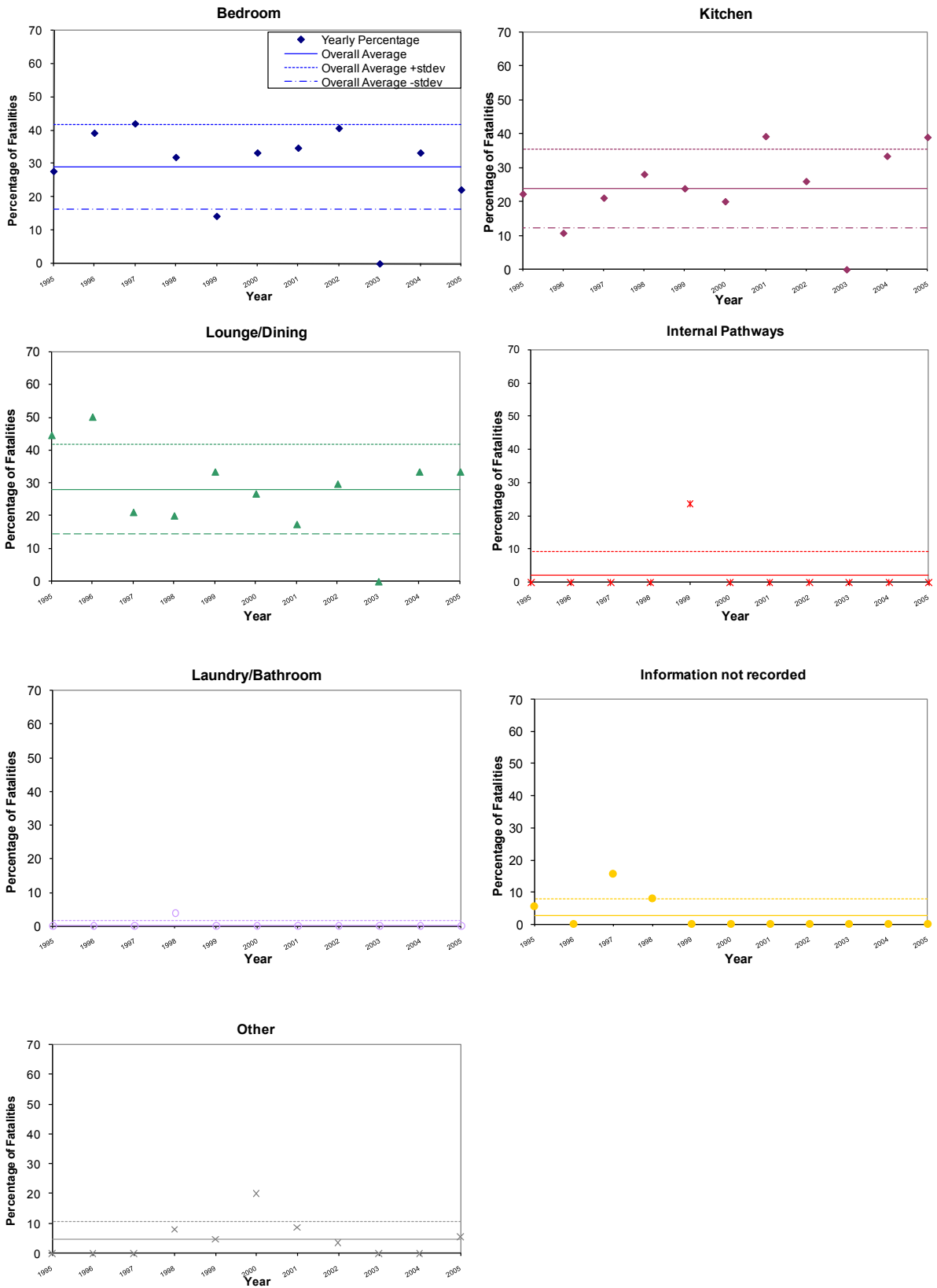


Figure 26: Percentage of fatalities for each group of rooms of origin considered each year for all residential properties.

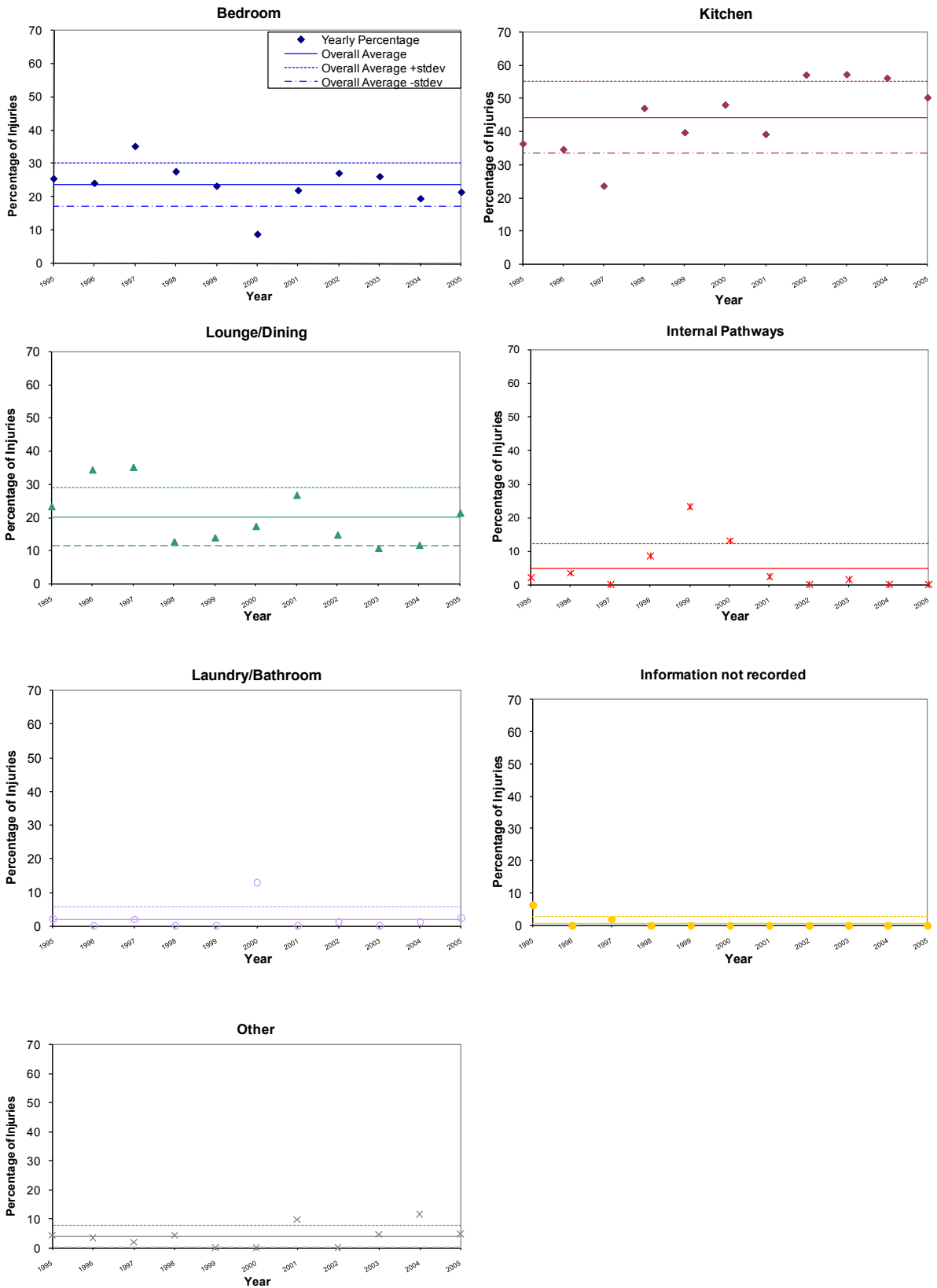


Figure 27: Percentage of injuries for each group of rooms of origin considered each year for apartments.

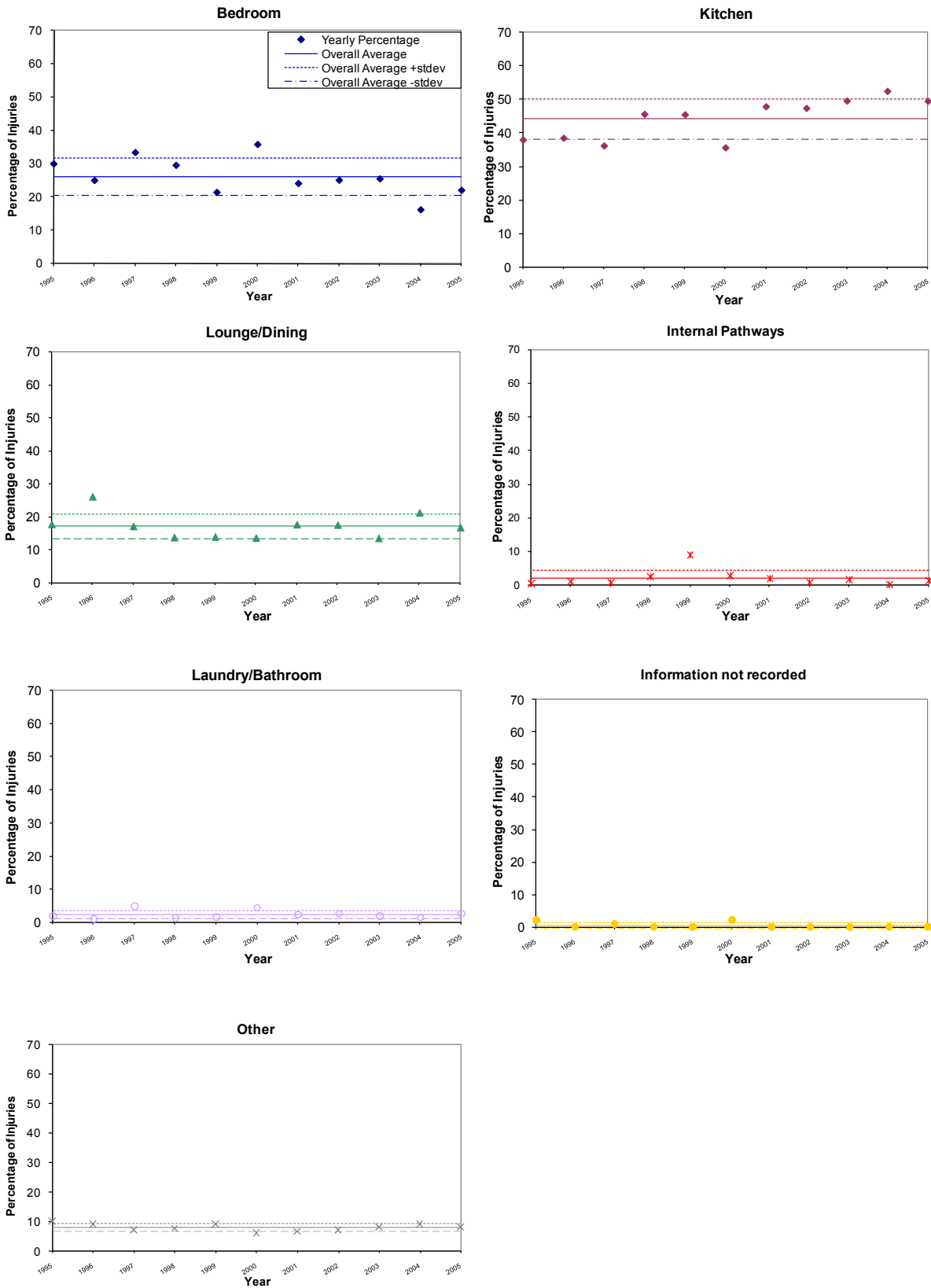


Figure 28: Percentage of injuries for each group of rooms of origin considered each year for all residential properties.

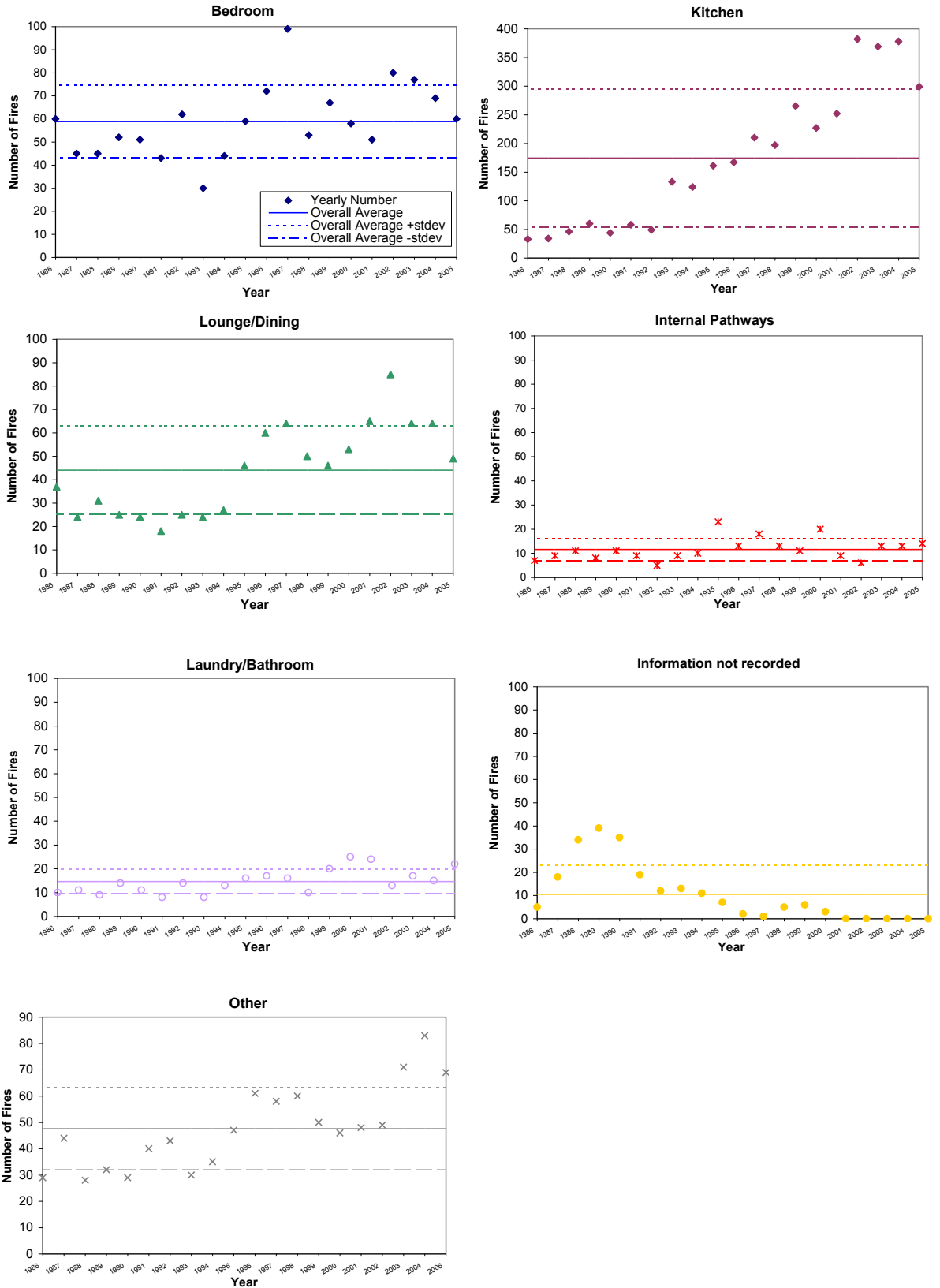


Figure 29: Number of fires that occurred in apartments by group of room of fire origin (1986 – 2005).

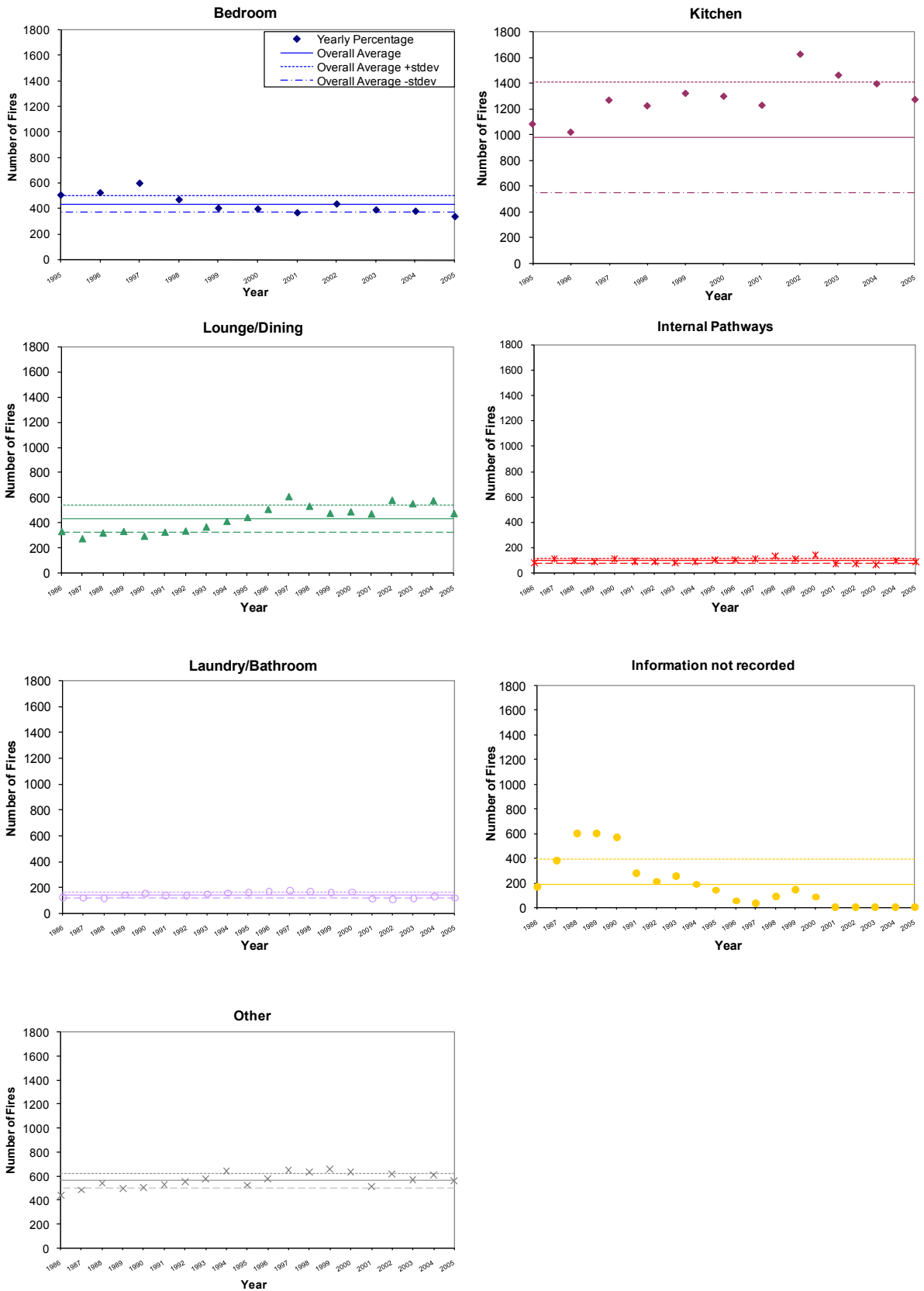


Figure 30: Number of fires in all residential properties by groups of room of fire origin (1985 – 2005).

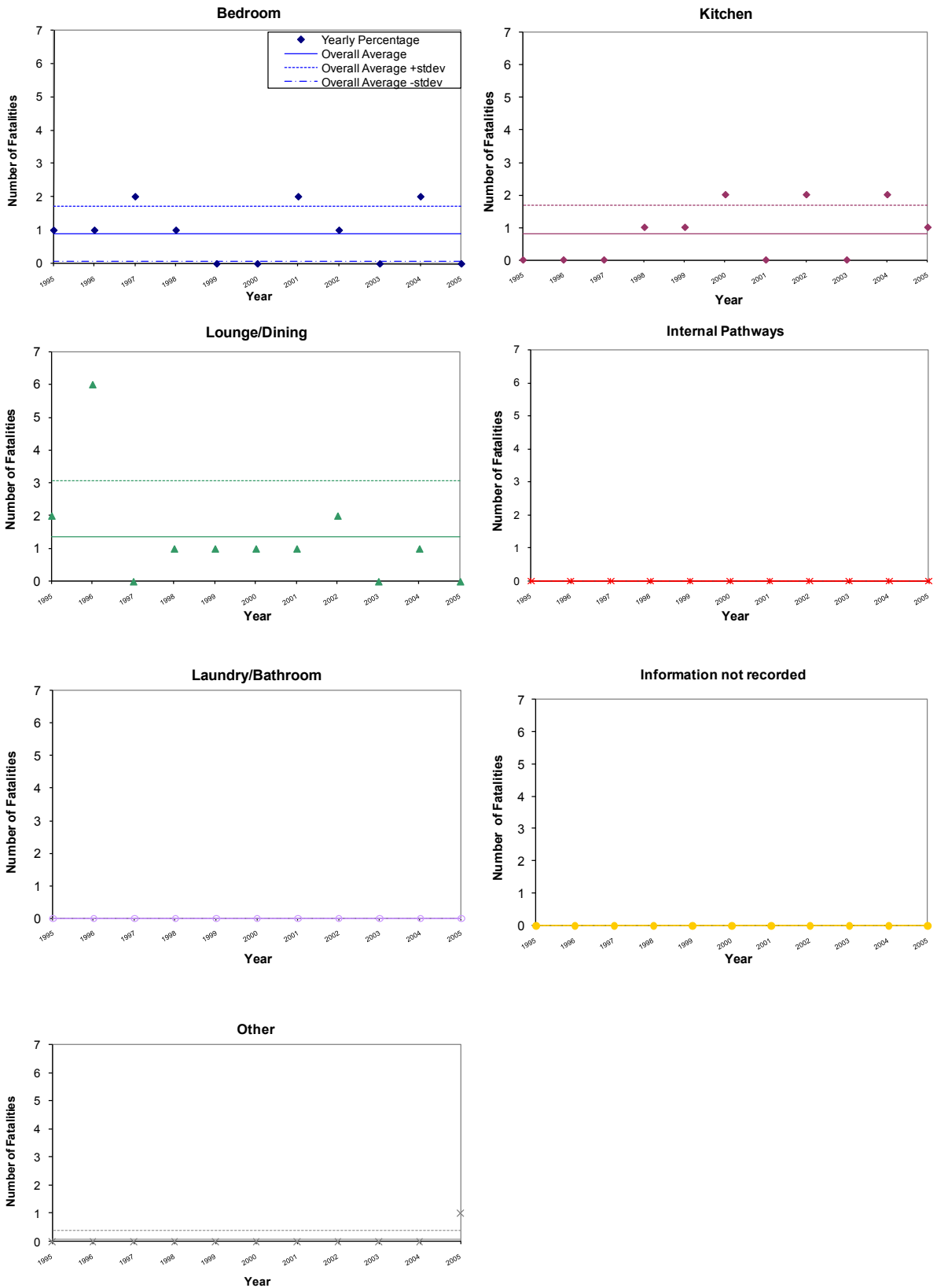


Figure 31: Number of fatalities by group of room of fire origin for apartments (1995 – 2005).

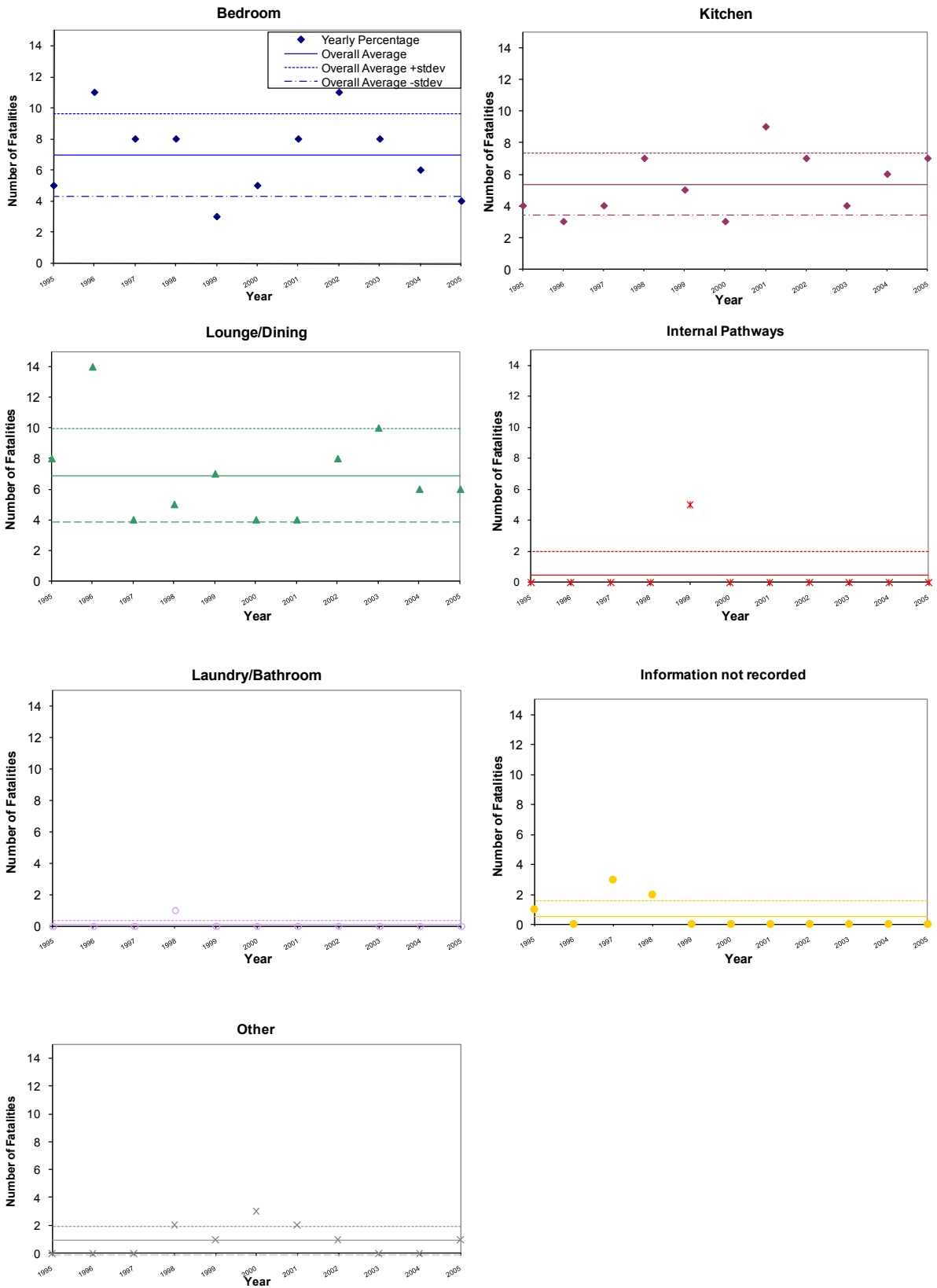


Figure 32: Number of fatalities for groups of rooms of fire origin for all residential properties (1995 – 2005).

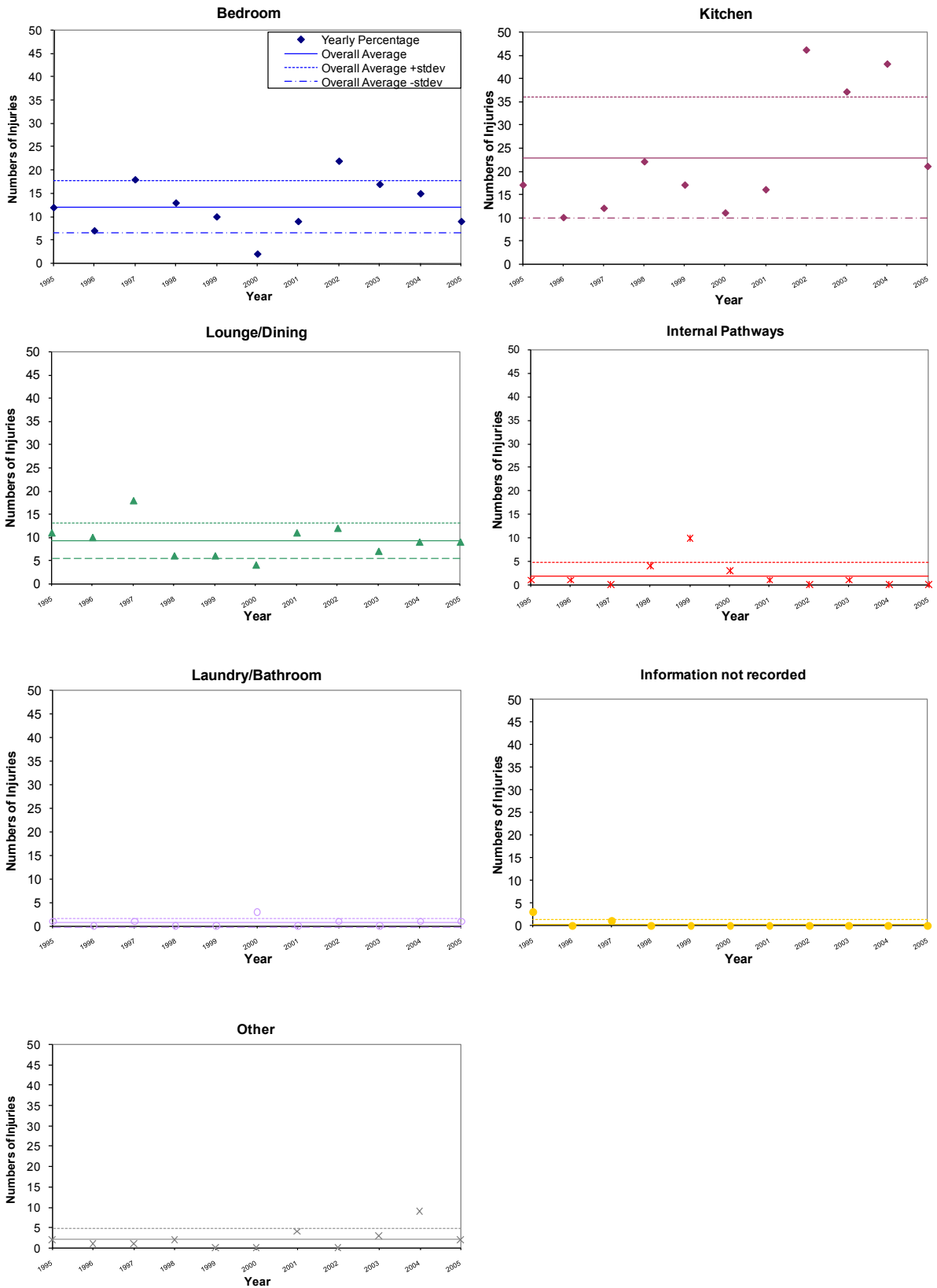


Figure 33: Number of injuries for apartments for groups of rooms of fire origin (1995 – 2005).

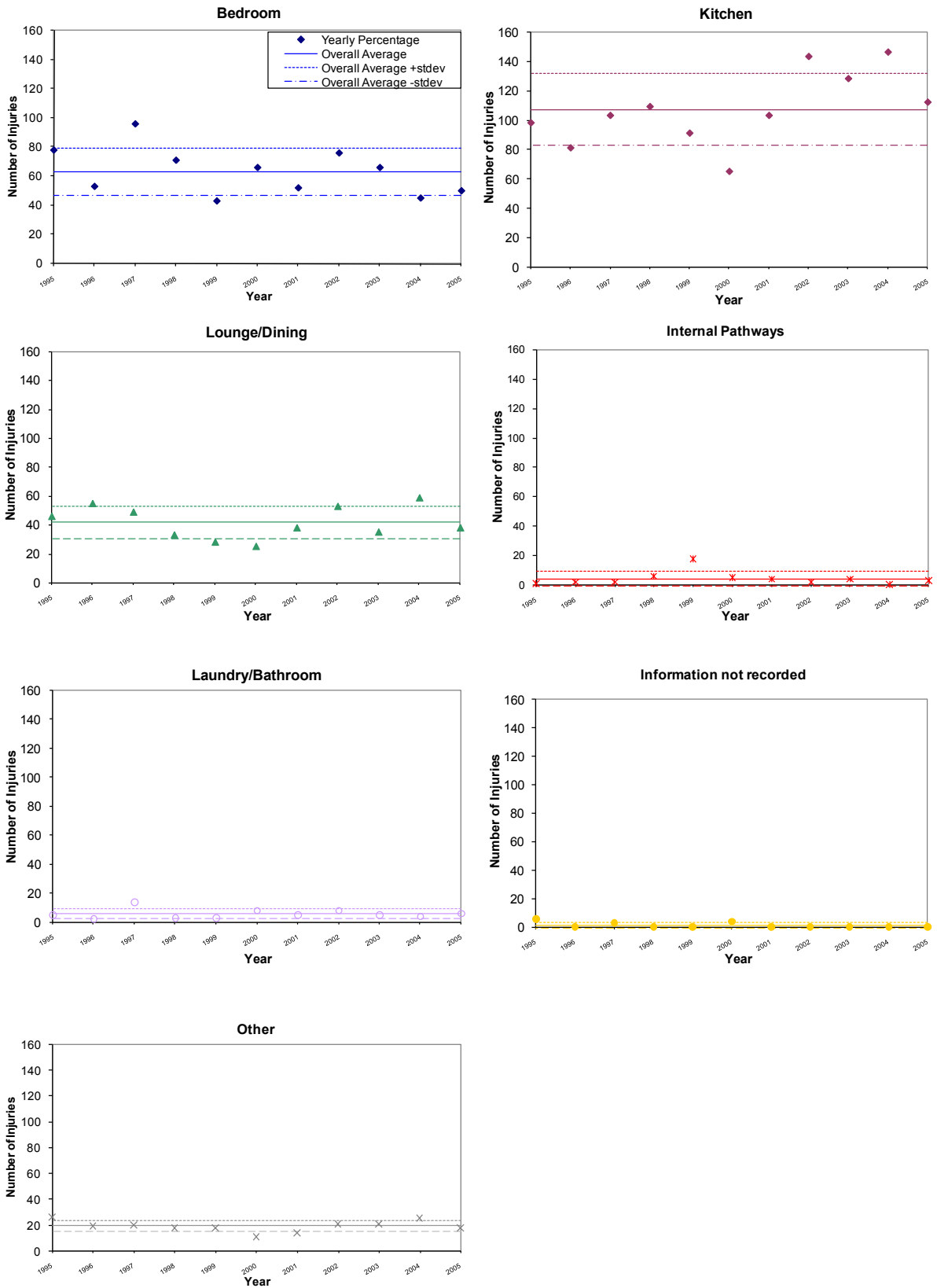


Figure 34: Number of injuries from all residential properties for groups of rooms of fire origin (1995 – 2005).

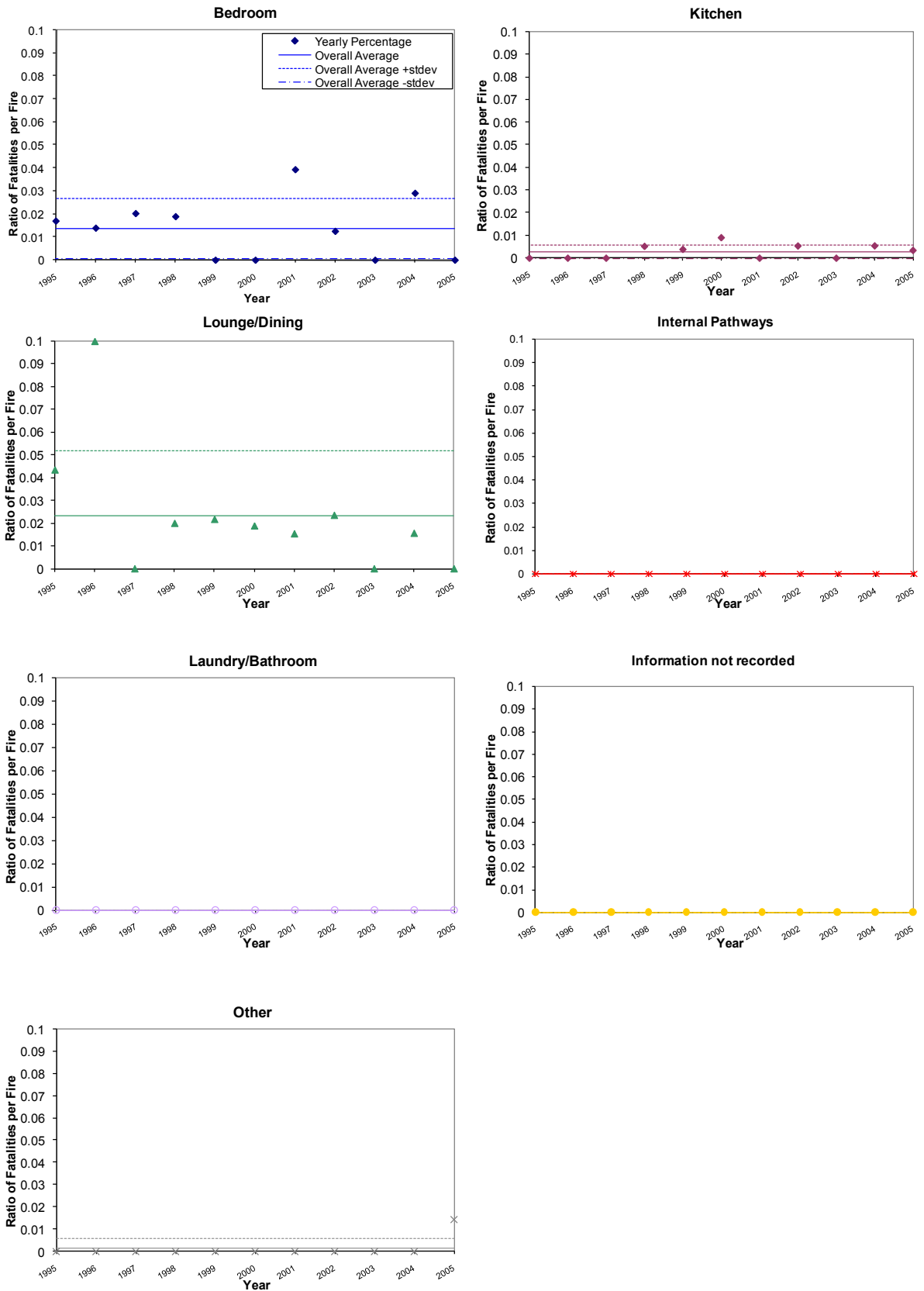


Figure 35: Ratios of fatalities to local fires for apartments only (1995 – 2005).

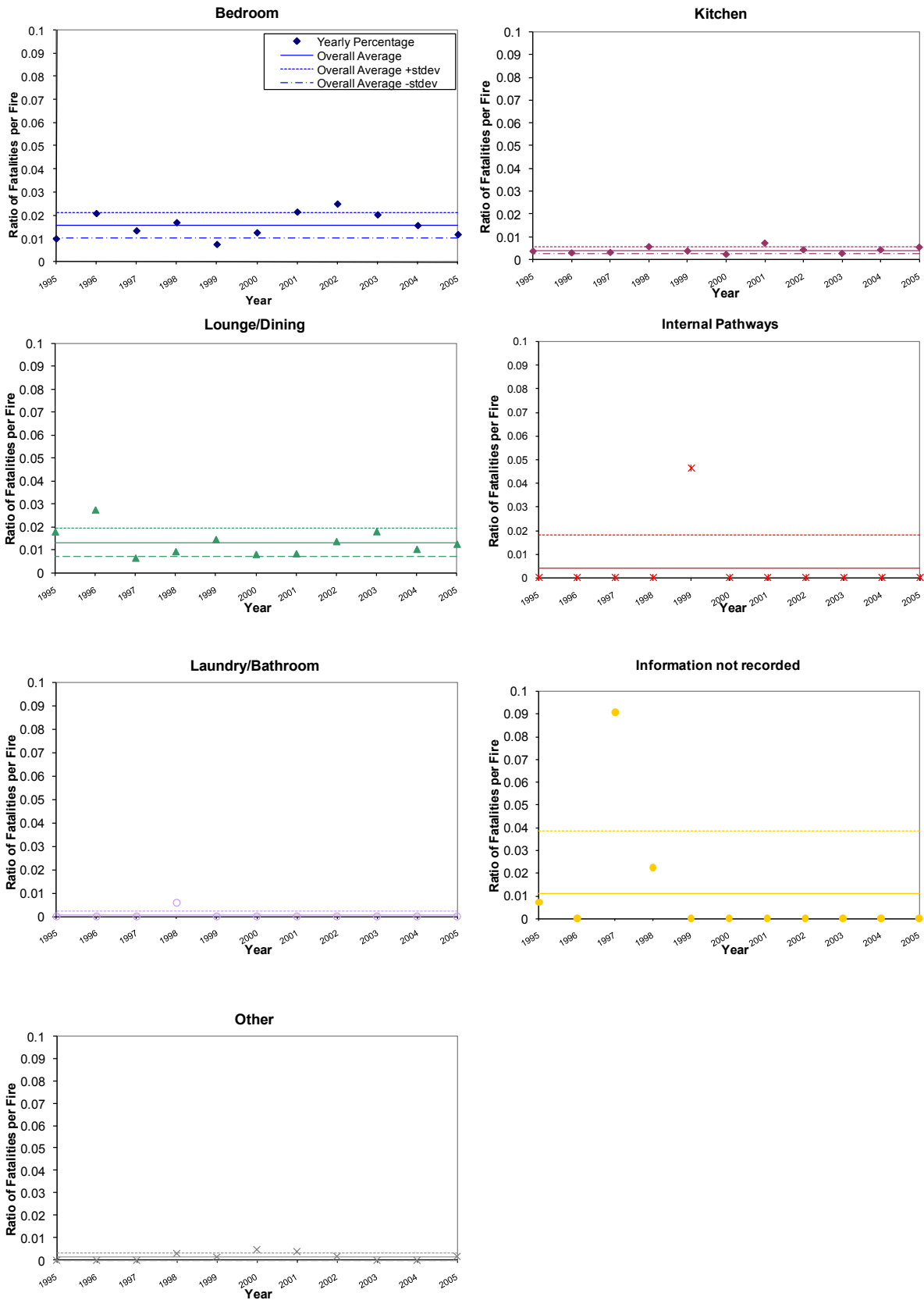


Figure 36: Ratios of fatalities to local fires for all residential structures (1995 – 2005).

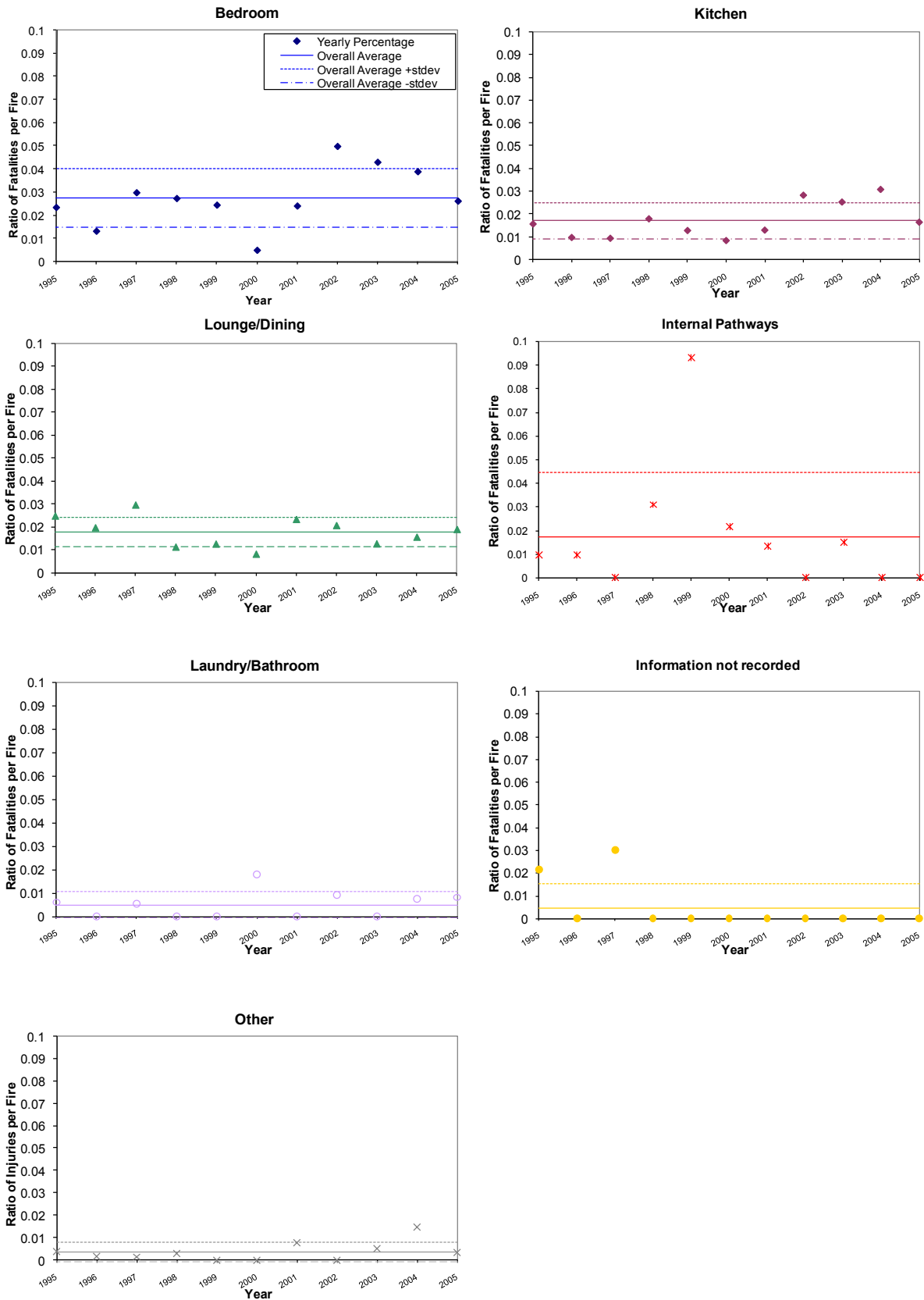


Figure 37: Ratios of injuries to local fires for apartments only (1995 – 2005).

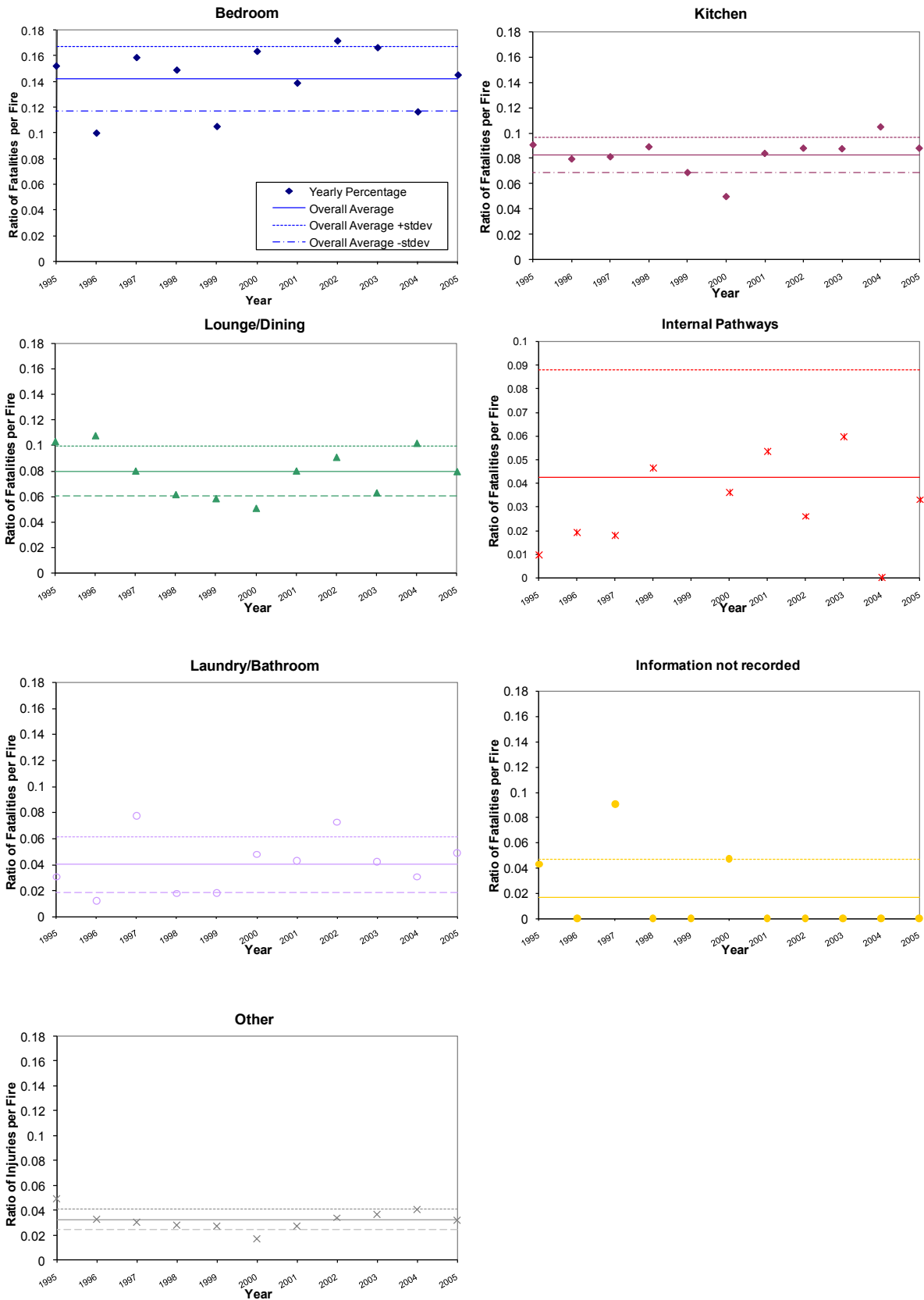


Figure 38: Ratios of injuries to local fires for all residential structures (1995 – 2005).

4.2 Equipment Involved in Ignition

The types of equipment considered in this section are powered items in general. That is, items powered by electricity, LPG, solid fuel, etc.

The numbers of fires that have occurred collectively from 1986 to 2005 in residential structures are shown in Figure 184 and in apartments only are shown in Figure 185. There are 211 classes within the category of “Equipment Involved in Ignition”, therefore it is suggested that using the zoom feature on the soft copy may ease viewing of some of the figure. The ranking of the most common equipment involved in ignition (up to the first 10 classes) by number of fire events for each type of property and structure damage are presented in Table 34 and Table 35. The numbers of civilian fatalities and injuries that have occurred collectively from 1995 to 2005 on residential structures are shown in Figure 186 and Figure 187 respectively. The ranking of the most common equipment involved in ignition (up to the first 10 classes) by number of fatalities and injuries for each type of property and structure damage are presented in Table 36 and Table 37 respectively. The ratios of the number of fatalities and number of injuries to the number of fires that occurred in each item of equipment involved in ignition (using the collective data from 1995 to 2005) are shown in Figure 188 and Figure 189 respectively. The top 10 ratios of numbers of fatalities and injuries to numbers of fires for each item of equipment involved in ignition for each type of property and structure damage are presented in Table 38 and Table 39 respectively. The ratios of the number of total fatalities and the number of total injuries to the number of total fires that occurred in each item of equipment involved in ignition (using the collective data from 1995 to 2005) are shown in Figure 190 and Figure 191 respectively. The ratios of the percentage of total fatalities and the percentage of total injuries to the percentage of total fires that occurred in each item of equipment involved in ignition (using the collective data from 1995 to 2005) are shown in Figure 192 and Figure 193 respectively. The top 10 ratios of percentage of total fatalities and total injuries to the percentage of total fires for each item of equipment involved in ignition for each type of property and structure damage are presented in Table 40 and Table 41 respectively. The number of fires according to the extent of flame damage for fire events recorded for each item of equipment involved in ignition is shown in Figure 194 and Figure 195 for all residential structures and apartments only respectively.

4.2.1 All Classes

All classes of the equipment involved in ignition were initially analysed individually in order to gain an initial feel for the important aspects and predominant classes of the data set. A full listing of each of the classes for the equipment involved in ignition category is presented in Appendix A. The results from this analysis were then used to select the most important and appropriate groupings of the classes to be used in a finer analysis of the data set. Following is a brief discussion of the results of the analysis using the individual classes for equipment involved in ignition. The associated tables and figures are included in Appendix F.

4.2.1.1 Most Common

Firstly it should be noted that over half (~ 55% for apartments only and ~ 61% for all residential structures) of the recorded fire incidents reported no information on the equipment involved in ignition. Therefore the data set for which details of the equipment involved in ignition is considered and the results are presented as generally indicative only.

The three most common items of equipment involved in ignition for fire events and fire injuries in both apartments and all residential structures (with and without structure

damage) for the total number of fire events (from 1986 to 2005 for fire events and 1995 to 2005 for fire casualties) are the electric stove, electric oven and no powered equipment (e.g. matches, etc) (Table 35 and Table 39). The proportions of the top three items of equipment involved in ignition for fire events and injuries are of similar proportions.

For the total number of fire events considered (1995 to 2005), the three most common items of equipment involved in fatal fires in both apartments only and all residential structures are the electric stove, electric blanket and no powered equipment (e.g. matches, etc) (Table 37). However the proportion of fatalities in apartments only attributed to the electric stove is almost twice that for all residential structures. However, as previously discussed, the total number of fatalities resulting from fire events in New Zealand is statistically small, therefore care should be used when drawing conclusions based on this data set.

4.2.1.1 Historical Trends

The numbers of fires attributed to each item of equipment involved in ignition for each year, during the period from 1986 to 2005, are shown in Figure 200 and Figure 201 for apartments only and all residential structures respectively. A decrease in the number of fires with no information recorded for the equipment involved in ignition can be seen for both apartments and all residential property. Also the influence of a change in data collation is obvious with the change occurring in 1992.

The numbers of fatalities for each item of equipment involved in ignition for each year, during the period from 1986 to 2005, are shown in Figure 202 and Figure 203 for apartments only and all residential structures respectively. No trends are obvious. This is expected, due to the very small population sizes and the relatively large proportion of fire events with no information recorded for the equipment involved in ignition.

The number of apartment injuries for each item of equipment involved in ignition for each year, during the period from 1986 to 2005, is shown in Figure 206. The number of all residential injuries for each year, during the period from 1986 to 2005, is shown in Figure 208. Again no trends are obvious.

4.2.1.2 Correlations

The numbers of fire events for the range of equipment involved in ignition that were considered has a strong correlation for apartments and all residential structures with structure damage (0.998 and 0.997) and no correlation when considering fire events "without structure damage" (0.022 and 0.022, for the years 1986 – 2005 and 1995 – 2005 respectively). Moderate correlation exists between the numbers of fire events that occurred in apartments (with and without structure damage) and in all residential structures (with and without structure damage) (0.871 and 0.825 for years 1986 – 2005 and 1995 – 2005 respectively).

The numbers of fatalities for the range of equipment involved in ignition that were considered has a strong correlation for apartments and all residential structures with structure damage (0.998 and 0.997) and no correlation when considering fire events "without structure damage" (0.022 and 0.022, for the years 1986 – 2005 and 1995 – 2005 respectively). Moderate correlation exists between the numbers of fire fatalities that occurred in apartments (with and without structure damage) and in all residential structures (with and without structure damage) (0.871 and 0.825 for years 1986 – 2005 and 1995 – 2005 respectively).

The numbers of fire events has good correlation to the number of fatalities for the range of equipment involved in ignition that were considered for each combination of the property and structure damage that were considered. For apartments with and without structure damage and both, the sample linear correlation between fire events

and fatalities is 0.998, 0.867 and 0.979 respectively. For all residential structures with and without structure damage and both, the sample linear correlation between fire event and fatalities is 0.996, 0.958 and 0.975 respectively.

The numbers of fire events has a strong correlation to the number of injuries for the range of rooms of fire origin that were considered for each combination of the property and structure damage that were considered. For apartments with and without structure damage, the sample linear correlation was 0.988 and 0.987 respectively. For all residential structures with and without structure damage the sample linear correlation was 0.960 and 0.982 respectively. There is also good correlation between the number of injuries for apartments and all residential structures with structure damage (0.993) and without structure damage (0.942).

In general, the correlations between various outcomes for the category of equipment involved in ignition is expected to be quite high. This is because the classification of “no information recorded” is consistently large for all outcomes considered in this category. The linear correlation values for the data set after removing the data associated with the classification of “no information recorded” are presented in Table 6. In general, the linear correlation values are only slightly lower for the data set excluding the “information not recorded” classification than for the data set including this classification.

Table 6: Summary of correlations for cumulative totals and casualties per fire between apartment and all residential data sets for 1-level event-tree

Categories	Building Types Compared ^c	No. Fires ^a	No. Fires ^b	No. Fatalities ^b	No. Injuries ^b	Fatality per Fire ^b	Injury per Fire ^b
Equipment Involved in Ignition	apt wd to res wd	0.998	0.997	0.988	0.999	0.546	0.354
	apt wod to res wod	0.022	0.022	0.009	0.017	0.013	0.027
	apt to res	0.871	0.825	0.780	0.756	0.607	0.241
Equipment Involved in Ignition (excluding “information not recorded”)	apt wd to res wd	0.916	0.968	0.840	0.987	0.546	0.354
	apt wod to res wod	0.022	0.021	-	0.017	-	0.027
	apt to res	0.125	0.185	0.170	0.261	0.607	0.241

Notes:

^a Number of fires considered is for years 1986 to 2005.

^b Number of casualties considered is for years 1995 to 2005.

^c ‘apt’ is the abbreviation for apartment buildings and ‘res’ is the abbreviation for all residential buildings, ‘wd’ is the abbreviation for with structure damage and ‘wod’ is the abbreviation for without structure damage.

4.2.1.2 Most Costly

The “cost” of a fire has been assumed to be apportioned by the number of resulting fatalities or injuries.

The ratios of the number of fatalities to the number of fires for each type of equipment involved in ignition are shown in Figure 190. For apartment fires the most costly equipment involved in ignition, in terms of civilian fatalities, was primarily the video player, power devices, oven and heater. For all residential property fires the most costly equipment involved in ignition, in terms of civilian fatalities, was primarily the heater, fat fryer, electrical cord, video player and oven.

The ratios of the number of injuries to the number of fires in each item of equipment involved in ignition are shown in Figure 191. For apartment fires the most costly items of equipment involved in ignition, in terms of civilian injuries, were portable cooking

devices, Bunsen burner, dehumidifying air conditioning, heater, fax machine, oil lamp and water heater. For all residential structure fires the most costly items of equipment involved in ignition, in terms of civilian injuries, were portable cooking devices, Bunsen burner, dehumidifying air conditioning, heater, clock radio, entertainment equipment and drill.

4.2.1.2.1 Historical Trends

There are no obvious trends showing for the ratios of numbers of casualties to fires, as shown in Figure 203 and Figure 205 for fatalities in apartments and all residential structures respectively and Figure 206 and Figure 208 for injuries to fire events for apartments and all residential structures respectively.

4.2.1.2.2 Correlations

The average percentage of fires for each item of equipment involved in ignition and one standard deviation are shown in Figure 210, Figure 211 and Figure 212 for fires, fatalities and injuries respectively. It is obvious that the smaller population size associated with civilian fatalities is consistent with the larger values for standard deviation from the average percentage. However the average percentages of fires, fatalities and injuries per room of fire origin are reasonably consistent between the apartment and all residential structures.

4.2.2 Grouped Classes

The results from the analysis of the individual classes was used to select the most important and appropriate groupings of the classes to be used in finer analysis. A listing of each of the classes that form each grouped classification for the equipment involved in ignition category is presented in Appendix B. Following is a discussion of the results of the analysis using the grouped classes for equipment involved in ignition.

4.2.2.1 Most Common

The most numerous fires were reported as “information not recorded” for both apartments and all residential structures, as shown in Figure 39 and Figure 40. For both apartments only and all residential structures, for the combinations of equipment involved in ignition considered, the next most common were the cooking equipment (stoves, ovens, BBQ, grill, etc), heaters and power transfer equipment (Figure 43 and Figure 44). The proportion of total fires where the equipment involved in ignition was not recorded decreased from the cumulative results for years 1986 – 2005 to the results for years 1995 – 2005.

For all residential properties, the recorded item of equipment involved in ignition that is associated with the most fatalities is cooking equipment followed closely by heaters and electric blankets, as shown in Figure 41, Figure 45 and Figure 66. For apartments, the order for heaters and electric blankets is reversed.

For all residential properties and apartments, the recorded items of equipment involved in ignition that is associated with the most injuries are also cooking equipment (stove, oven, etc) heater and electric blanket, as shown in Figure 42, Figure 45 and Figure 66.

4.2.2.1.1 Historical Trends

The percentage of the “information not recorded” class of the equipment involved in ignition is consistently high throughout the years considered (Figure 46 and Figure 48), however the trend from 1986 to 2005 is generally decreasing. Consequently the yearly data for the grouped equipment involved in ignition is shown both including and excluding the “information not recorded” class, for comparison. Since the “information

not recorded” class represents a large proportion of the data set, the results from the analysis of this data set are presented only as generally indicative (e.g. Figure 46 and Figure 47).

Considering the number of yearly fires (1986 – 2005), for apartments and all residential properties, it is clear that there is a distinct change in the data after 1992 (Figure 46, Figure 47, Figure 48 and Figure 49). In 1995 there was a change in the framework for collecting the data, therefore trends in the data from 1995 onwards only are considered here.

From 1995 onwards, the percentage of fires ignited by clothes dryers/washing machines, electric blankets each year show a slight decrease (Figure 47 and Figure 49, for apartments only and all residential structures respectively, excluding information not recorded).

Considering the number of yearly fires (1986 – 2005), for apartments and all residential properties, the percentage of fires ignited by clothes dryers/washing machines, electric blankets each year have increased (Figure 46, Figure 47, Figure 48 and Figure 49).

For fatalities and injuries (1995 – 2005), for apartments and all residential properties, considering the percentage of fatalities each year that occur in each of the groups of items of equipment involved in ignition, no clear trend was evident for the data available (Figure 54, Figure 56, Figure 62 and Figure 64). Similarly, no clear trend is evident for the yearly percentages of injuries over the same period for apartments (Figure 50, Figure 52, Figure 58 and Figure 60). This is attributed to the small sample sizes.

For all residential properties, the yearly proportion of injuries resulting from fires that ignited in a bedroom slightly decreased over the years considered and slightly increased for the kitchen (Figure 62 and Figure 64). For each other group of items of equipment involved in ignition considered no trend is clear over the years for which data were available.

4.2.2.12 Correlations

For apartments (1995 – 2005), for the combination of items of equipment involved in ignition, the linear correlation between fires and fatalities is poor (0.47). The linear correlation between numbers of fires and injuries is good (0.92). Moderate linear correlation exists between fatalities and injuries for the combined items of equipment involved in ignition considered (0.71). The correlation between numbers of fires where the flame damage was confined to the equipment involved in ignition and fatalities is low (0.67) and injuries is moderate (0.86). The correlation between numbers of fires where the flame damage extended beyond the equipment involved in ignition and fatalities is moderate (0.76) and injuries is low (0.51).

For all residential properties (1995 – 2005), for the combination of items of equipment involved in ignition, the linear correlation between fires and fatalities is poor (0.57). The linear correlation between numbers of fires and injuries is good (0.91). Moderate linear correlation exists between fatalities and injuries for the combined items of equipment involved in ignition considered (0.718). Low correlation exists between numbers of fires where the flame damage was confined to the equipment involved in ignition and fatalities (0.54) and injuries (0.66). Low correlation also exists between numbers of fires where the flame damage extended beyond the equipment involved in ignition and fatalities (0.69) and injuries (0.53).

4.2.2.2 Most Costly

Assuming the 'cost' of a fire is apportioned by the number of resulting fatalities or injuries. Assuming the 'cost' of a fire is apportioned by the number of resulting fatalities or injuries. The term 'local' fire or casualty is used to refer to data pertaining to the group of interest within each category.

The ratios of the number of casualties to the number of local fires in each group of items of equipment involved in ignition are shown in Figure 67 and Figure 68Figure 18 for apartments and all residential structures respectively. For apartment fires the most costly equipment involved in ignition, in terms of civilian fatalities, was the electric blanket followed by the entertainment equipment, cooking equipment and heaters. For fires in all residential structures the most costly equipment involved in ignition, in terms of civilian fatalities, was the electric blanket followed by the entertainment equipment then heater and cooking equipment. Except for the water heater and power transfer equipment, where the ratio of fatalities to fires was higher for residential structures than for apartments, the values for the ratios for apartments and all residential structures were similar.

In terms of civilian injuries, for apartment fires the most costly equipment involved in ignition was the heater followed by the water heater, electric blanket then cooking equipment. For all residential structure fires the most costly equipment involved in ignition, in terms of civilian injuries, was the electric blanket followed by the entertainment equipment, cooking equipment, heater then water heater. Except for the higher ranking of the heater and water heater for apartments, the rankings of the areas for apartments and all residential structures were similar. However the values for the ratios of injuries to fires were consistently higher for apartments than for all residential properties.

Another approach to apportioning 'cost' to a fire is in terms of the resulting flame damage. However the proportion for which no information for the level of flame damage was recorded was consistently high (1 – 26% of fires that occurred at each group of areas of fire origin for apartments and 1 – 30% for all residential structures), as shown in Figure 71 and Figure 72. With such a large amount of data lacking detail, it is difficult to perform a useful analysis. However to provide a general indication, one approach is to assume that the fires with less detailed data attributed to them were relatively small fires and to use the detailed data available. Excluding data with no information recorded (for either the equipment involved in ignition or the amount of flame damage), the flame damage for fires of the grouped items of equipment involved in ignition are shown as percentage of total fires with recorded details in Figure 73 and Figure 74, for apartments and all residential structures respectively. For both apartments and all residential structures, of the detailed data available for the groups of items of equipment involved in ignition considered, the ranking of areas from the highest proportion of fires with flame damage beyond the equipment involved in ignition occurred was recorded for the cooking equipment and then the heater. However the values for the ratios of fires with flame damage to the total number of fires was higher for apartments than for all residential structures for ignition involving the cooking equipment. But all other ratio values were similar for apartments and all residential structures.

4.2.2.2.1 Historical Trends

For ratios of numbers of fatalities to local fires (1995 – 2005), there are no obvious trends for either apartments only (Figure 51) or all residential structures (Figure 55). For apartments only, for ratios of numbers of injuries to local fires (1995 – 2005), there is a slight increase in values for the cooking equipment, a slight decrease in values for the heaters, and no obvious trends for the other areas considered (Figure 59). For all residential structures, for ratios of numbers of injuries to local fires (1995 – 2005), there

is a slight increase in values for the heater and power transfer equipment, a general decrease in the values for the electric blanket, and no obvious trends for the other areas considered (Figure 63).

4.2.2.2 Correlations

The correlation between ratios of numbers of fatalities to local fires for apartments and for all residential structures is high (0.97) (Table 18).

The correlation between ratios of numbers of injuries to local fires for apartments and for all residential structures is high (0.87).

The correlation between ratios of numbers of fatalities to local fires for apartments and ratios of numbers of injuries to local fires is negligible for apartments (0.47) and moderate for all residential structures (0.82). The correlation for all residential structures between ratios of numbers of fatalities to local fires and ratios of numbers of injuries to local fires is moderate (0.83). The correlation between the ratios of numbers of injuries to local fires for apartments and the ratios of numbers of fatalities to local fires for all residential structures is negligible (0.49).

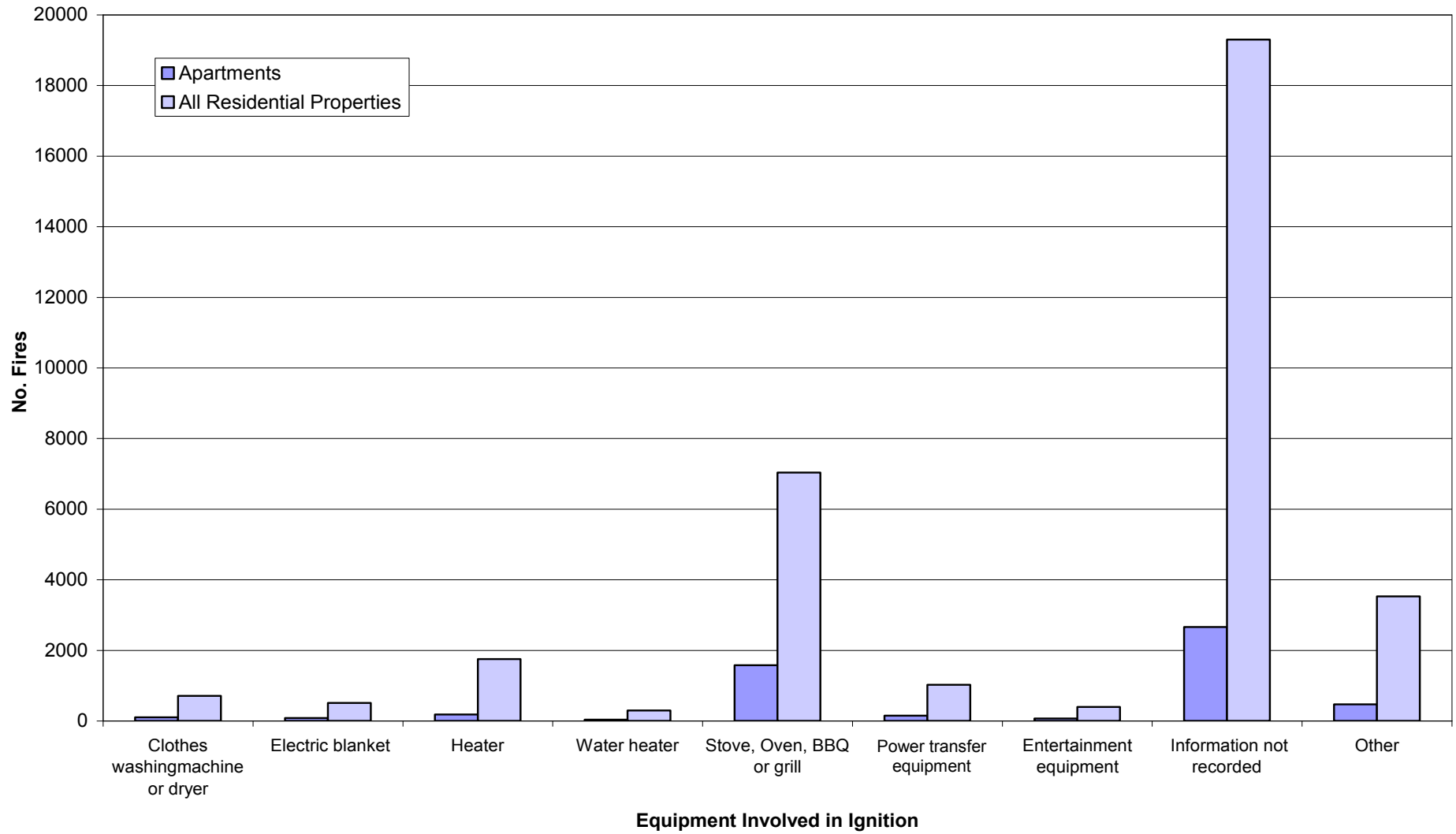


Figure 39: Number of fires for groups of equipment involved in ignition (1995 – 2005).

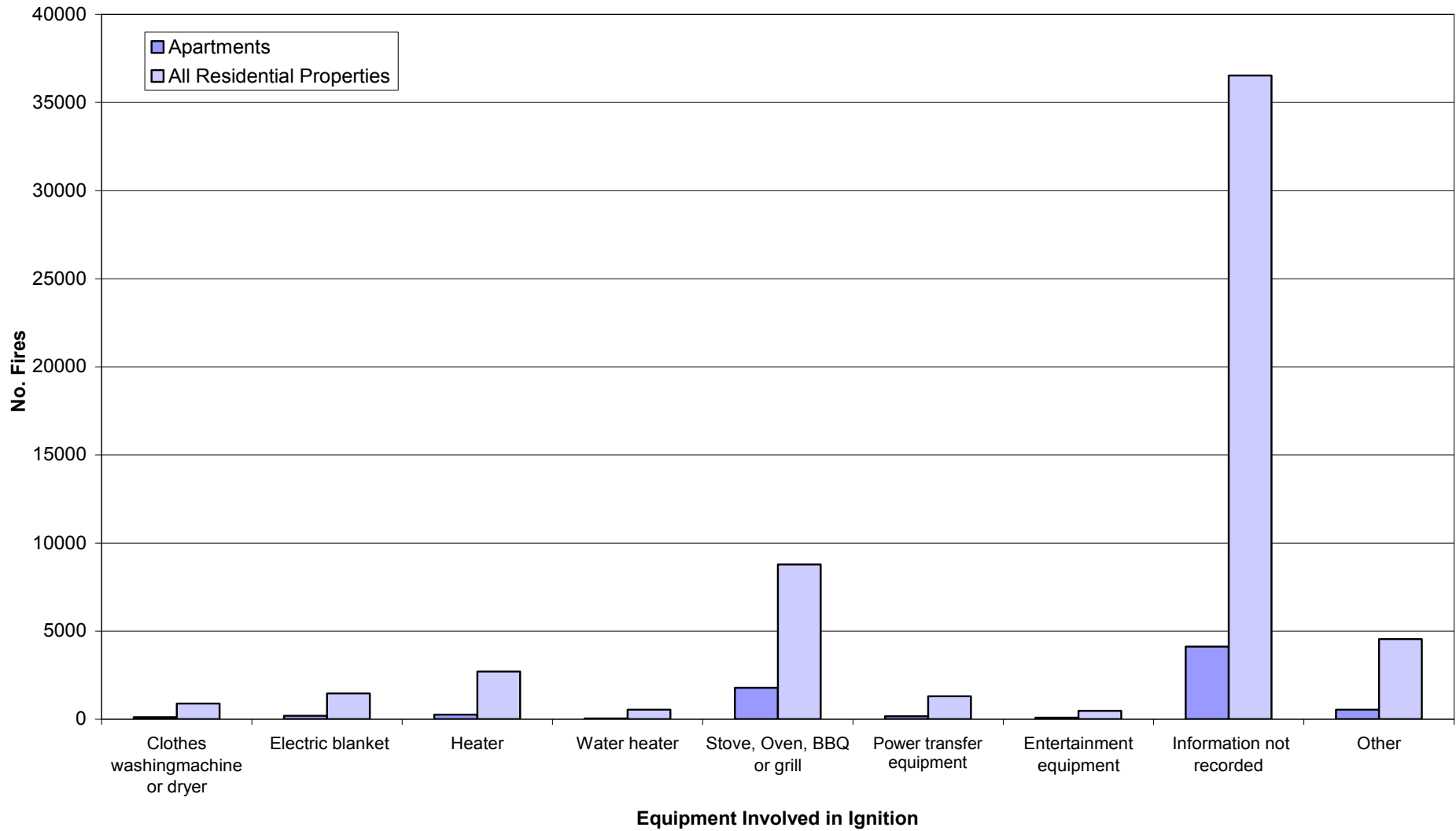


Figure 40: Number of fires for groups of equipment involved in ignition (1986 – 2005).

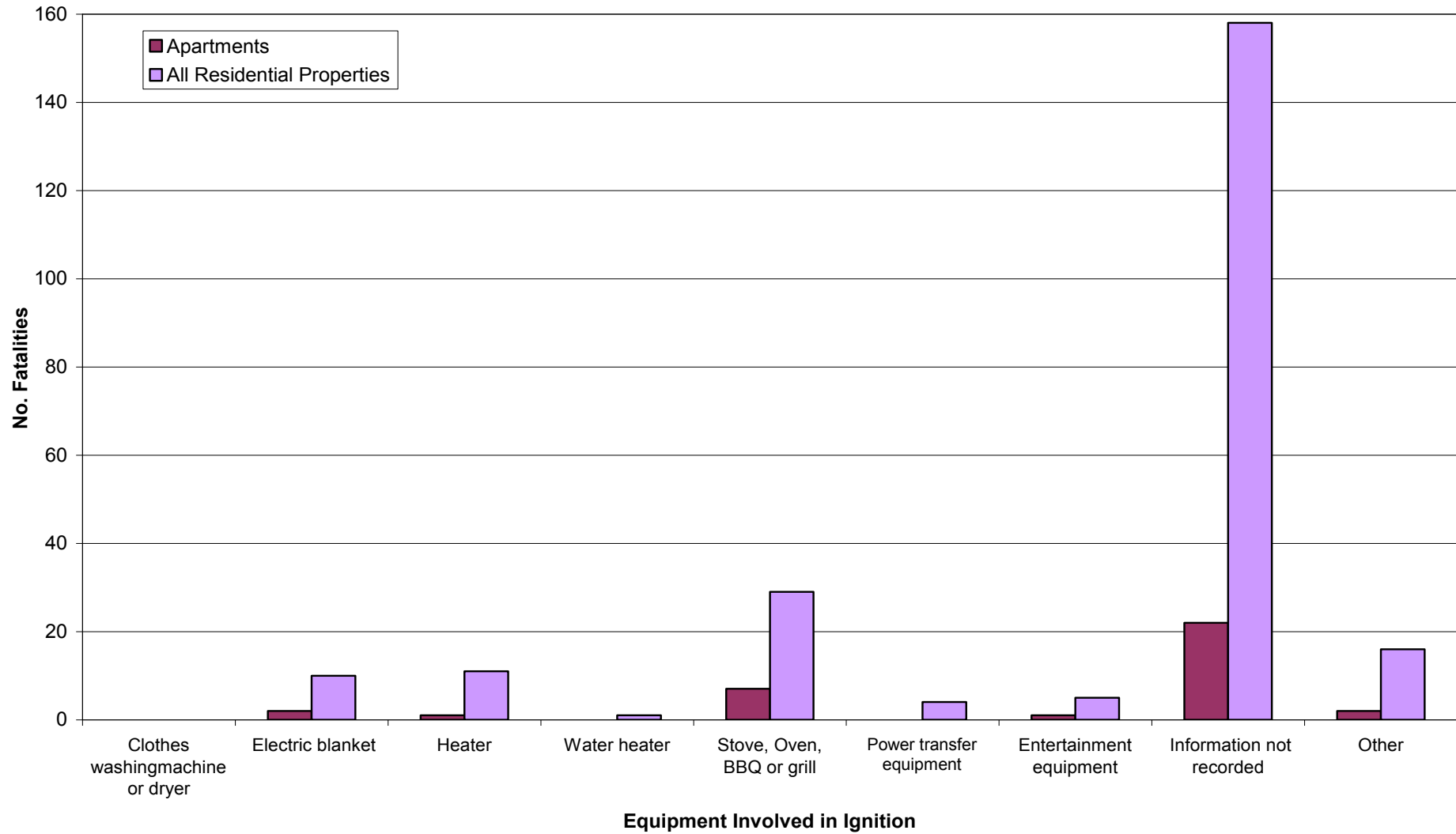


Figure 41: Number of fatalities for groups of equipment involved in ignition (1995 – 2005).

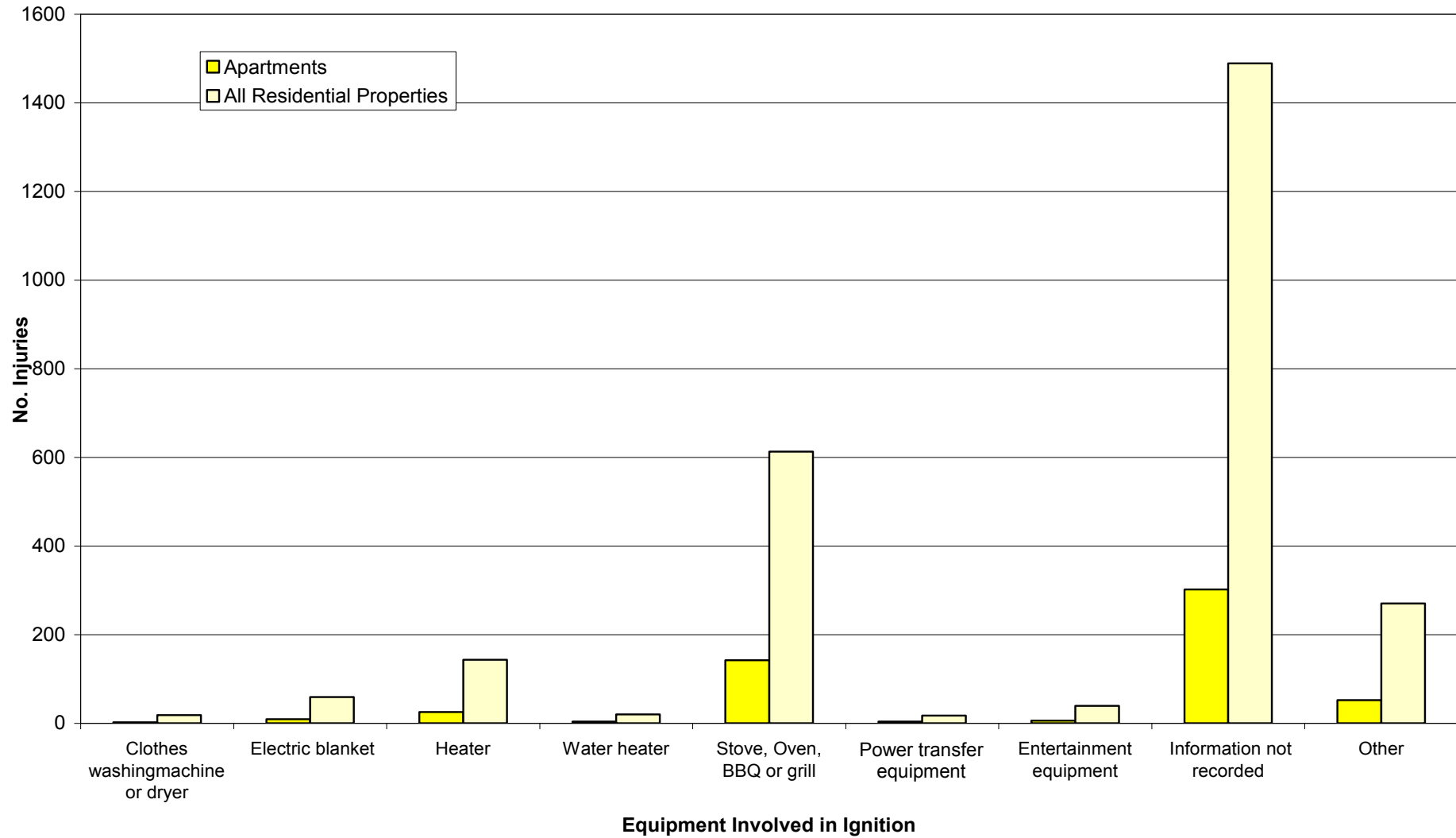


Figure 42: Number of injuries for groups of equipment involved in ignition (1995 – 2005).

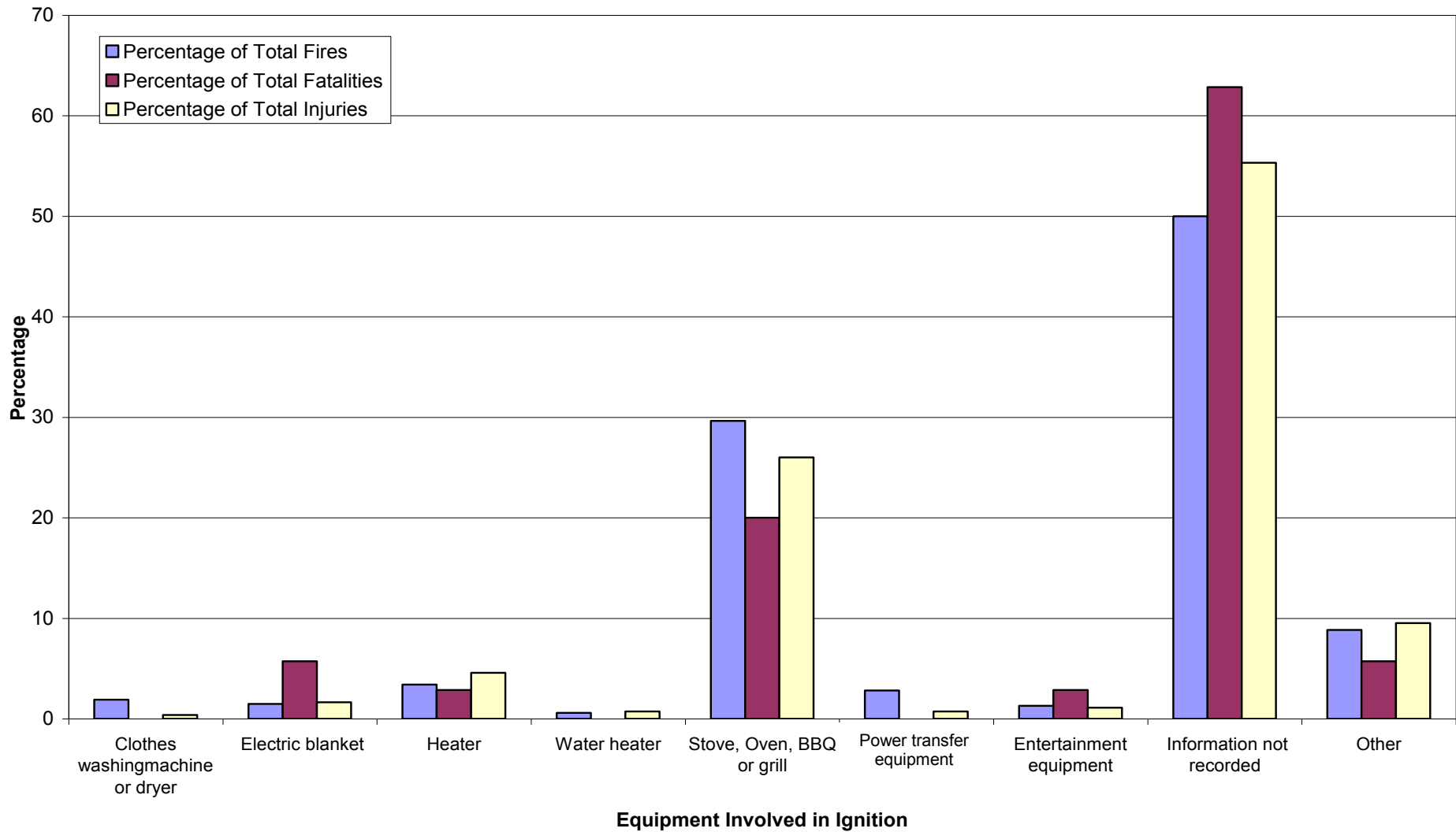


Figure 43: Percentage of totals for fires, fatalities and injuries that occurred in apartments as recorded for each group of equipment involved in ignition (1995-2005).

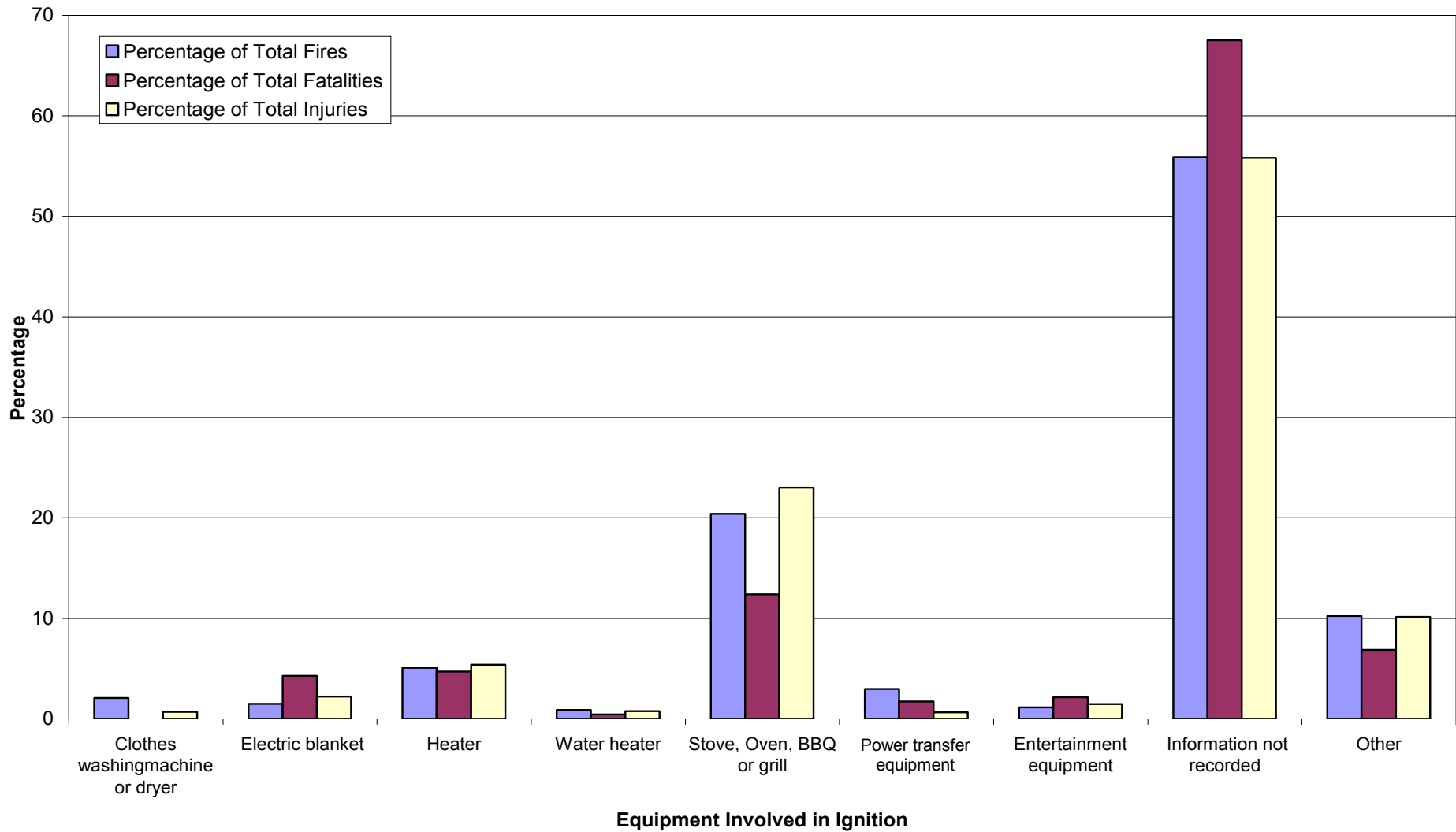


Figure 44: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of equipment involved in ignition (1995-2005).

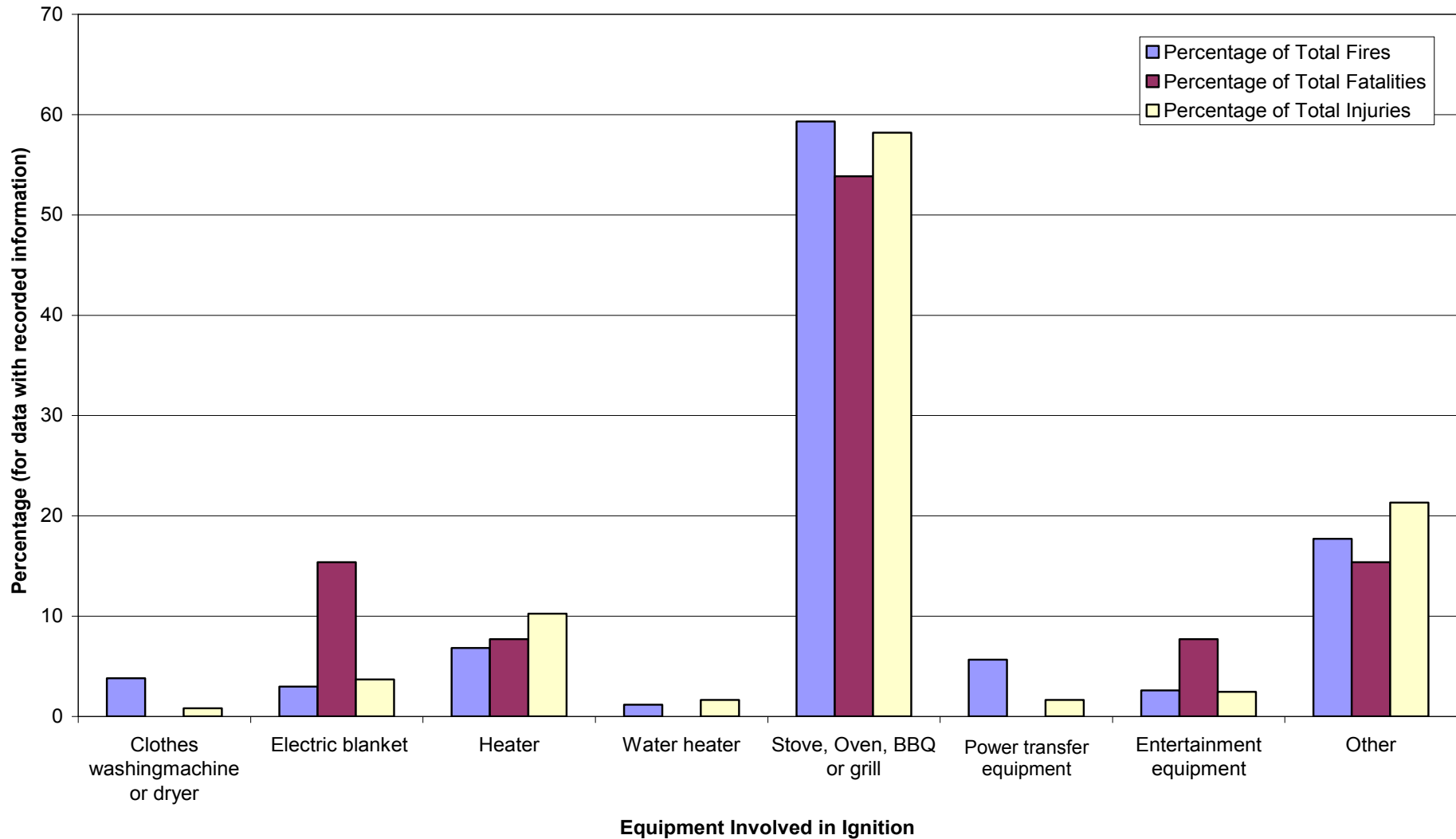


Figure 45: Percentage of totals excluding data where information was not recorded for fires, fatalities and injuries that occurred in apartments as recorded for each group of equipment involved in ignition (1995-2005).

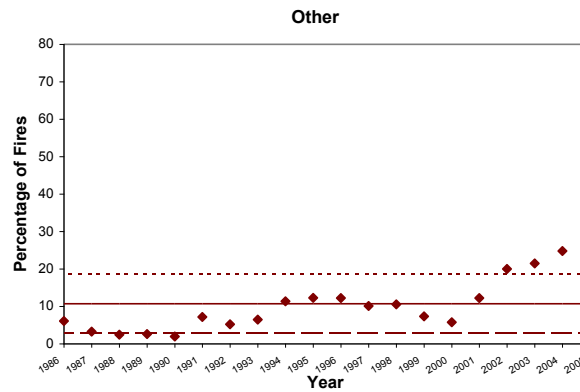
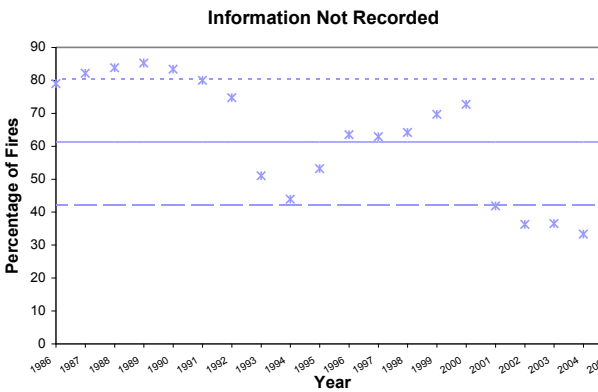
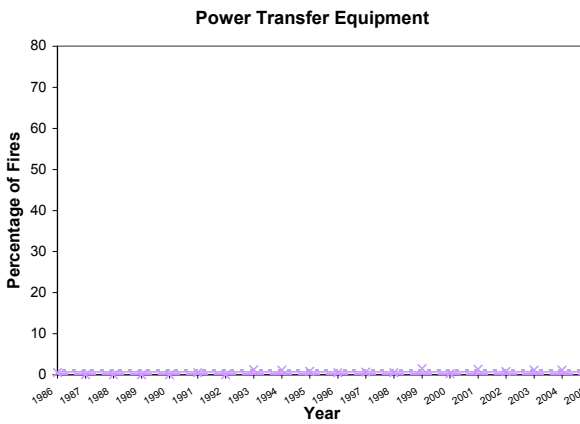
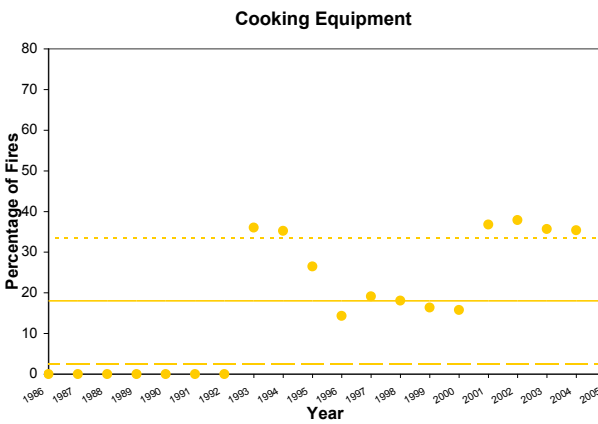
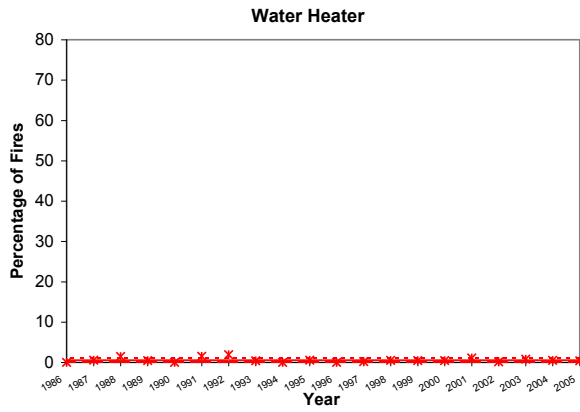
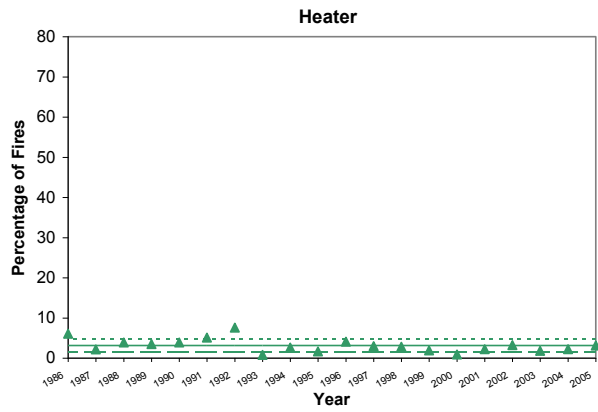
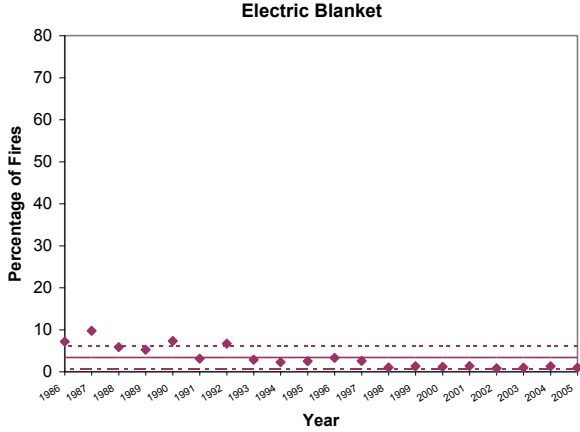
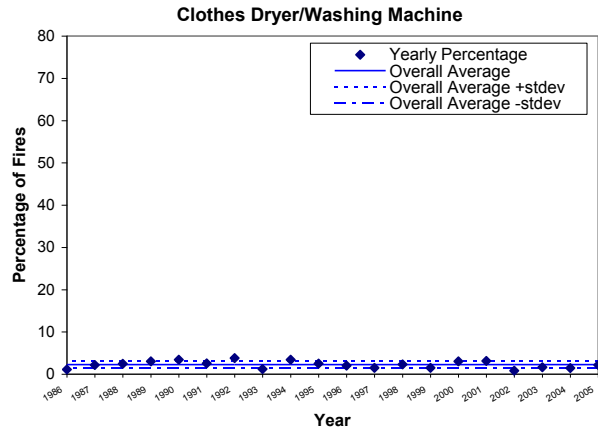


Figure 46: Yearly percentage of total apartment fires for each group of items of equipment involved in ignition, including “information not recorded” (1986 – 2005).

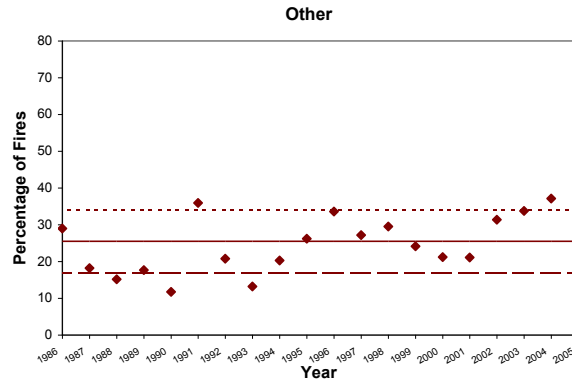
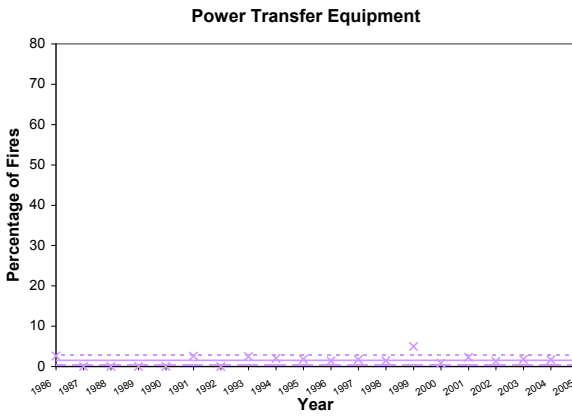
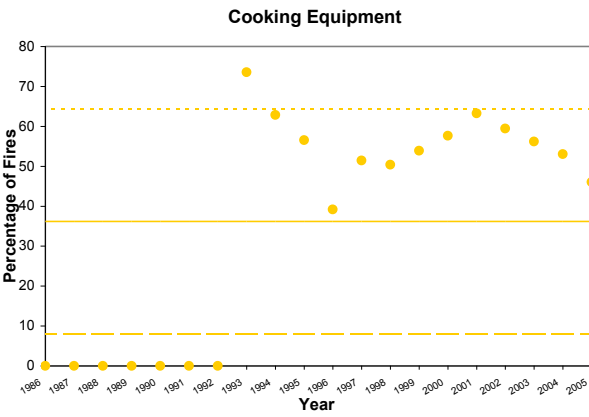
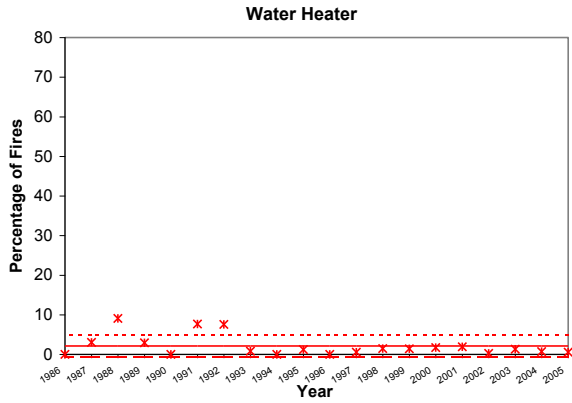
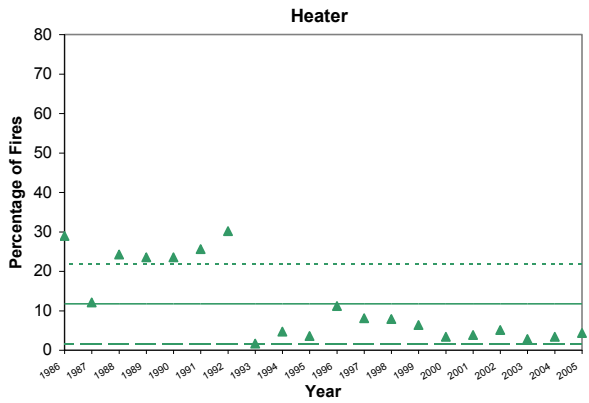
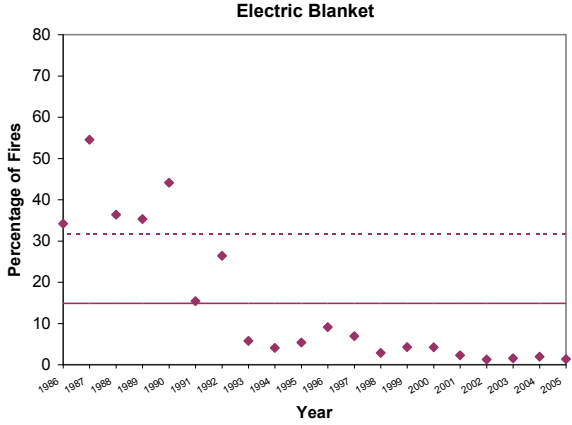
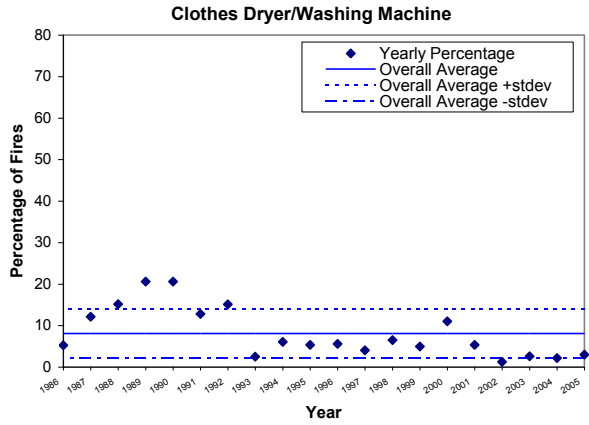


Figure 47: Yearly percentage of total apartment fires for each group of items of equipment involved in ignition, excluding “information not recorded” (1986 – 2005).

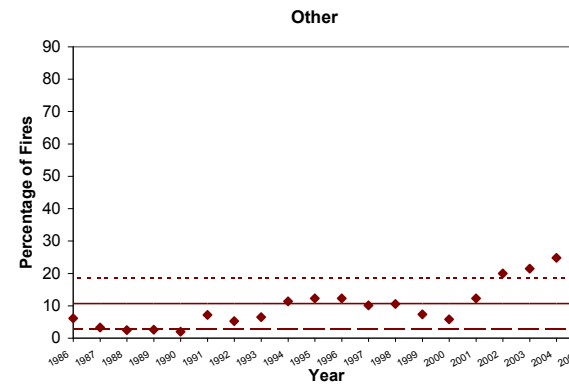
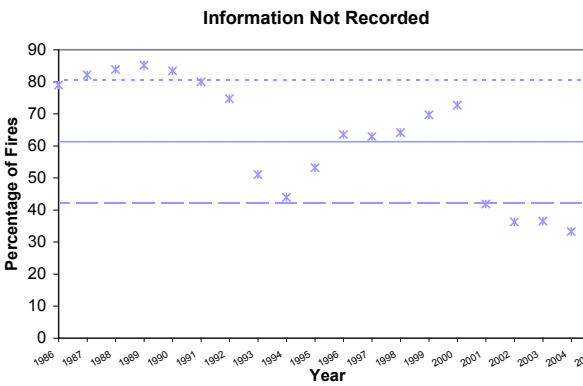
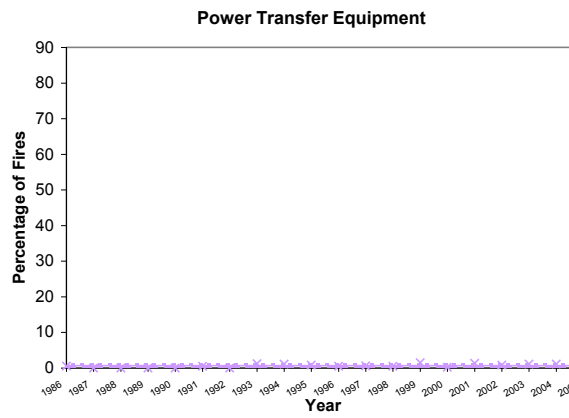
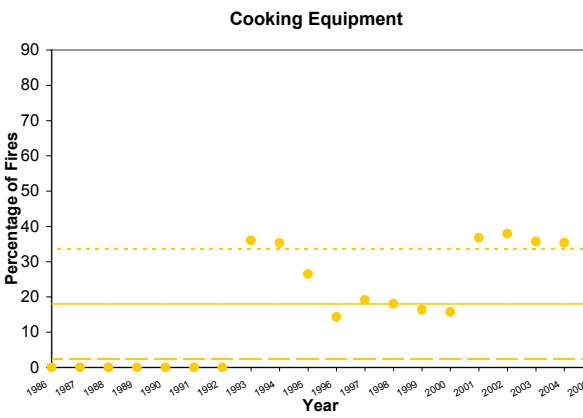
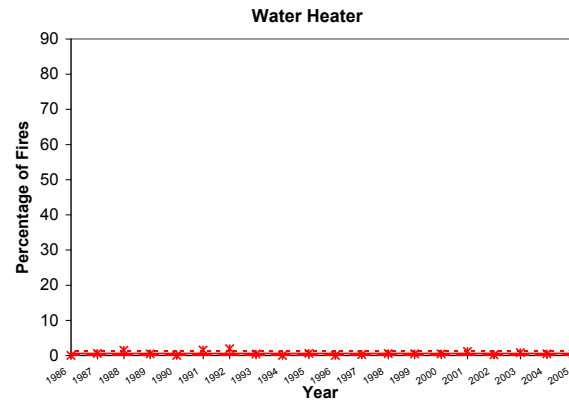
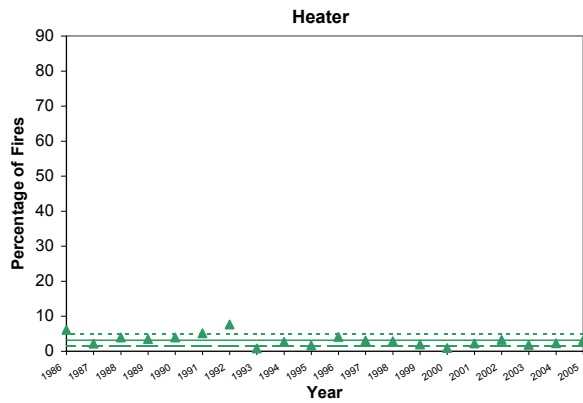
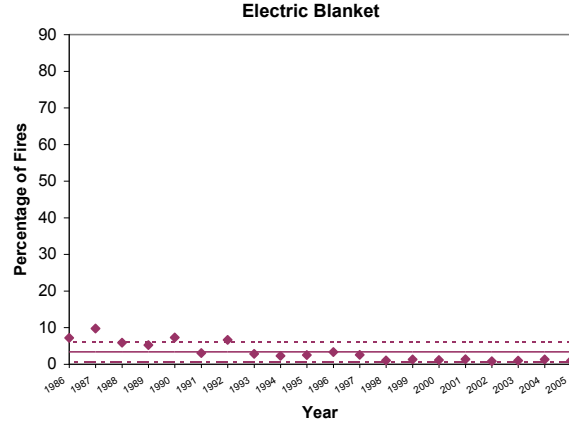
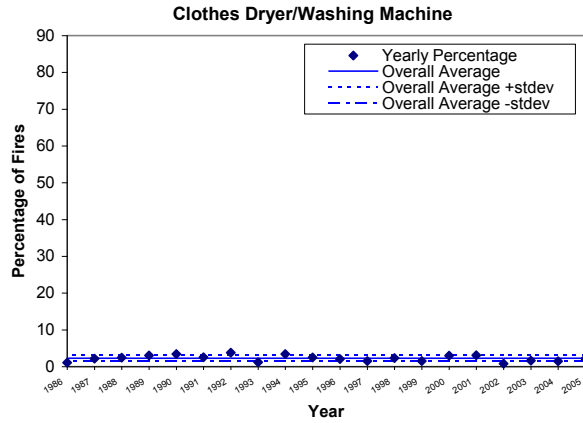


Figure 48: Yearly percentage of total all residential structure fires for each group of items of equipment involved in ignition, including “information not recorded” (1986 – 2005).

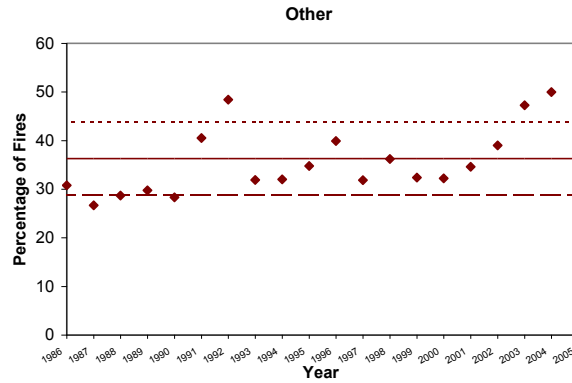
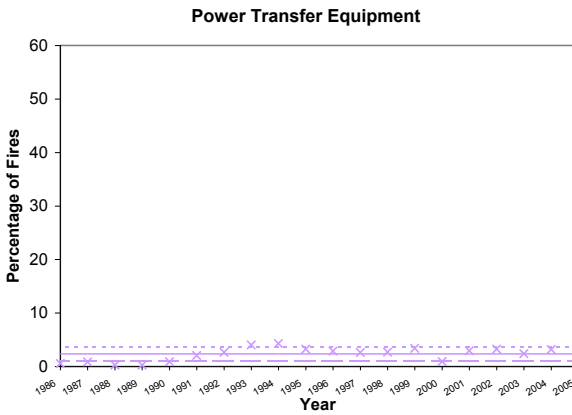
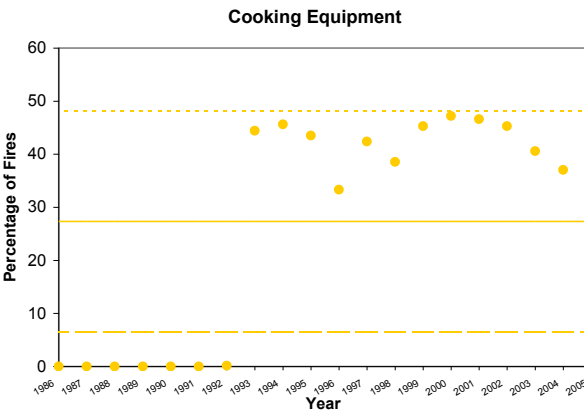
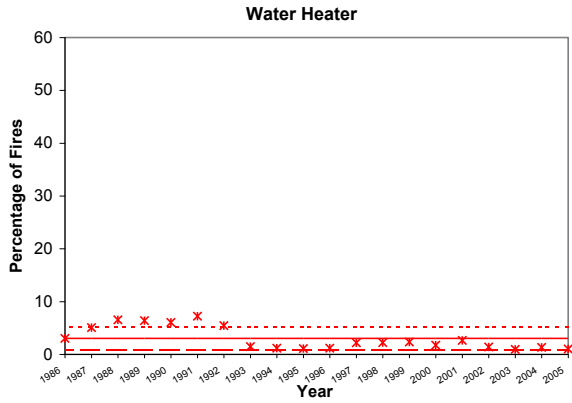
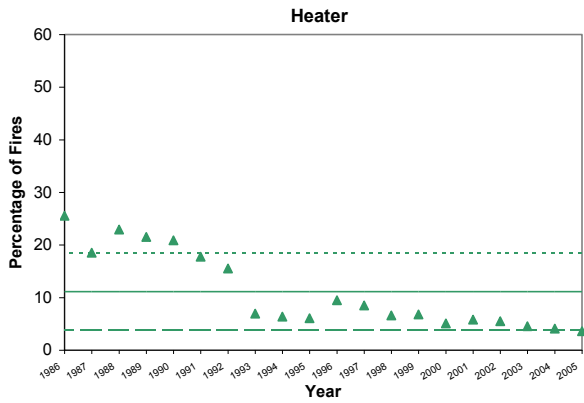
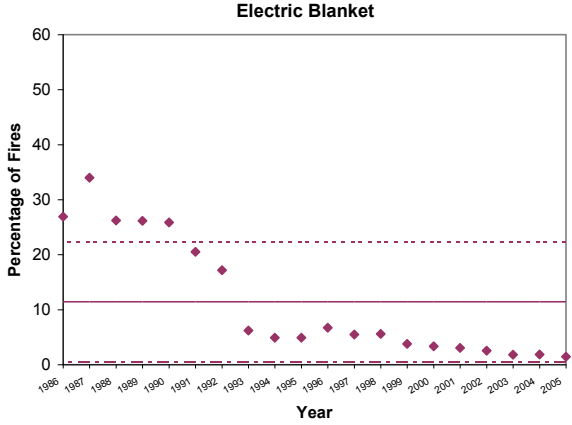
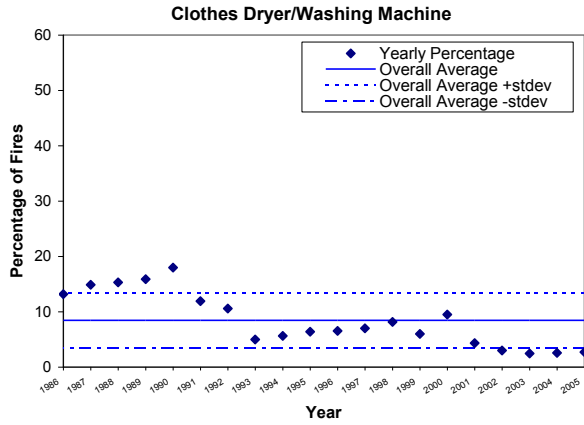


Figure 49: Yearly percentage of total all residential structure fires for each group of items of equipment involved in ignition, excluding “information not recorded” (1986 – 2005).

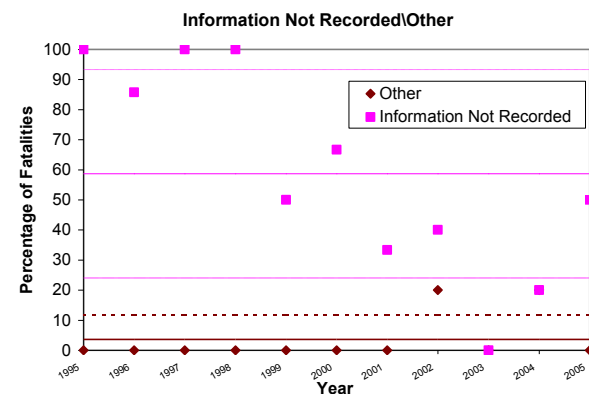
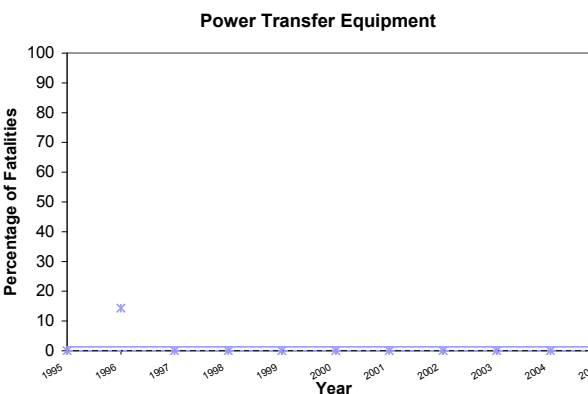
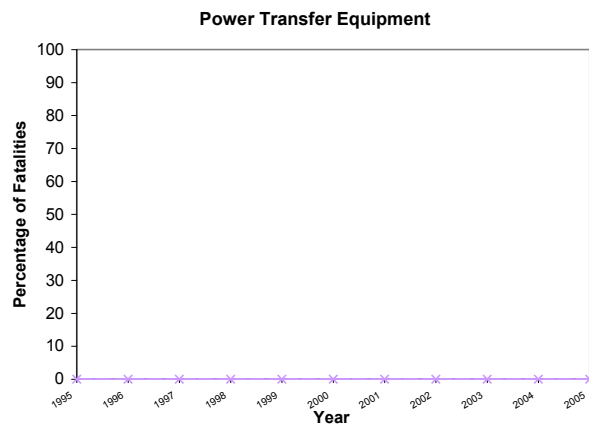
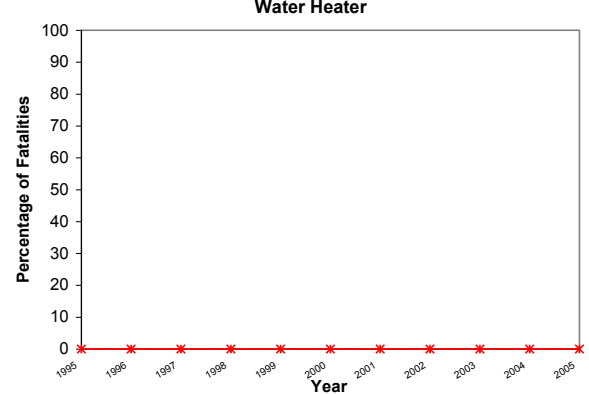
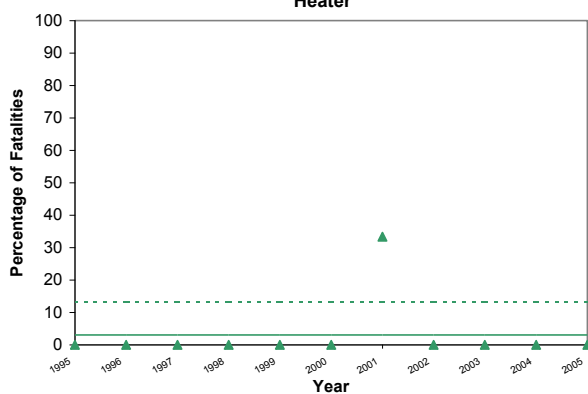
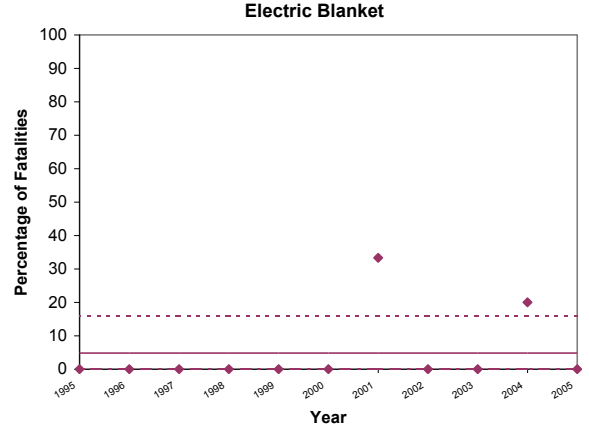
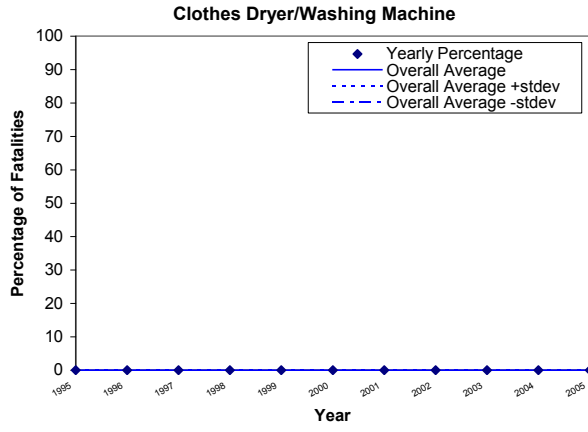


Figure 50: Yearly percentage of total apartment fatalities for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

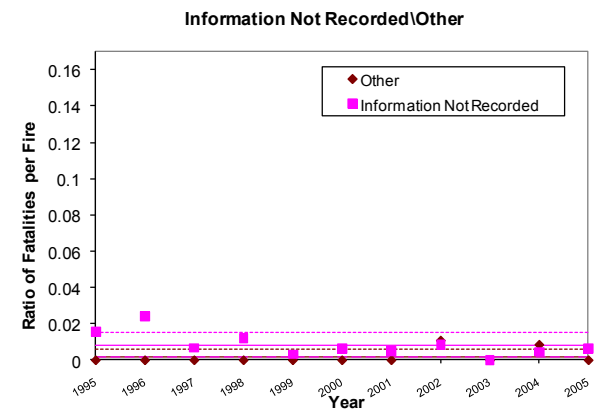
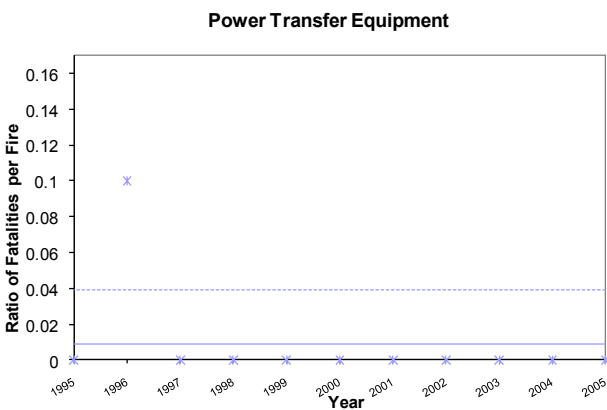
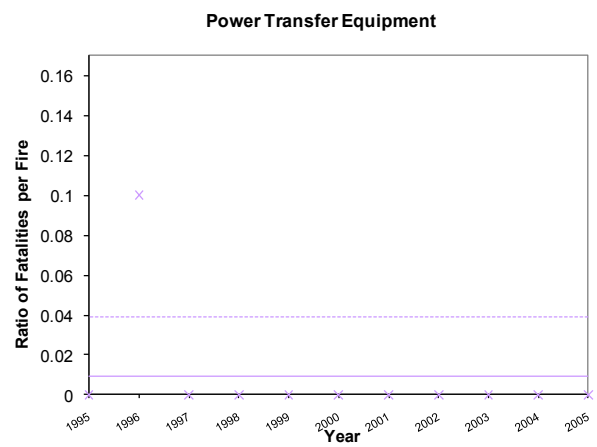
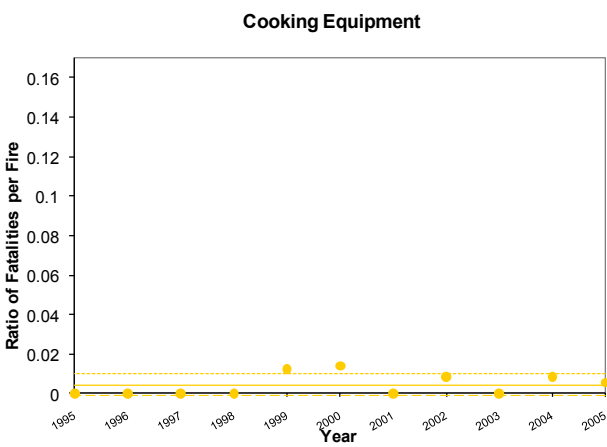
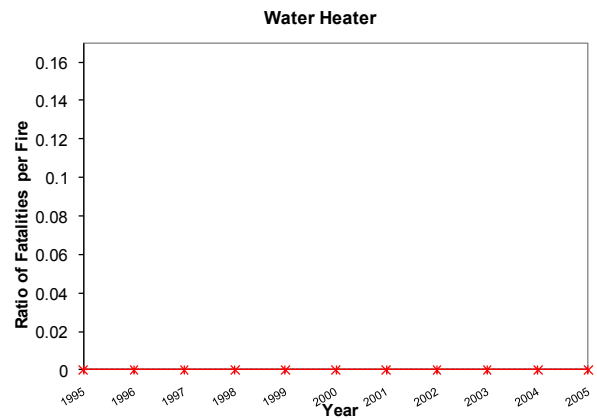
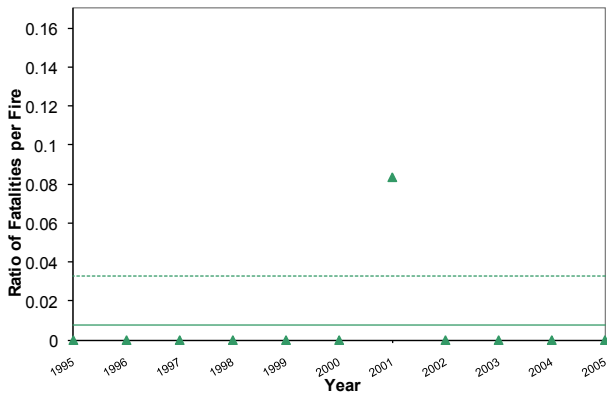
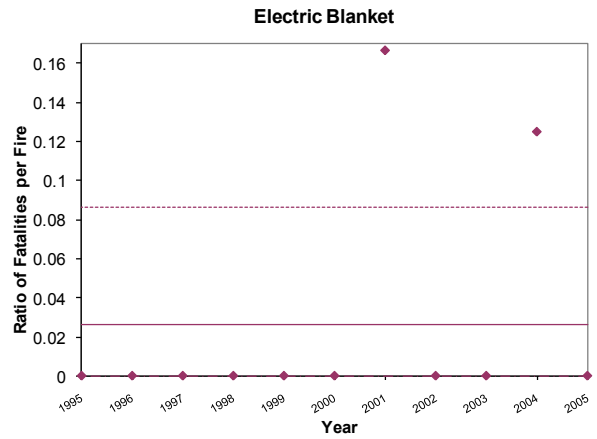
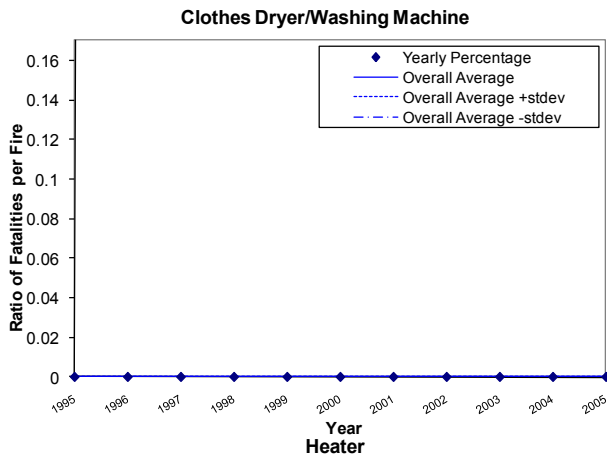


Figure 51: Yearly ratio of apartment fatalities to fires for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

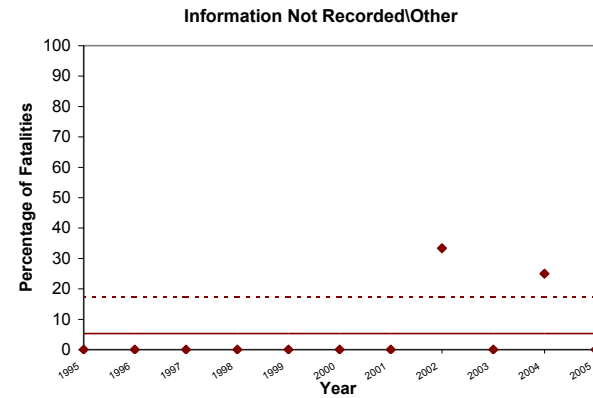
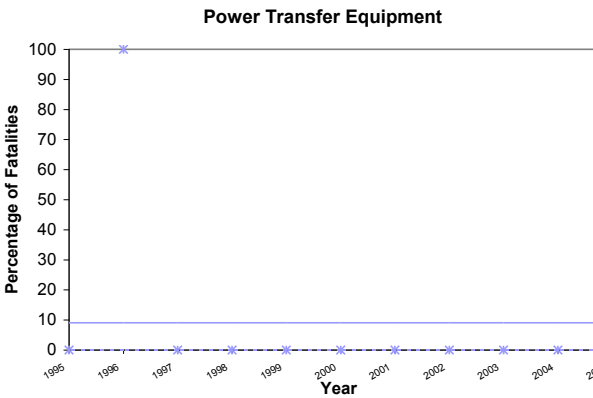
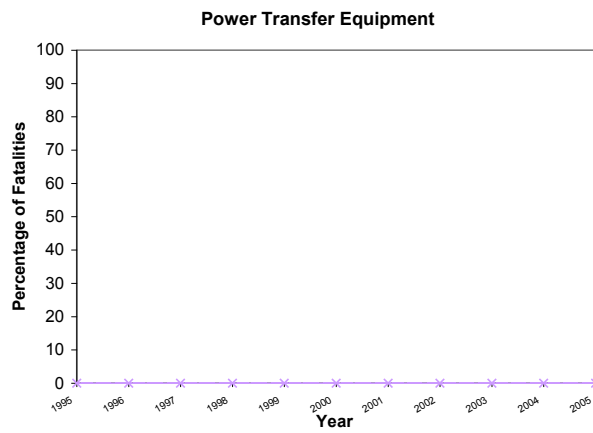
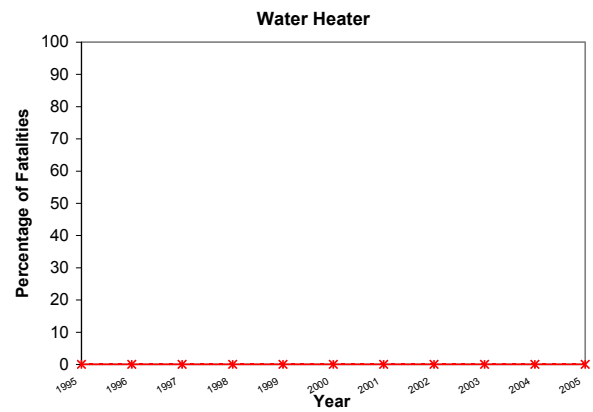
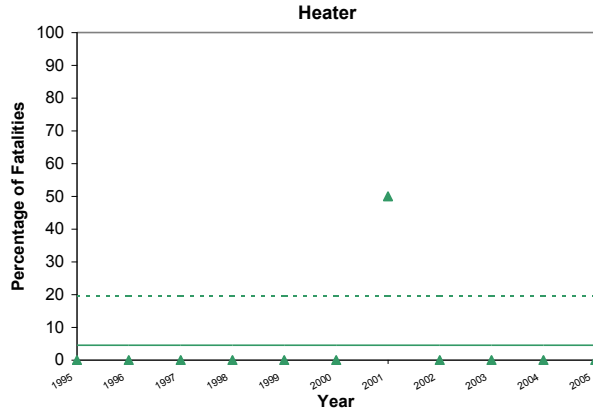
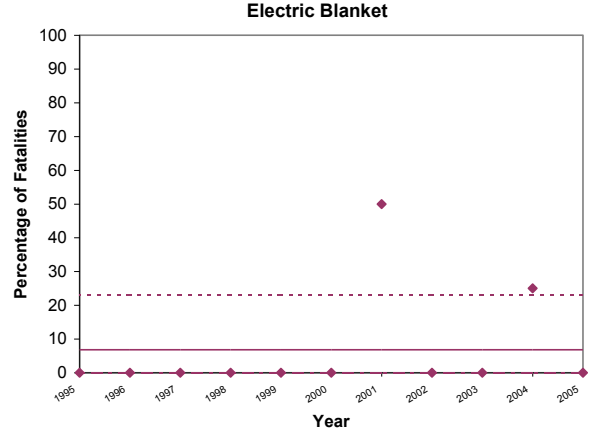
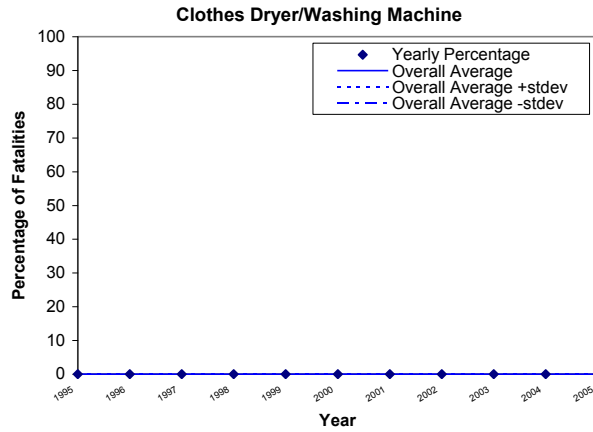


Figure 52: Yearly percentage of total apartment fatalities for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

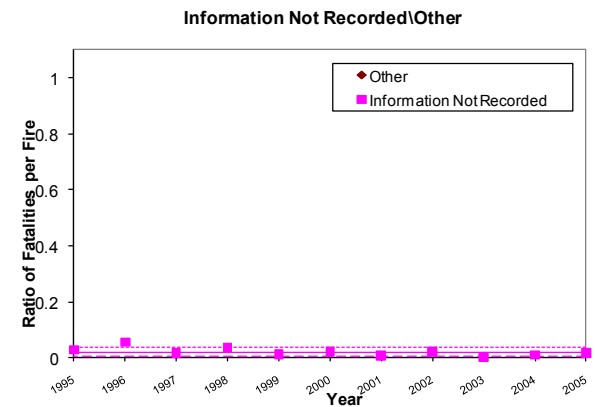
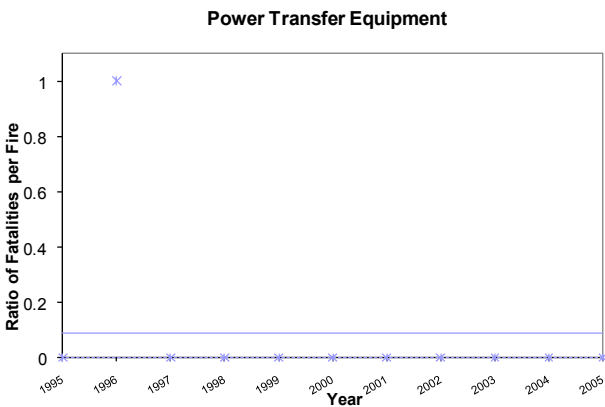
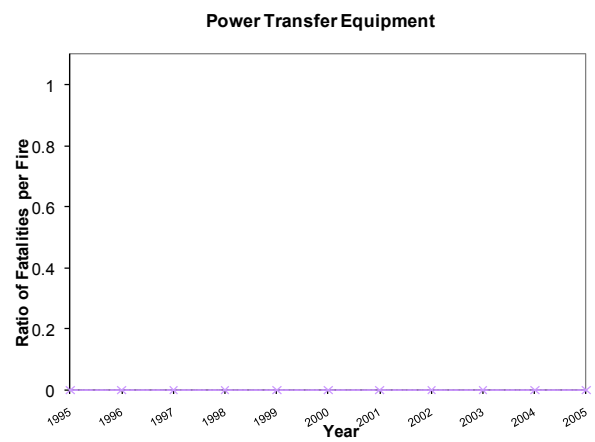
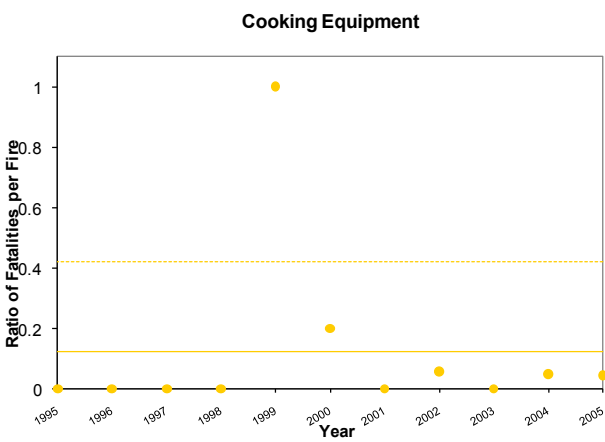
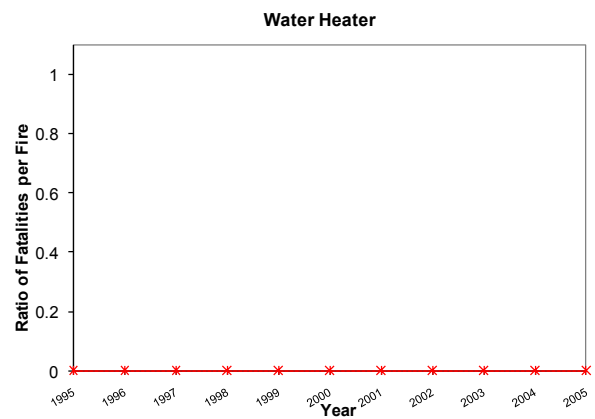
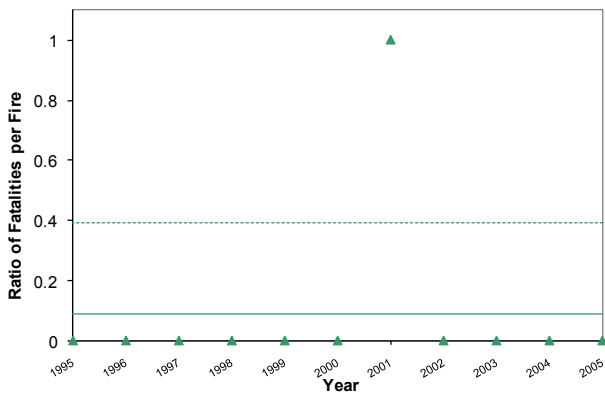
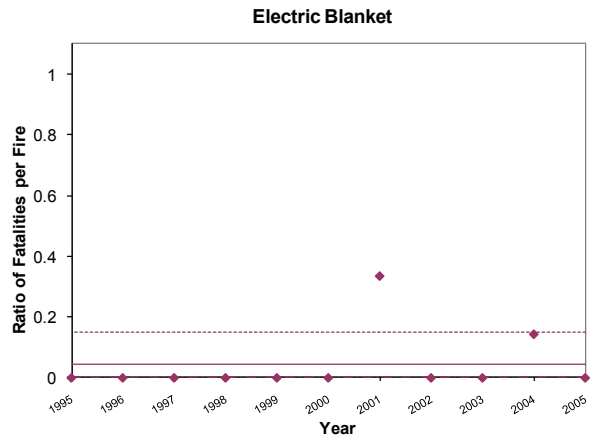
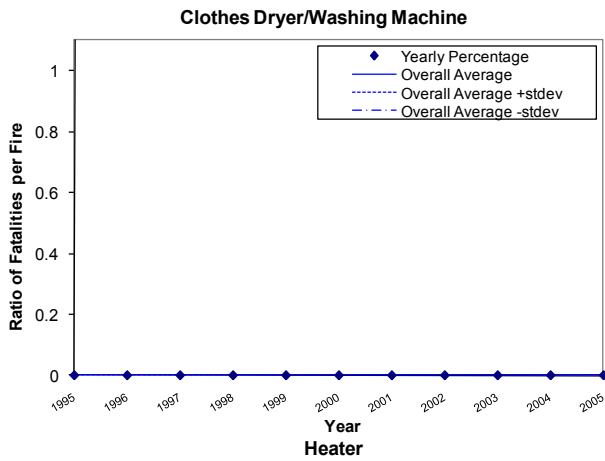


Figure 53: Yearly ratio of apartment fatalities to fires for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

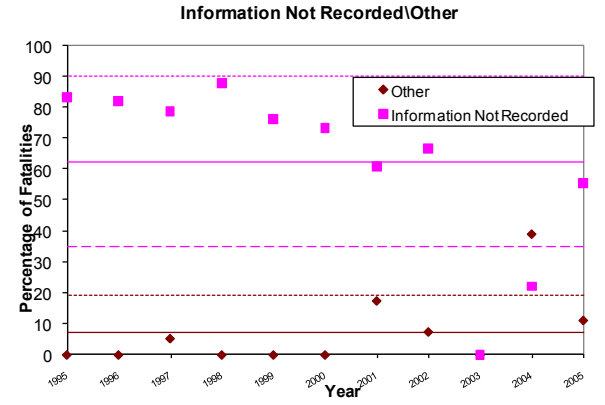
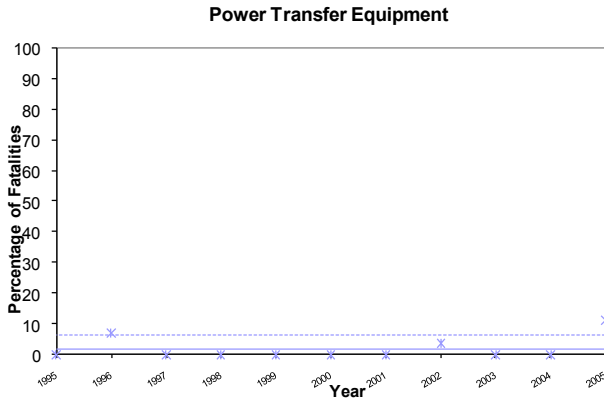
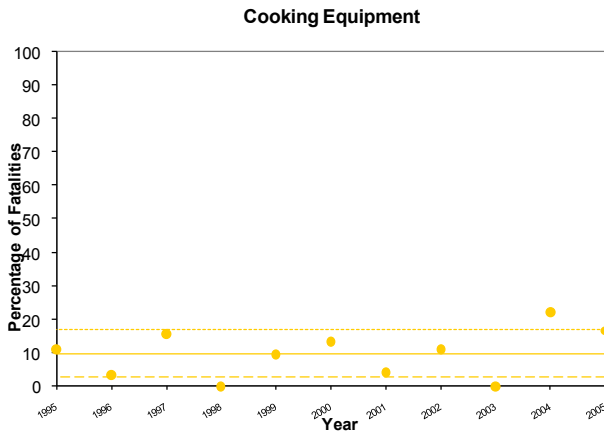
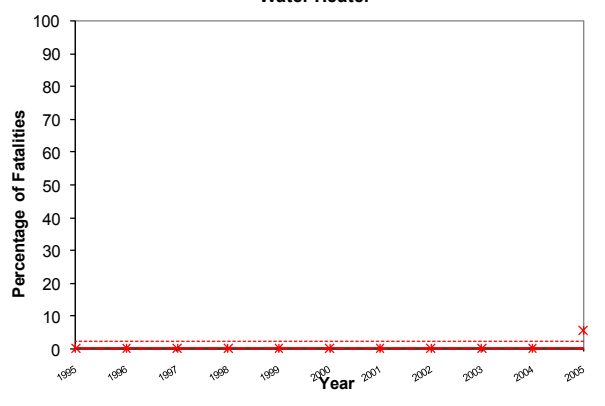
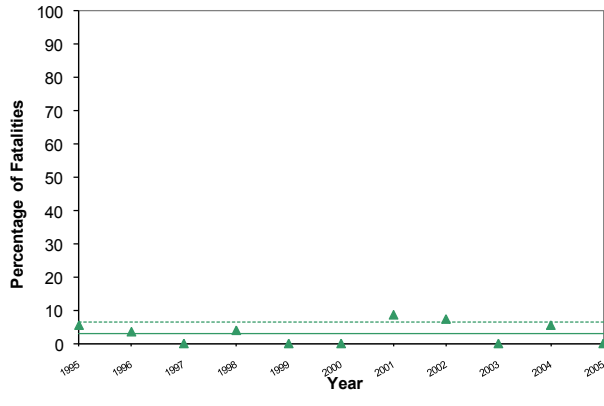
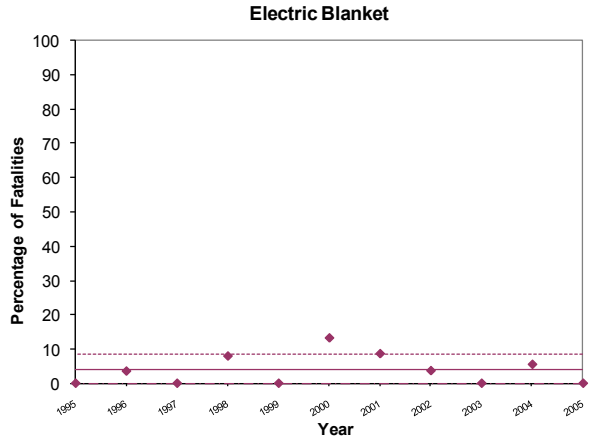
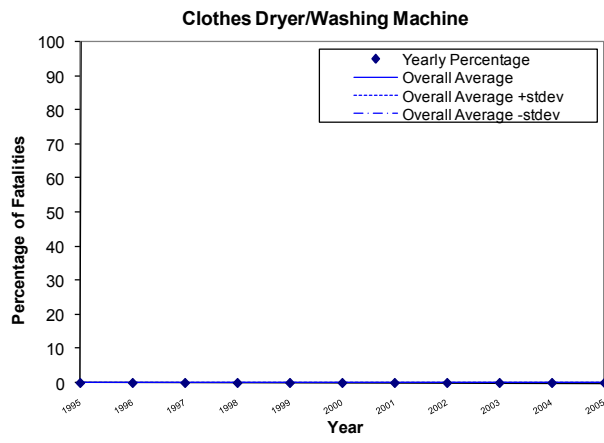


Figure 54: Yearly percentage of total all residential structures fatalities for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

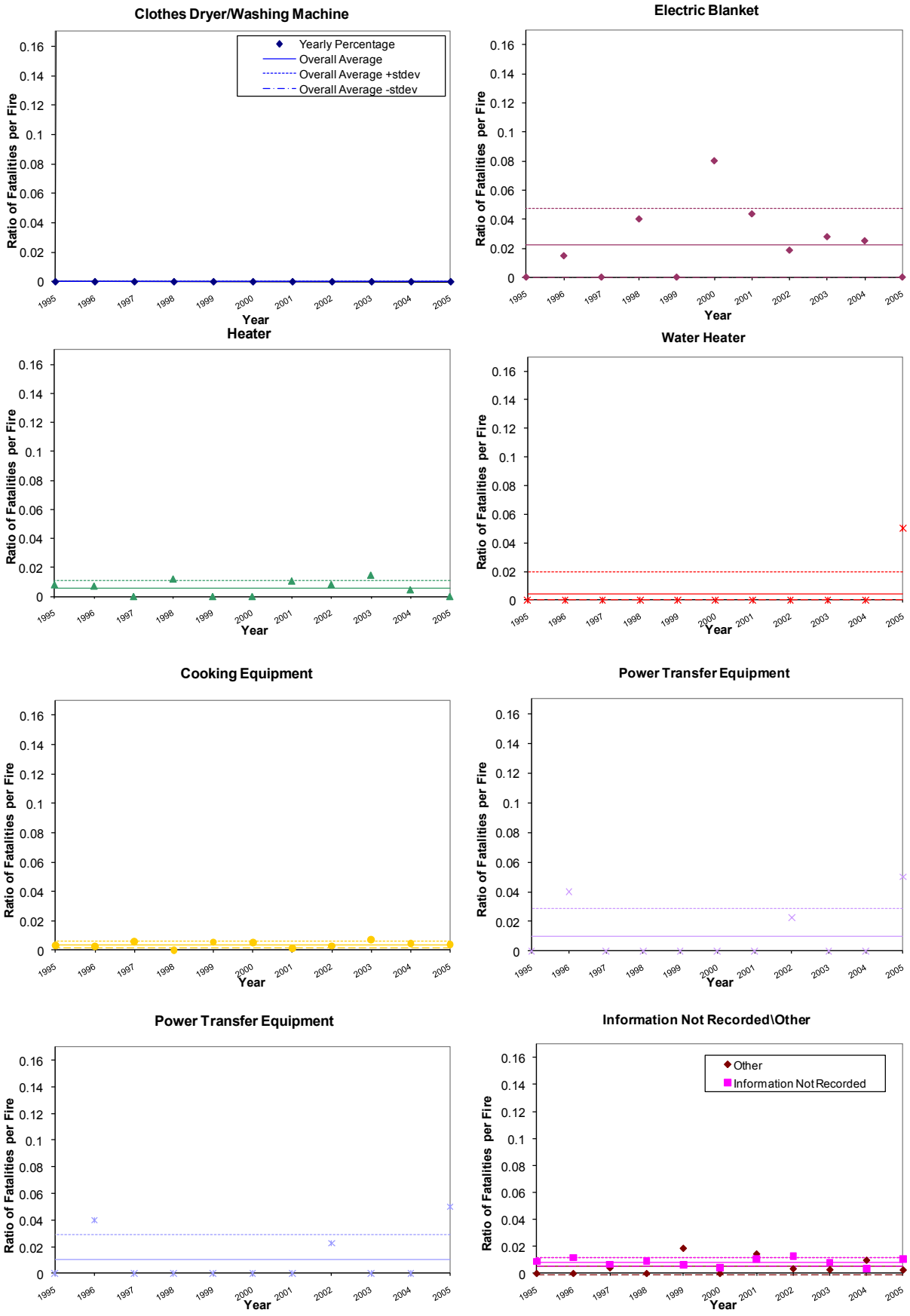


Figure 55: Yearly ratio of residential structure fatalities to fires for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

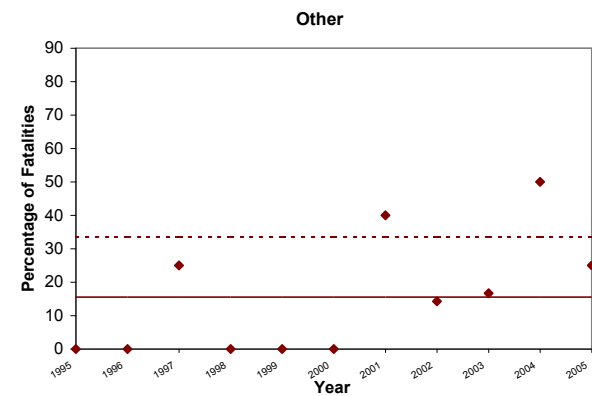
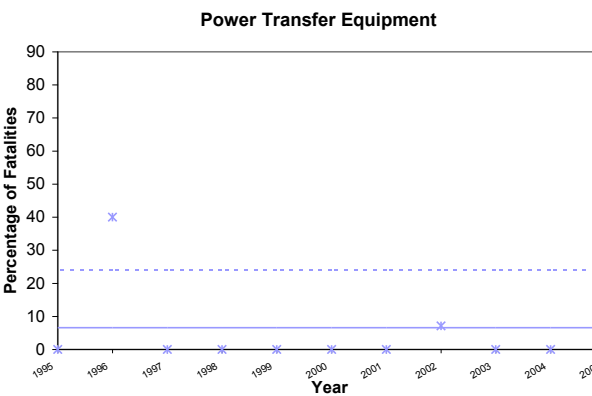
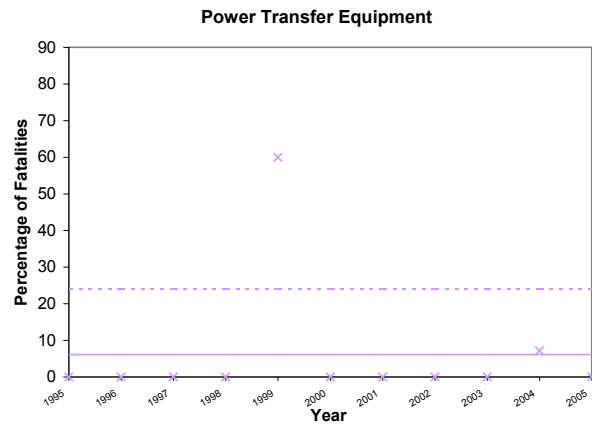
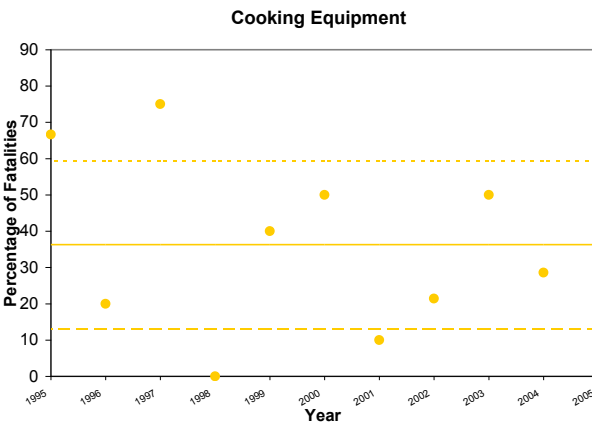
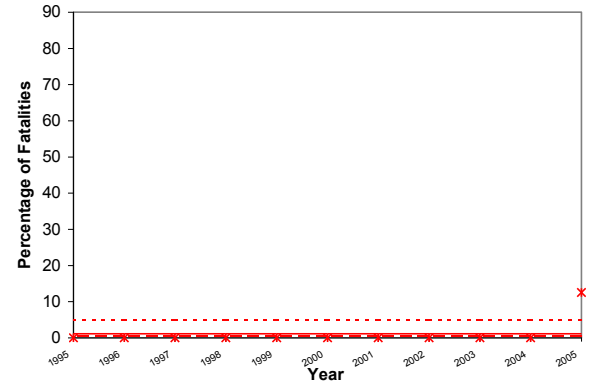
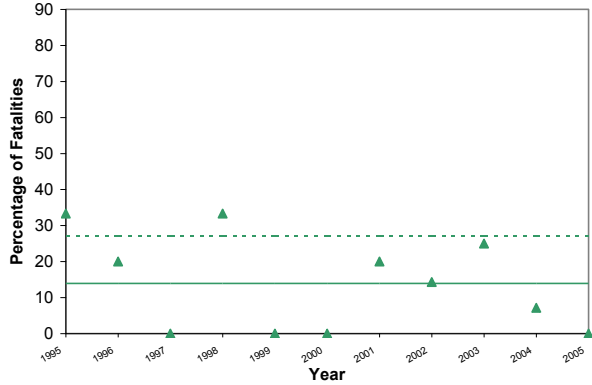
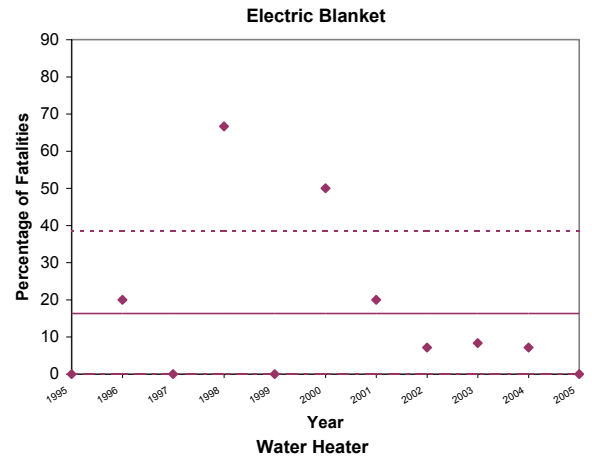
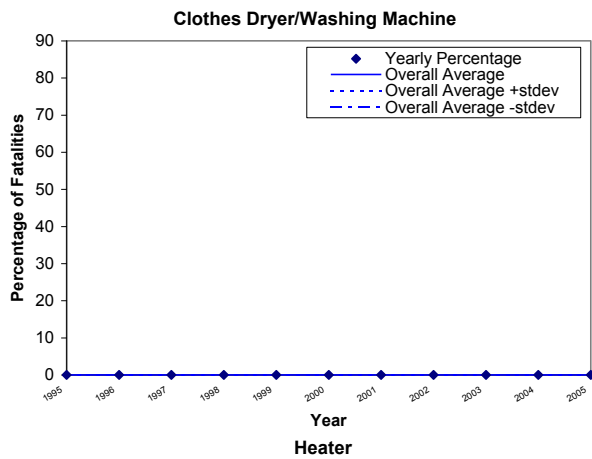


Figure 56: Yearly percentage of total all residential structures fatalities for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

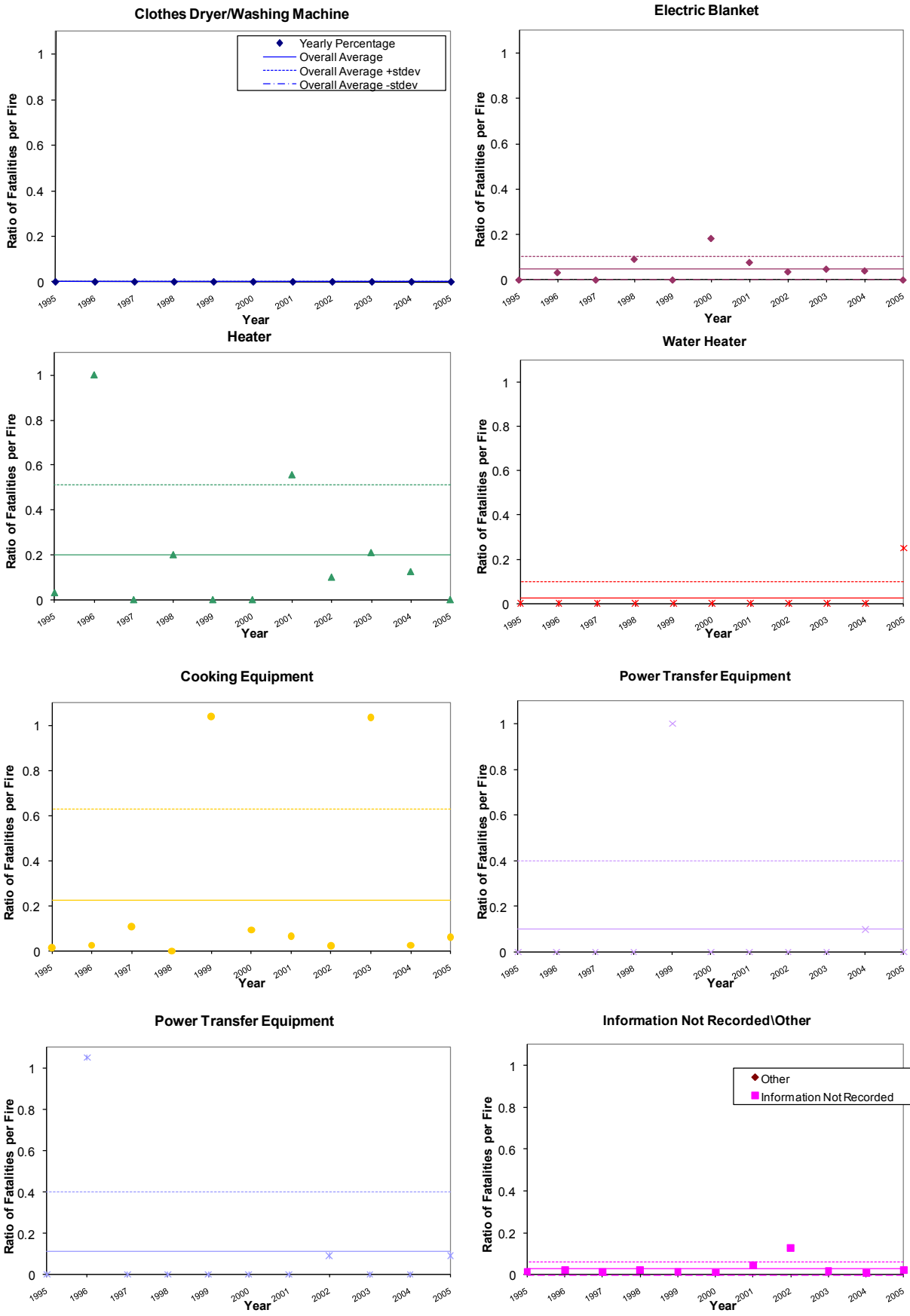


Figure 57: Yearly ratio of all residential structures fatalities to fires for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

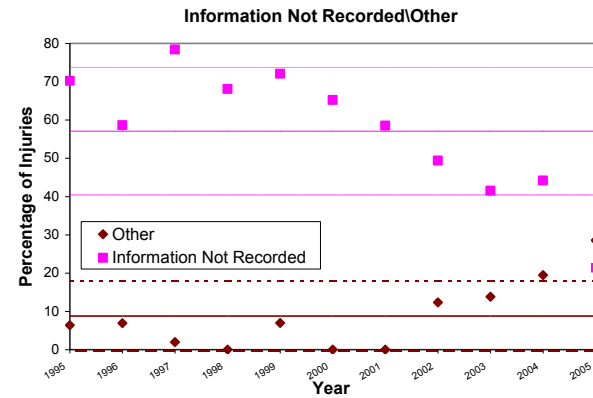
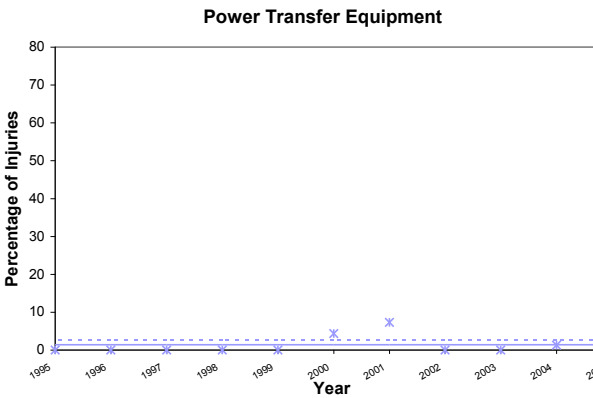
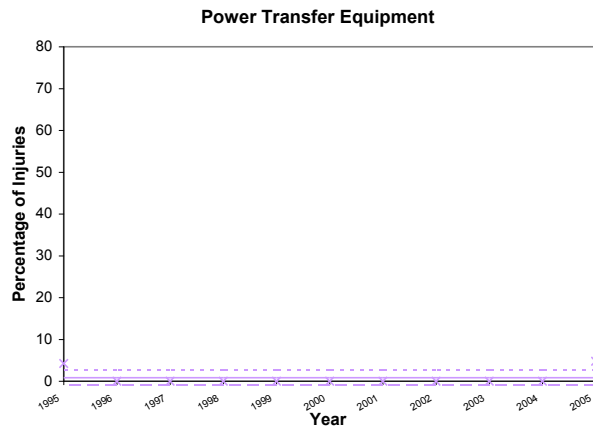
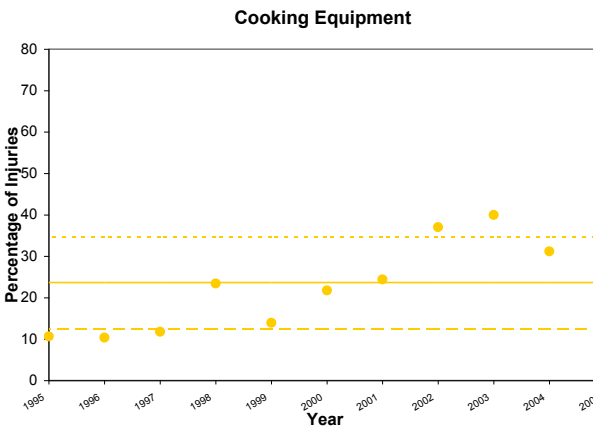
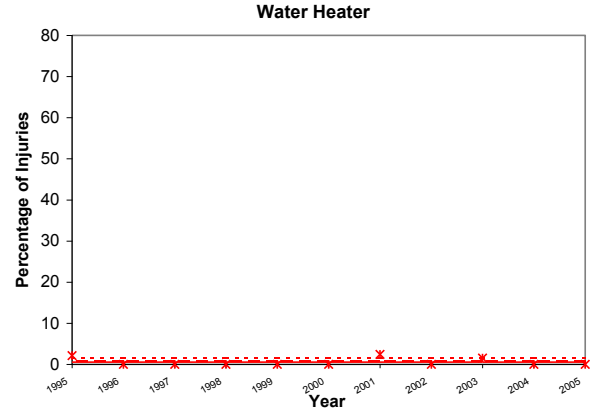
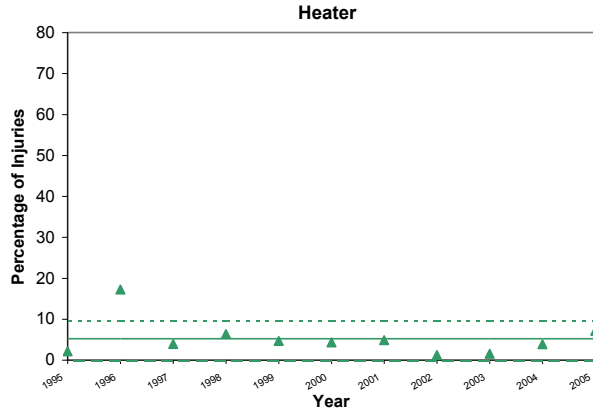
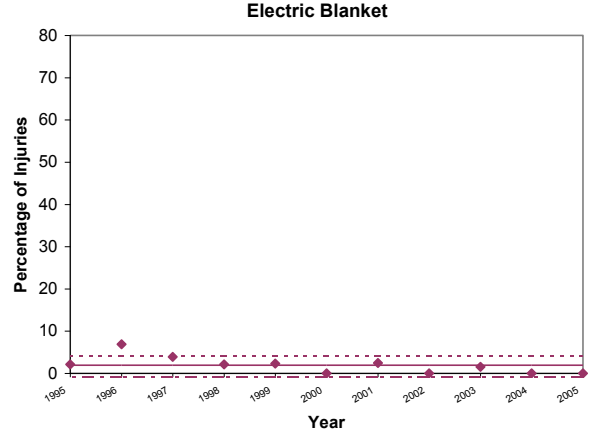
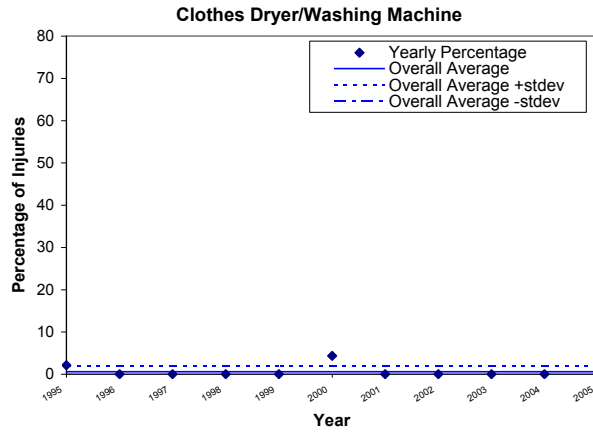


Figure 58: Yearly percentage of total apartment injuries for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

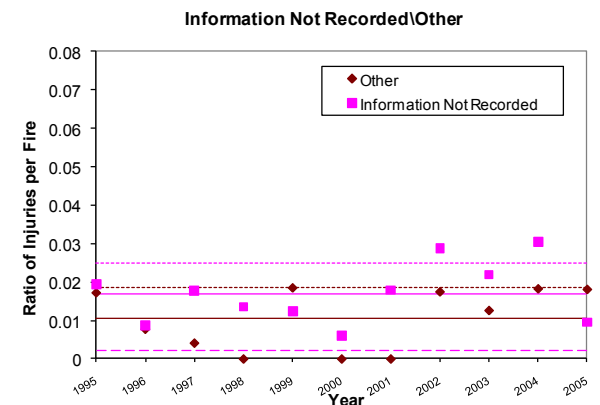
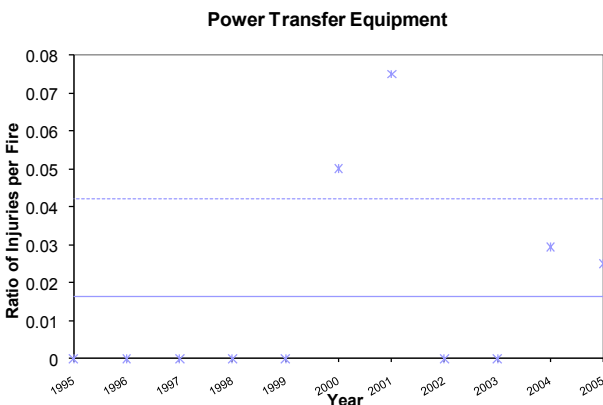
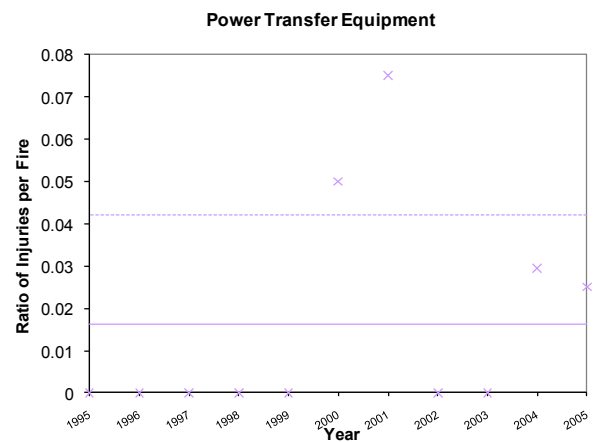
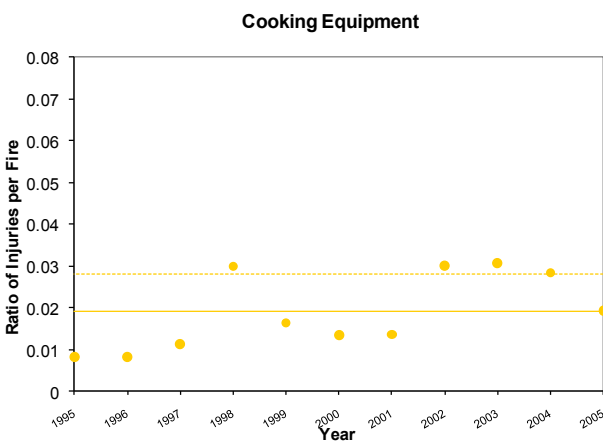
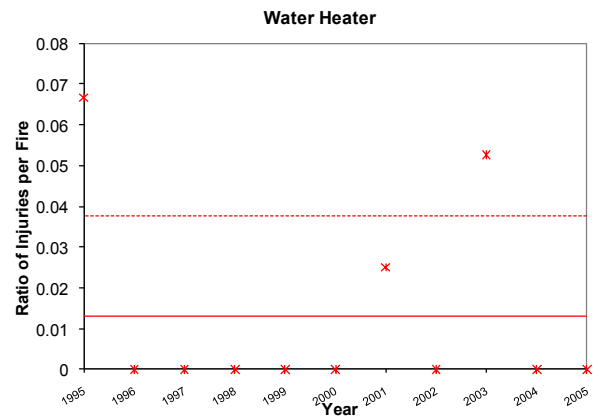
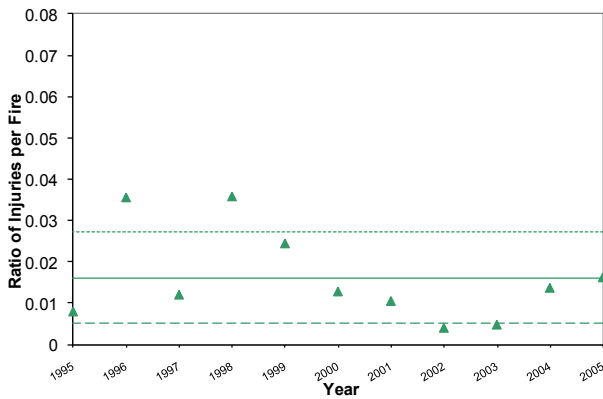
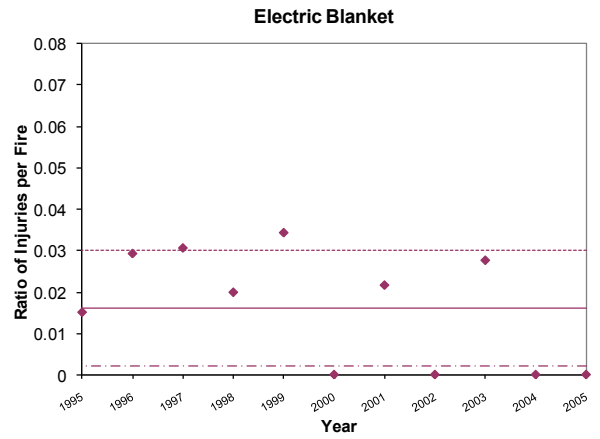
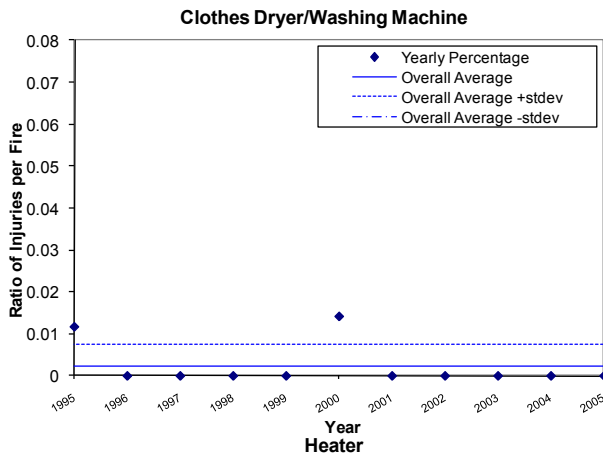


Figure 59: Yearly ratios of apartment injuries to fire incidents for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

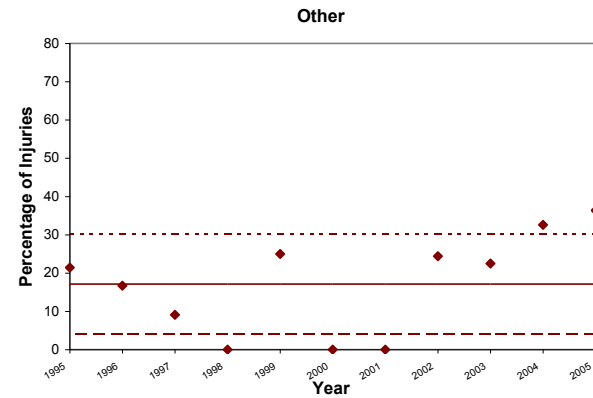
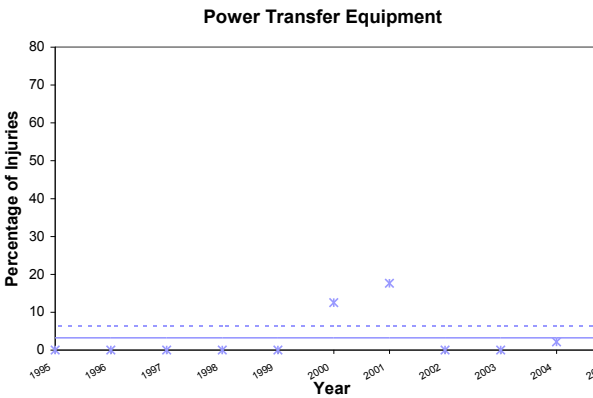
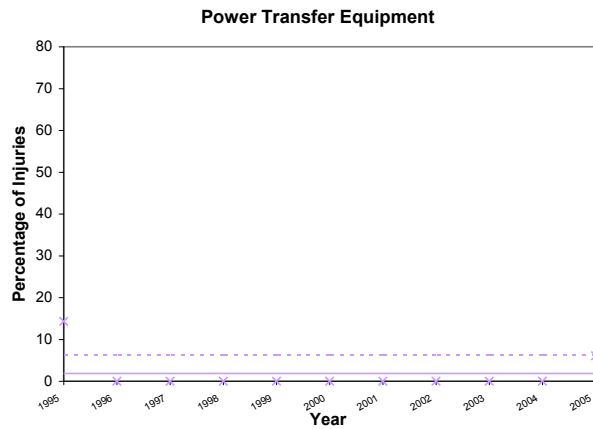
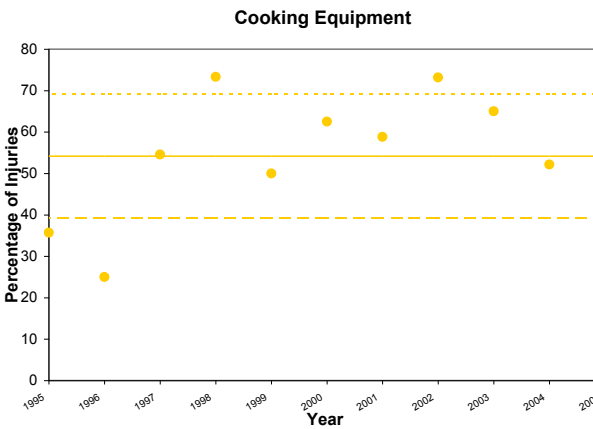
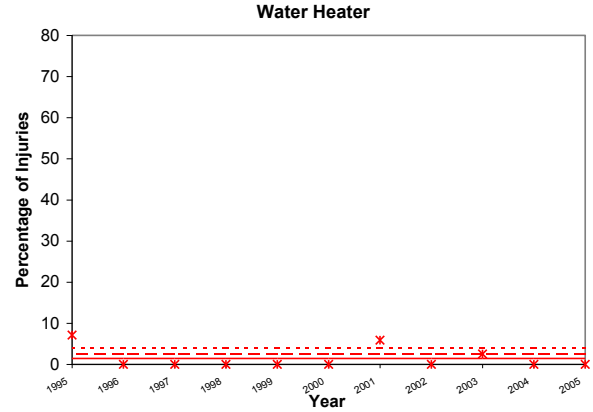
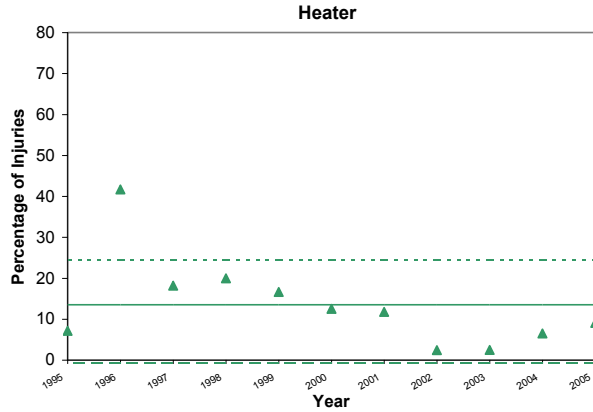
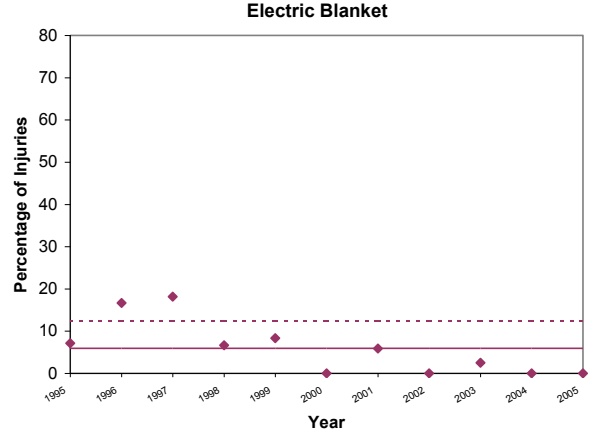
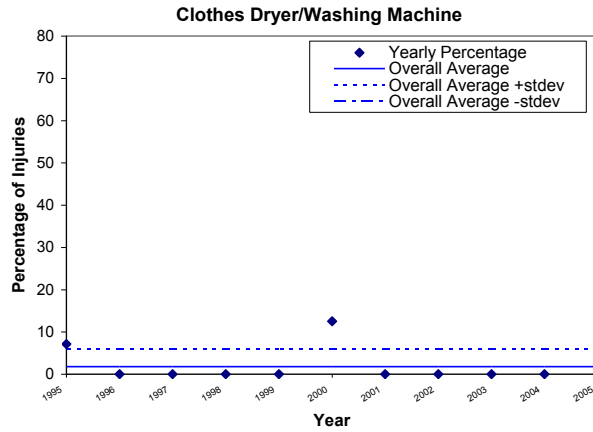


Figure 60: Yearly percentage of total apartment injuries for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

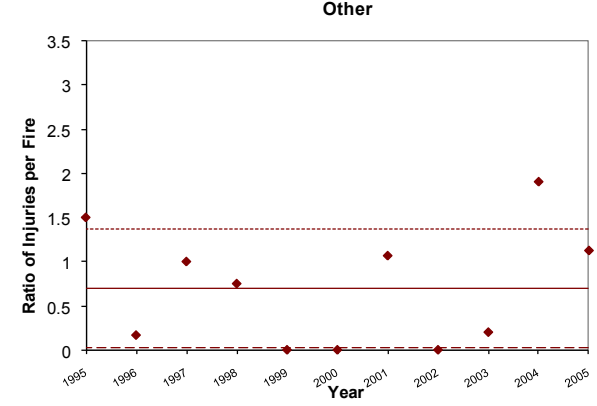
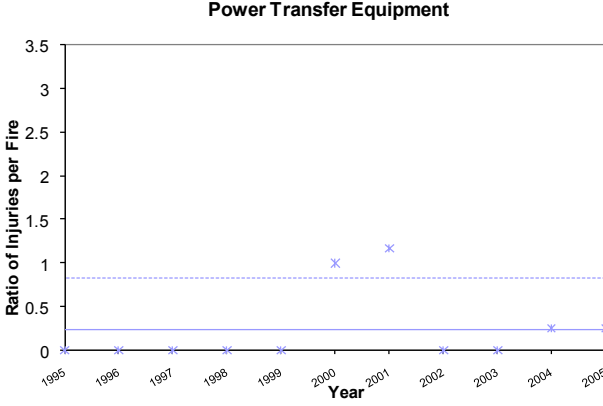
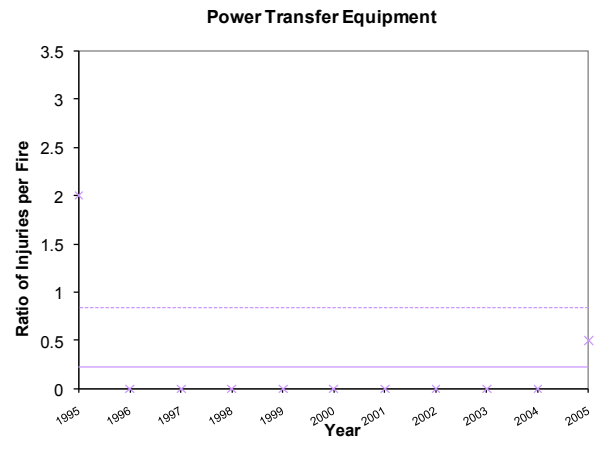
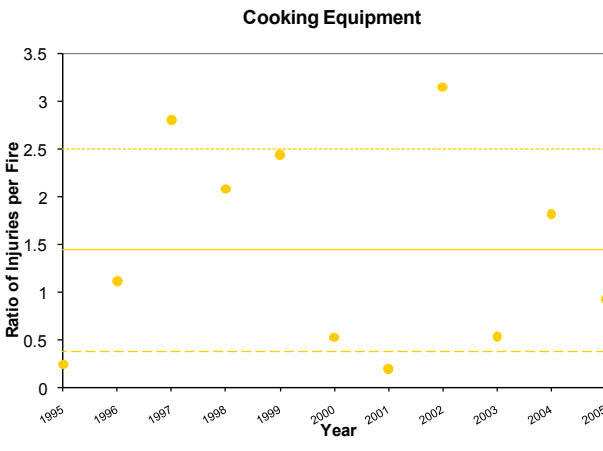
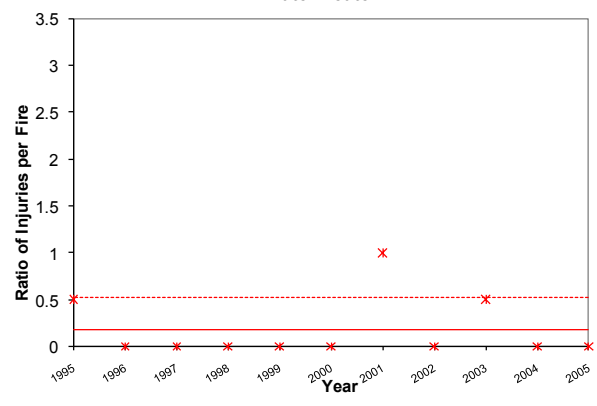
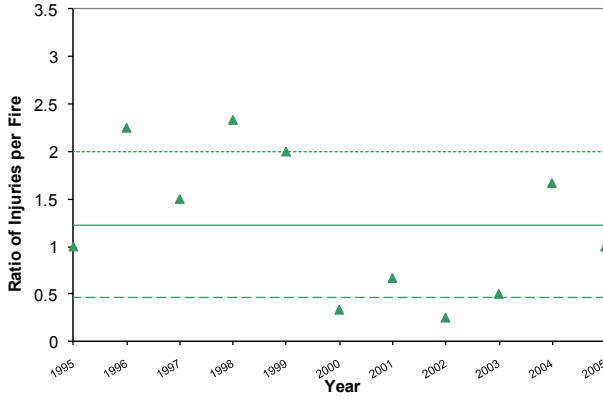
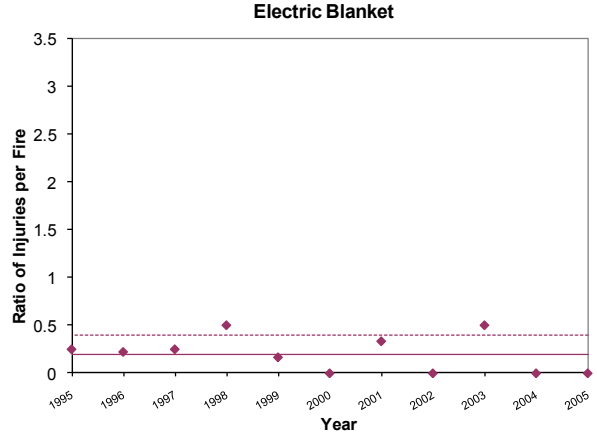
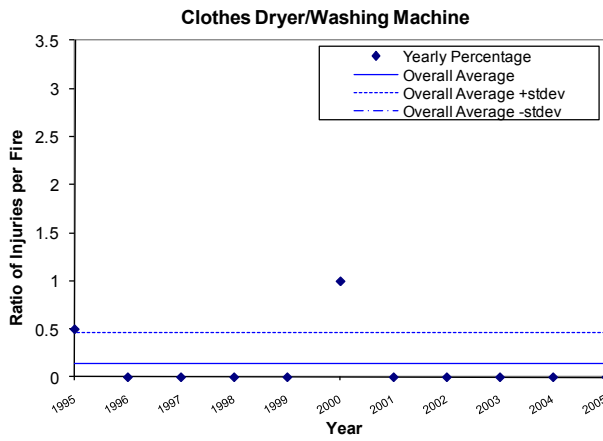


Figure 61: Yearly ratios of apartment injuries to fires for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

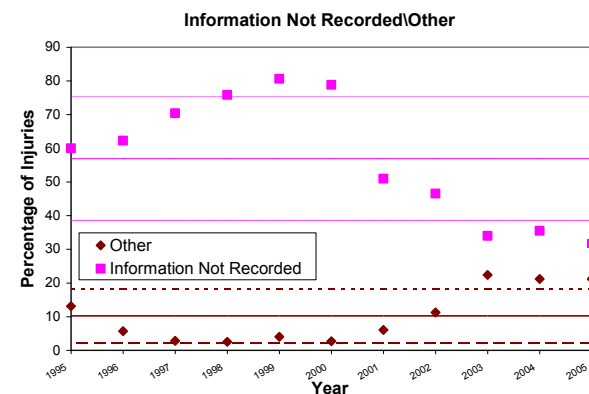
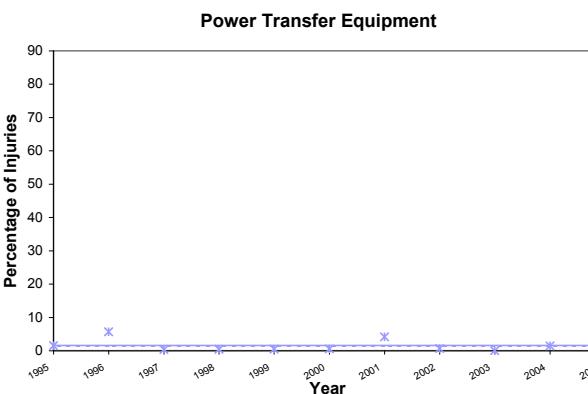
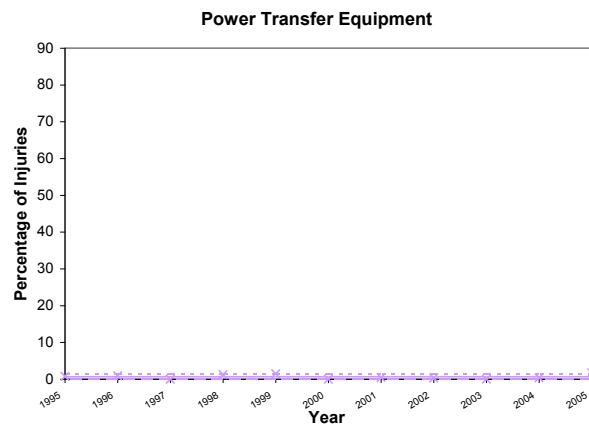
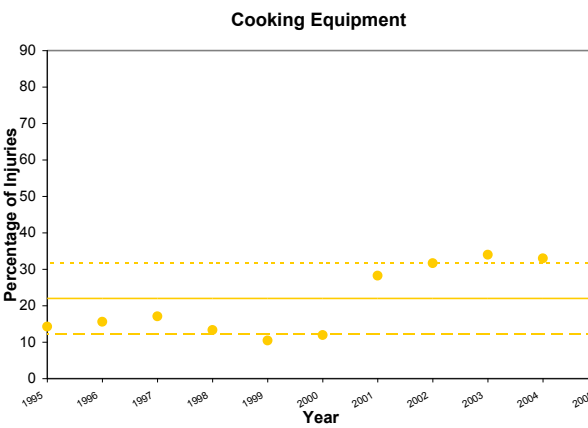
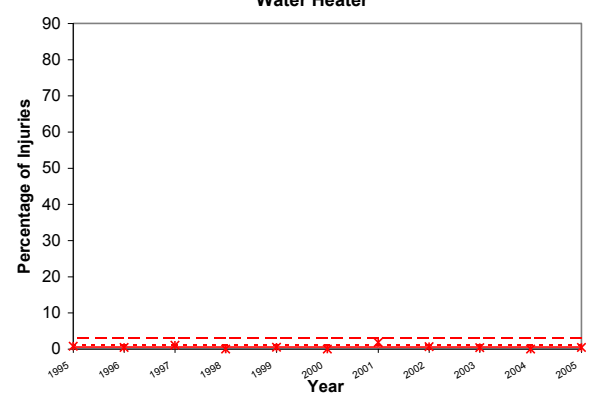
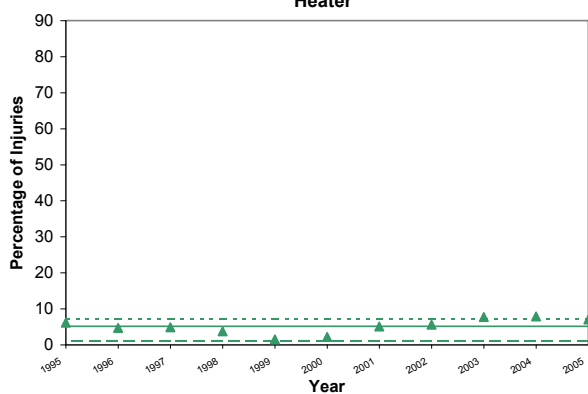
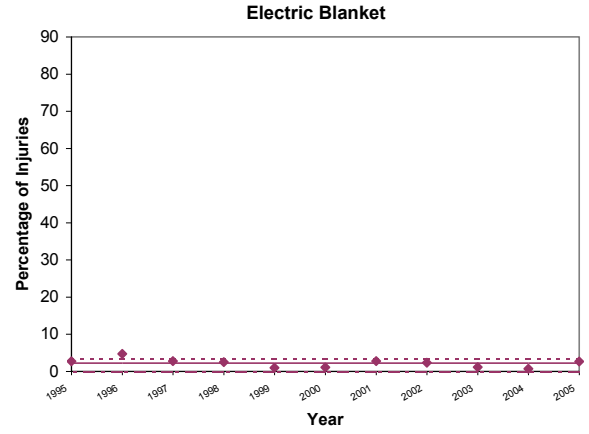
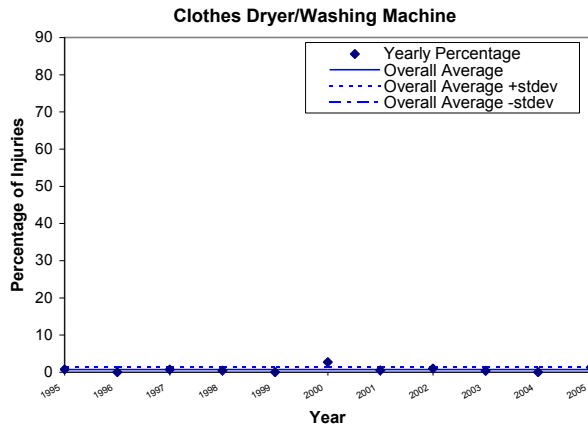


Figure 62: Yearly percentage of total all residential structure injuries for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

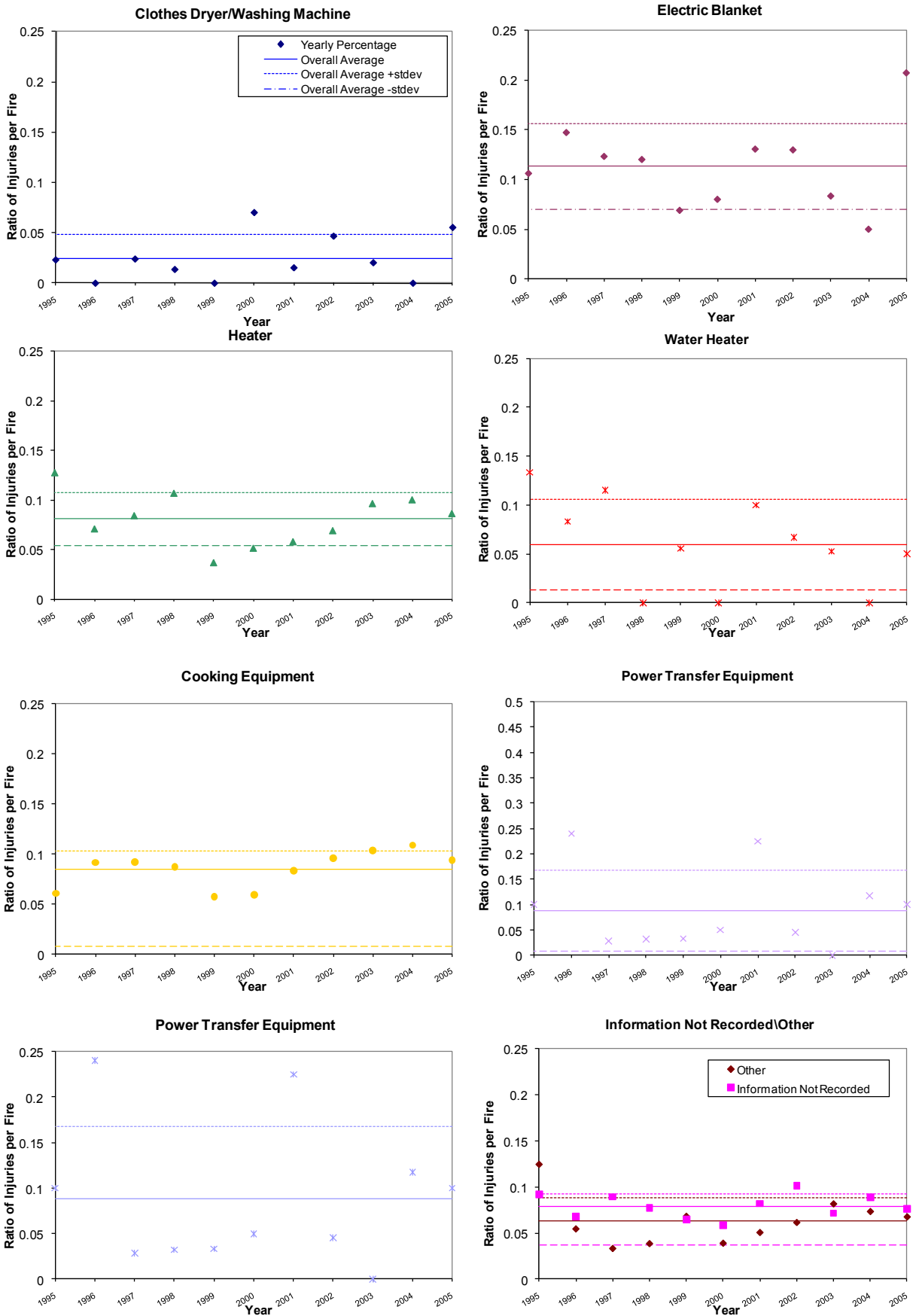


Figure 63: Yearly ratio of residential structure injuries to fire incidents for each group of items of equipment involved in ignition, including “information not recorded” (1995 – 2005).

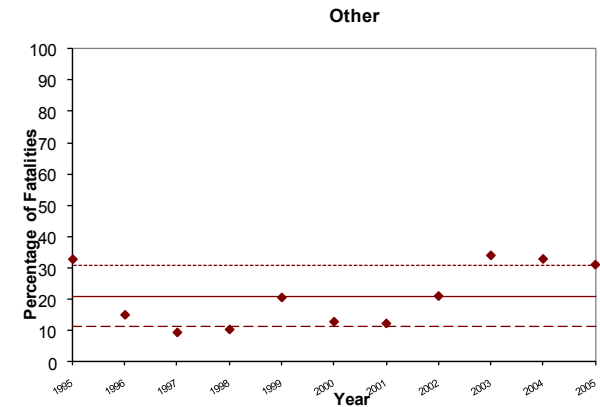
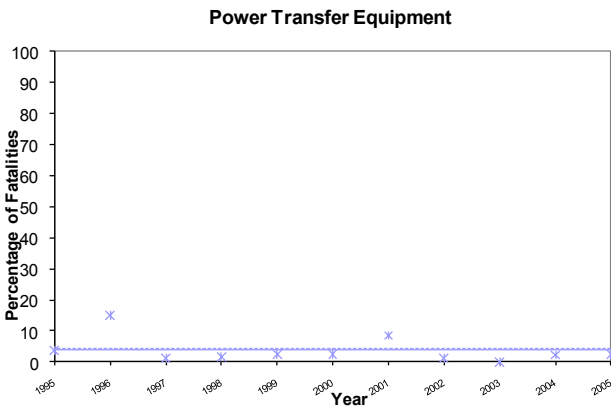
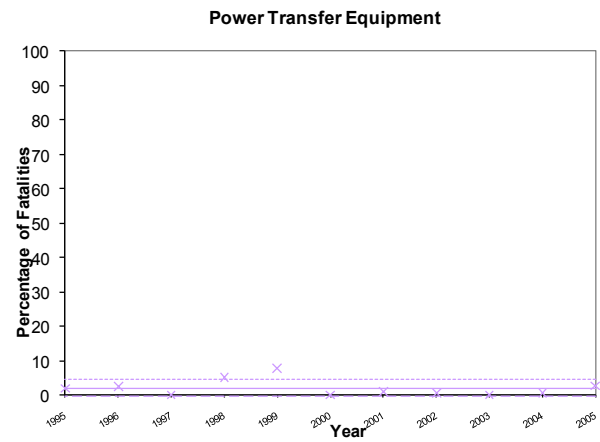
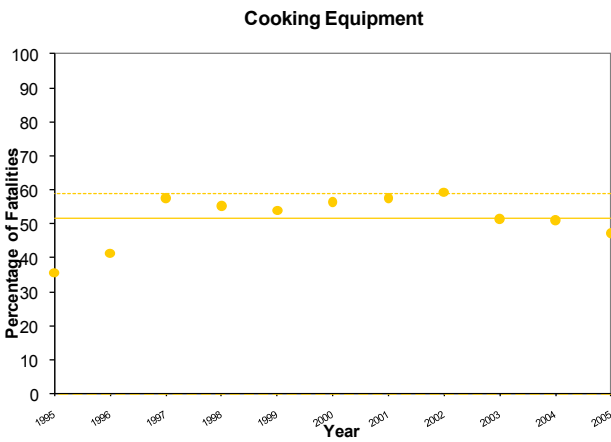
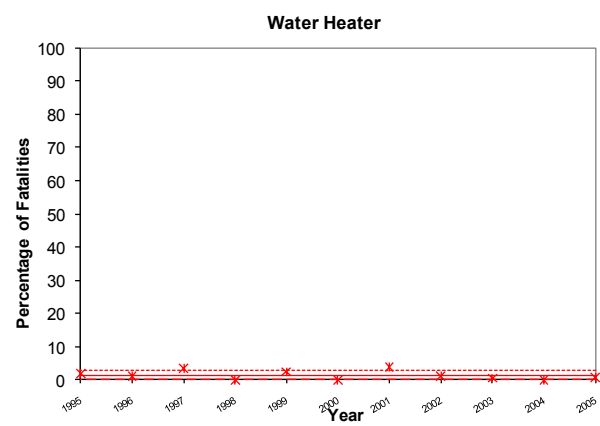
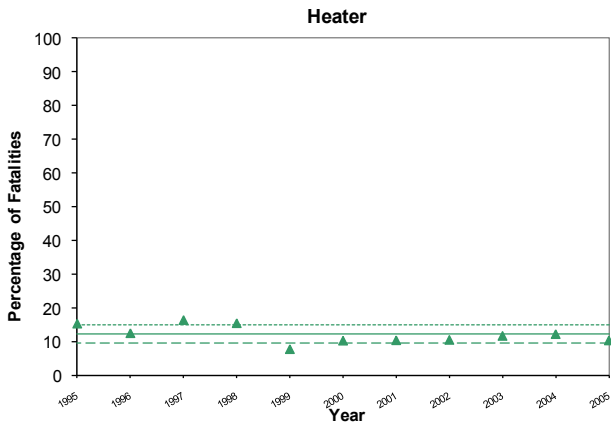
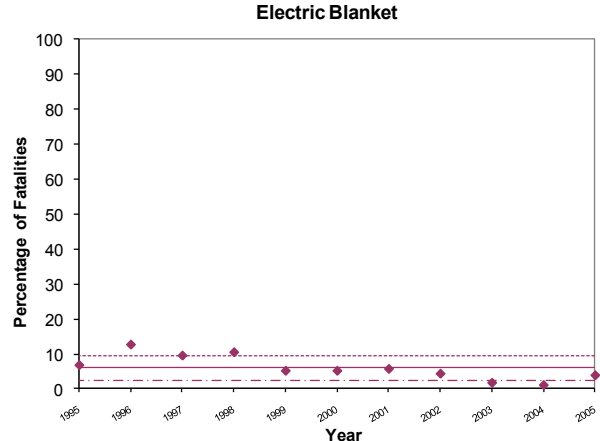
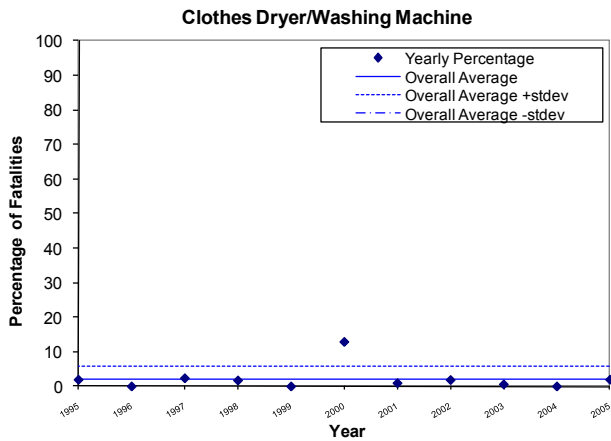


Figure 64: Yearly percentage of total all residential structure injuries for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

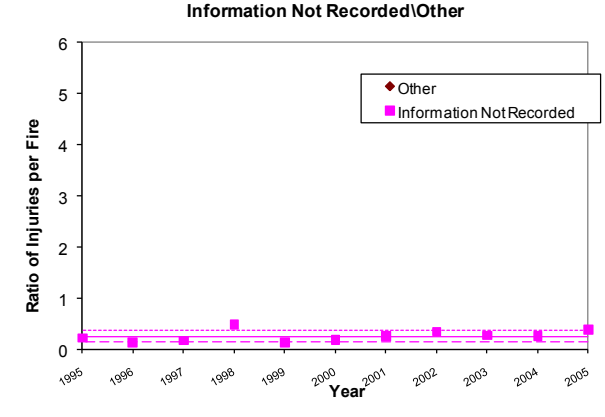
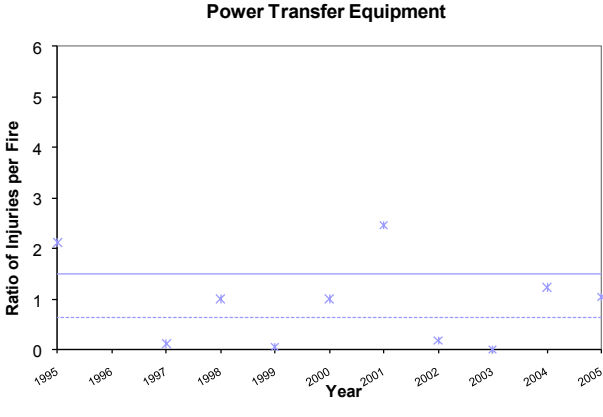
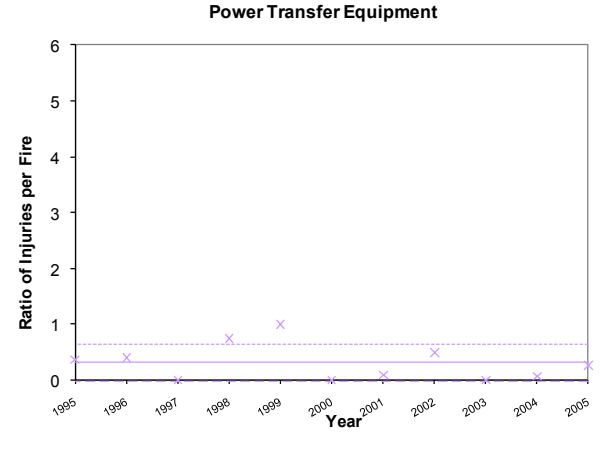
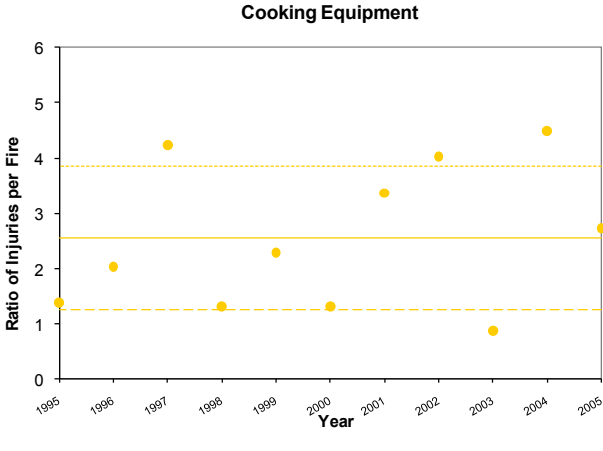
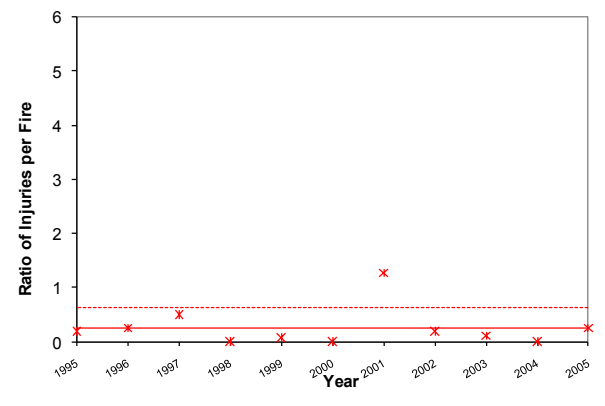
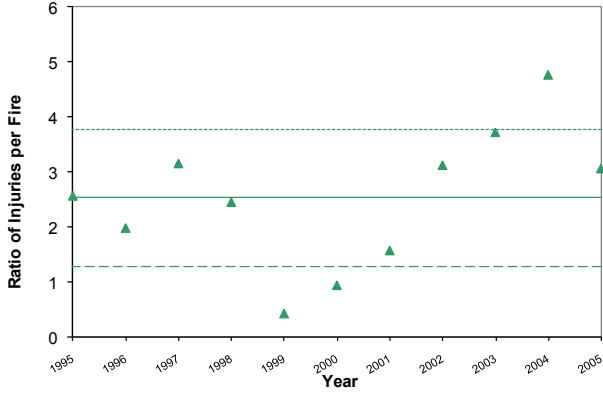
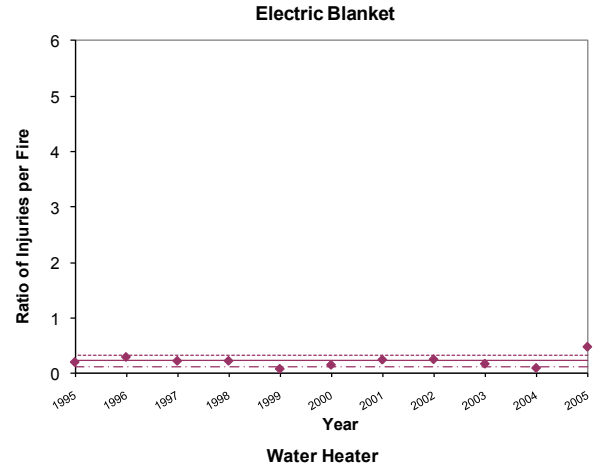
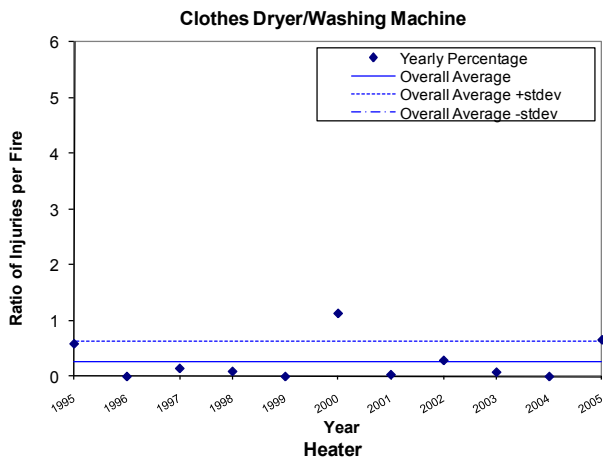


Figure 65: Yearly ratios of all residential structure injuries to fires for each group of items of equipment involved in ignition, excluding “information not recorded” (1995 – 2005).

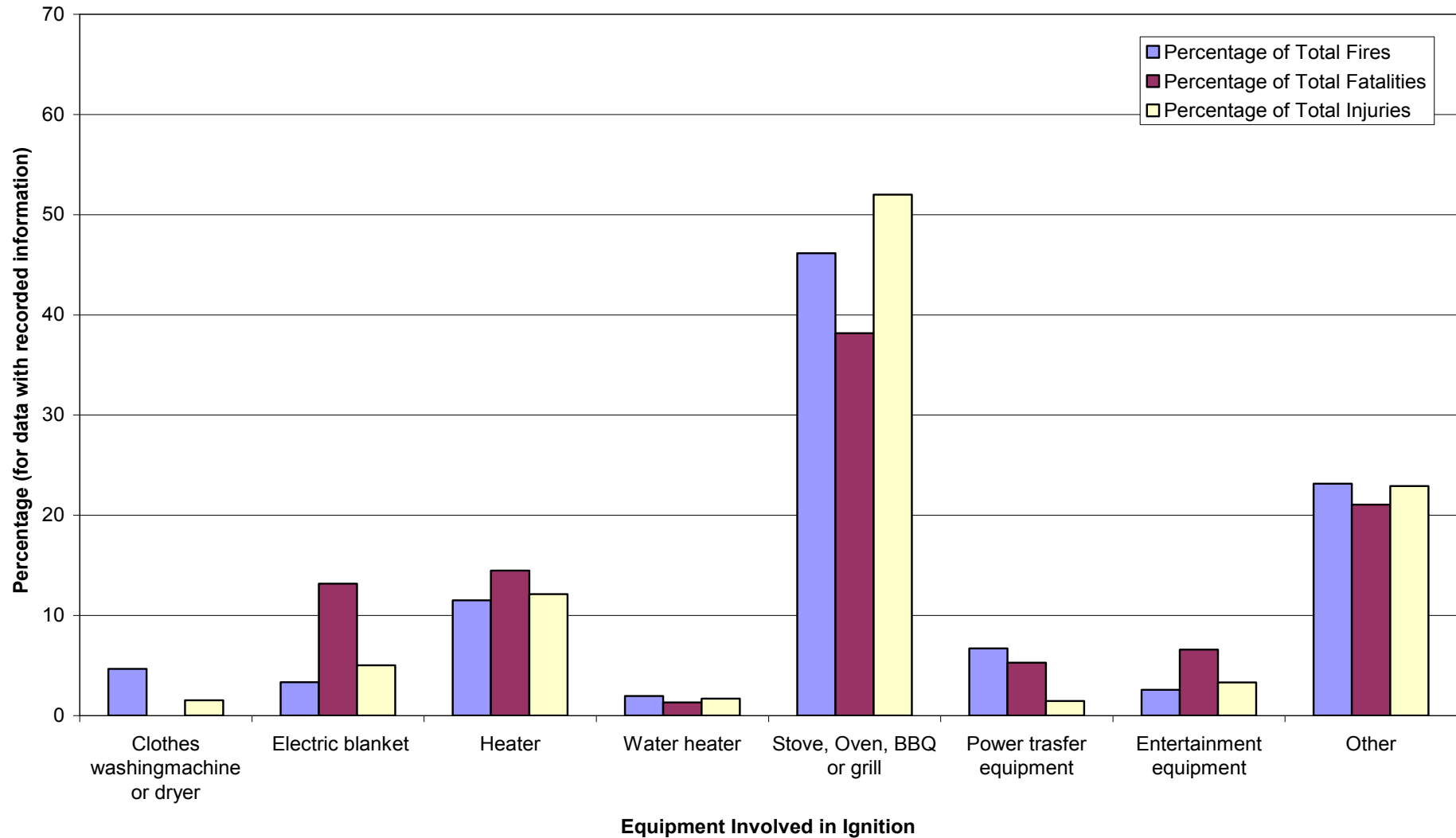


Figure 66: Percentage of totals excluding data where information was not recorded for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of equipment involved in ignition (1995-2005).

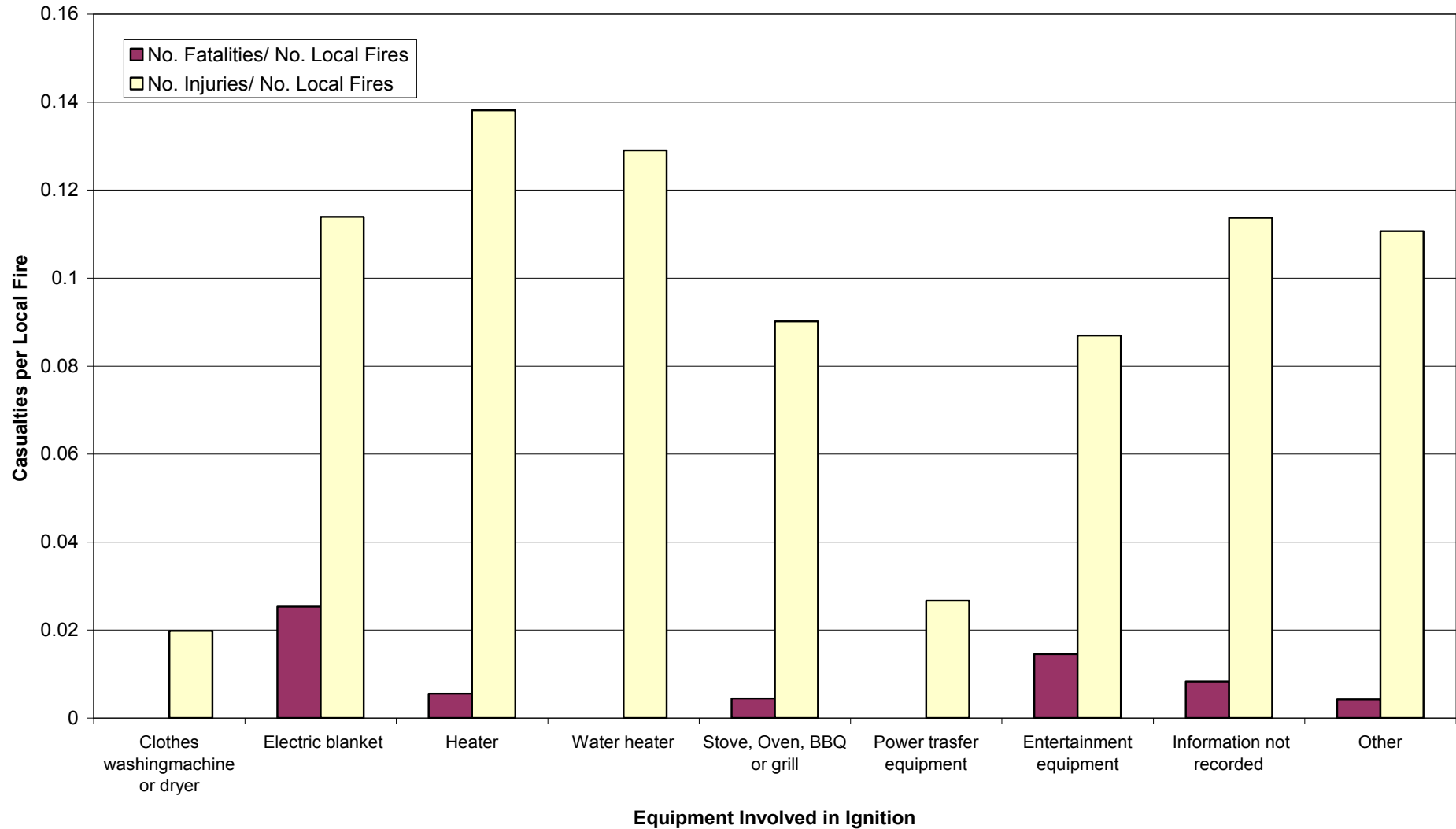


Figure 67: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in apartments as recorded for each group of equipment involved in ignition (1995-2005).

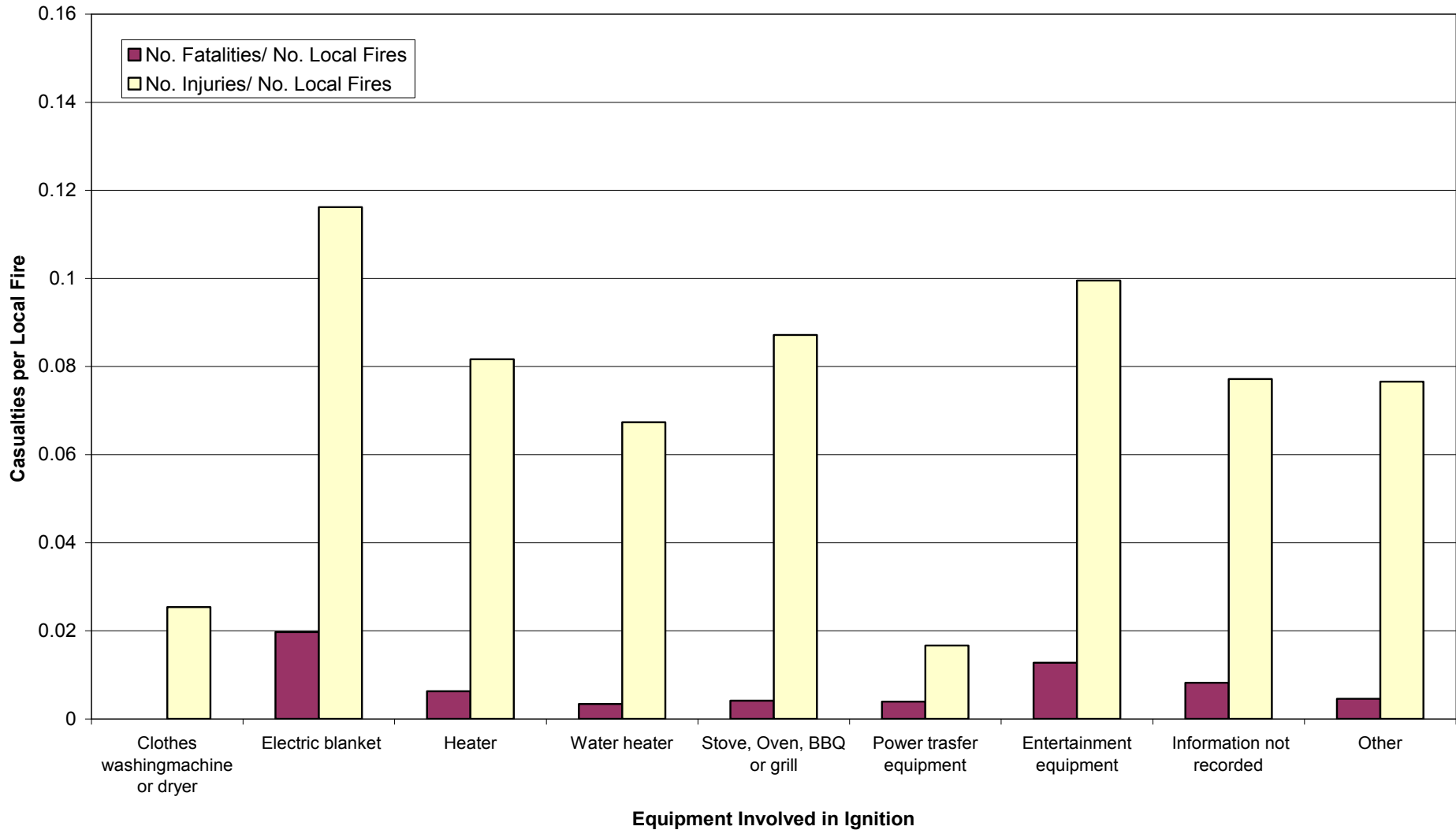


Figure 68: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of equipment involved in ignition (1995-2005).

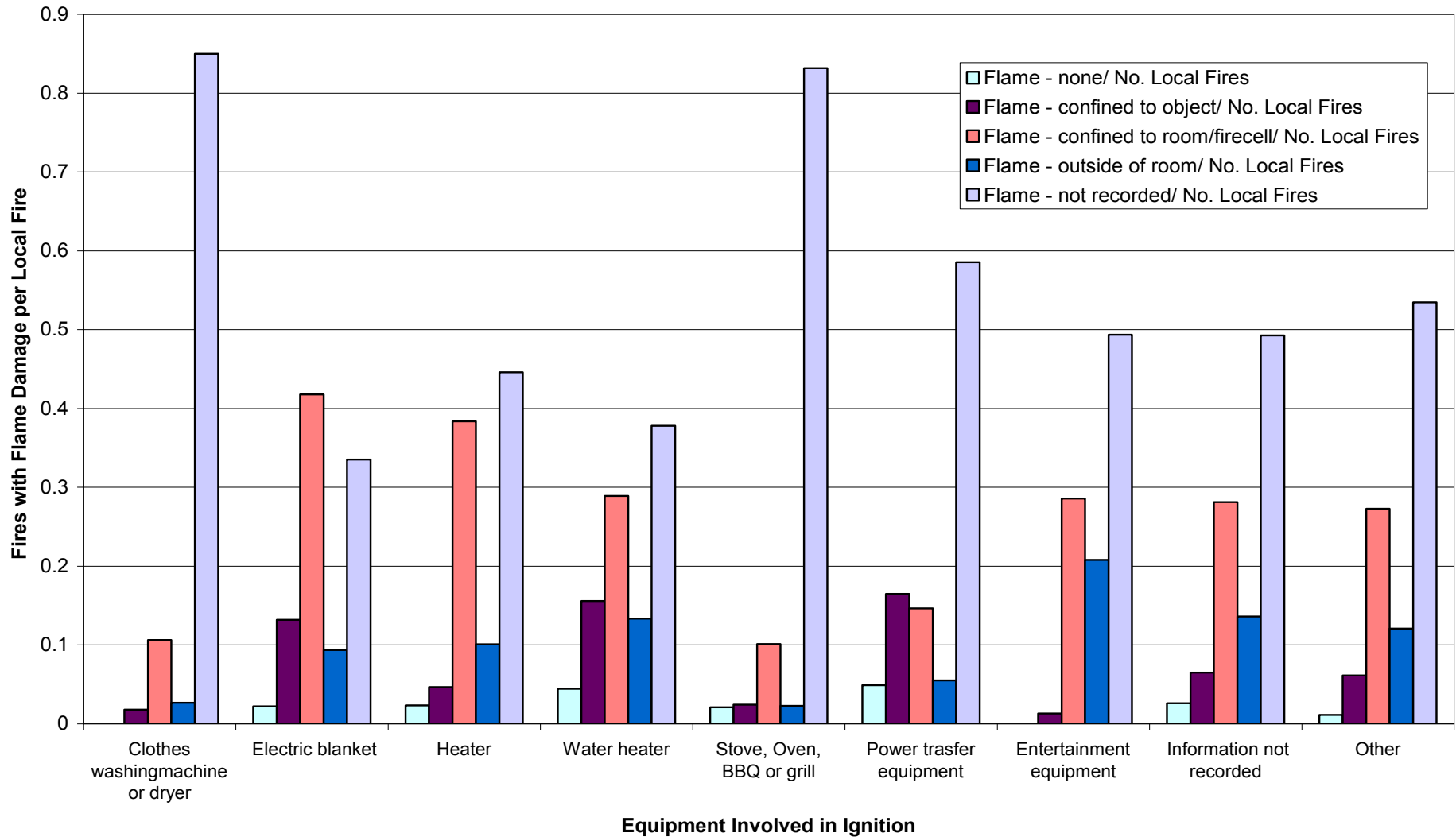


Figure 69: Ratios of numbers of fires with flame damage to numbers of total local fires that occurred in apartments as recorded for each group of equipment involved in ignition (1986-2005).

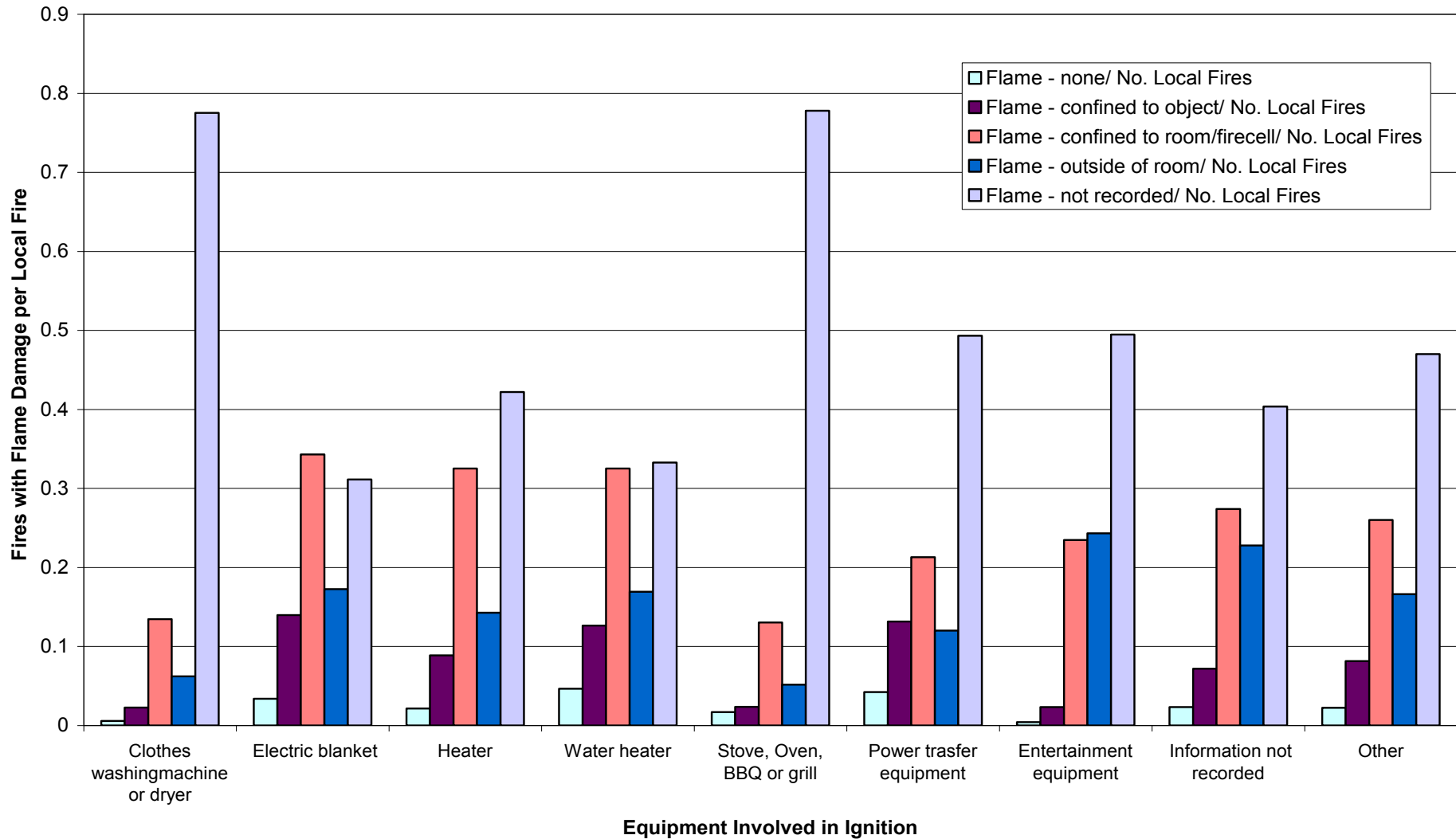


Figure 70: Ratios of numbers of fires with flame damage to numbers of total local fires that occurred in all residential structures as recorded for each group of equipment involved in ignition (1986-2005).

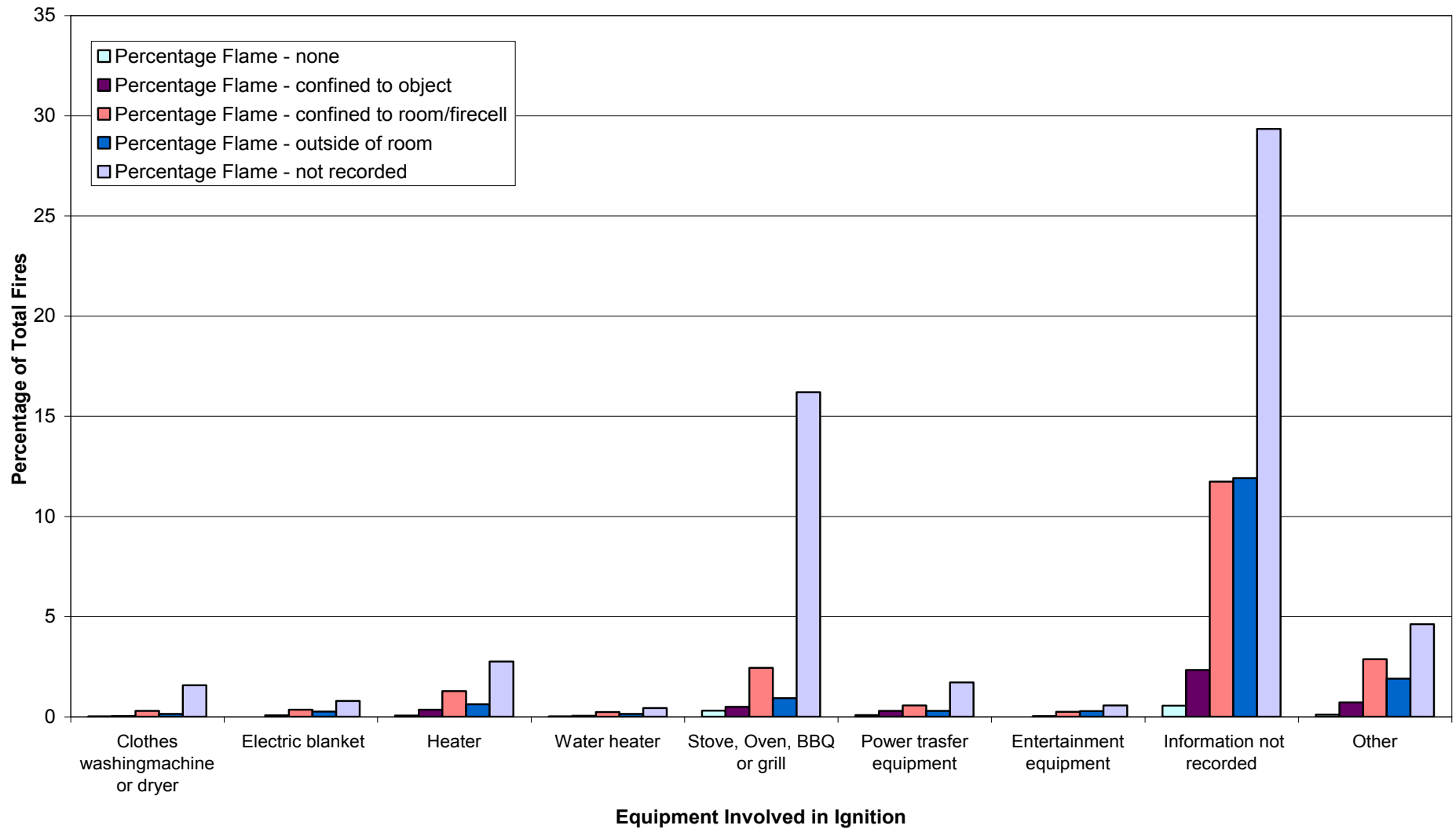


Figure 71: Percentage of total firesfires for fires with flame damage that occurred in apartments as recorded for each group of equipment involved in ignition (1986-2005).

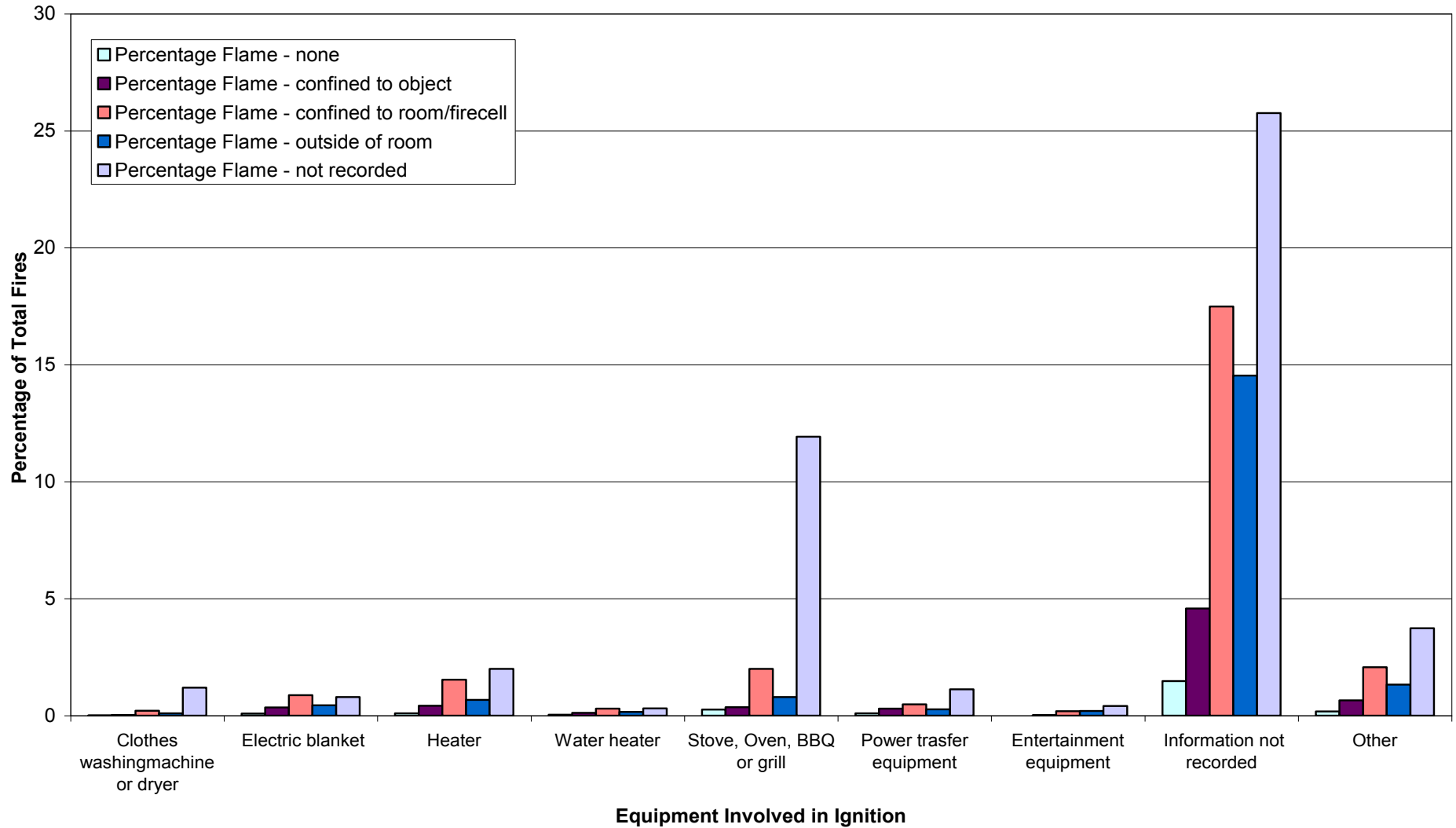


Figure 72: Percentage of total fires with flame damage that occurred in all residential structures as recorded for each group of equipment involved in ignition (1986-2005).

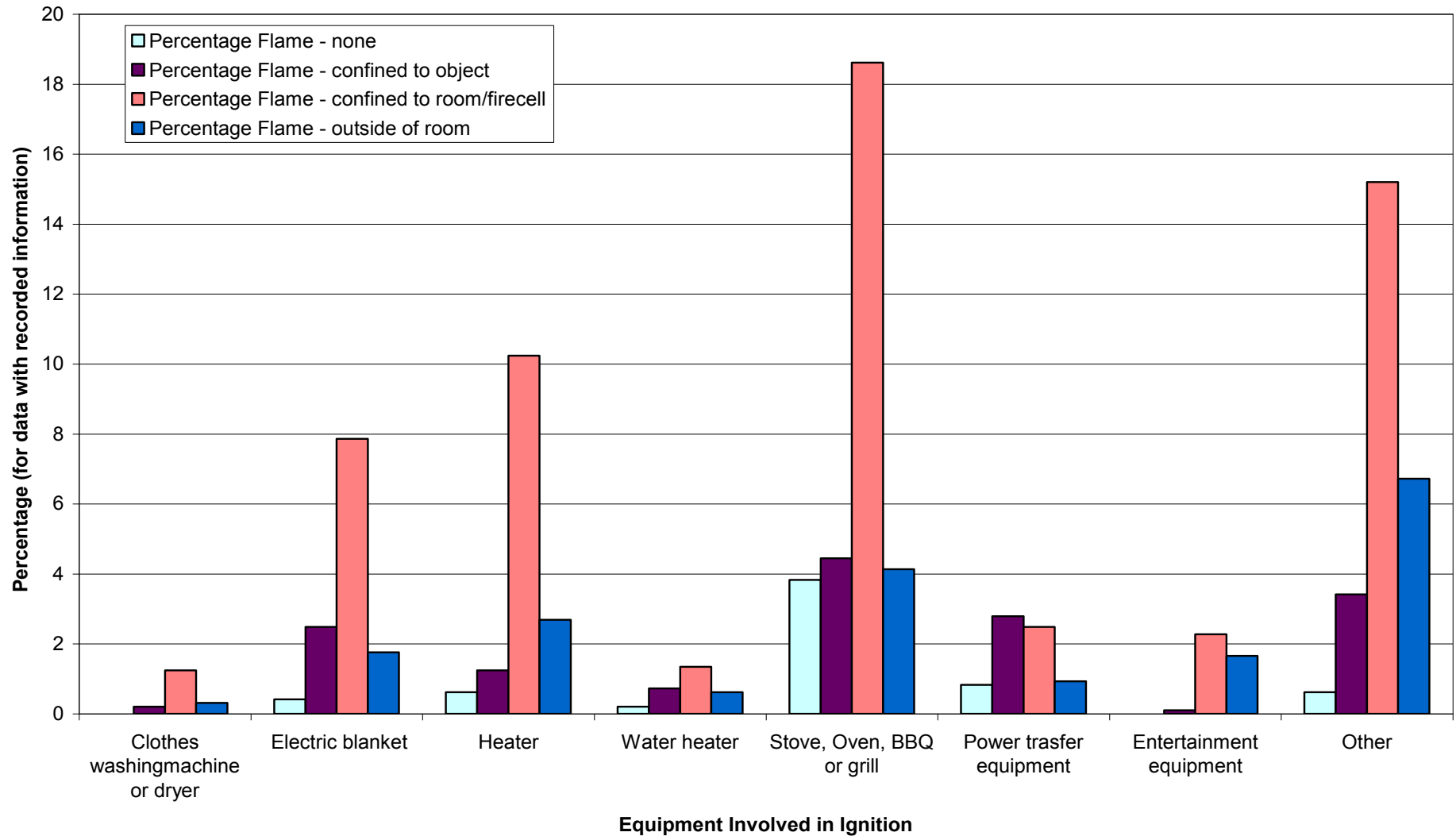


Figure 73: Percentage of total firesfires, excluding data where information was not recorded, for fires with flame damage that occurred in apartments as recorded for each group of equipment involved in ignition (1986-2005).

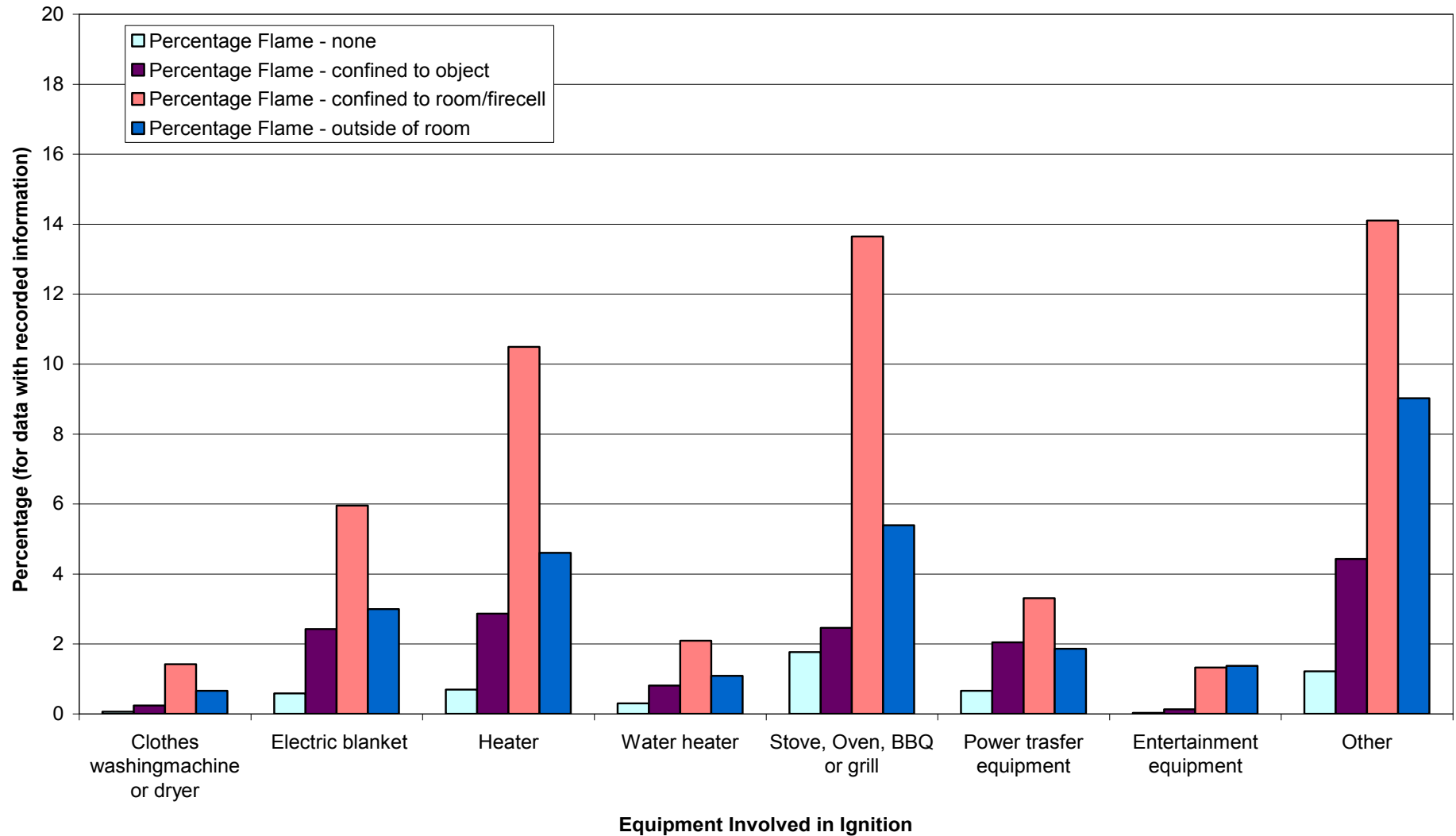


Figure 74: Percentage of total firesfires, excluding data where information was not recorded, for fires with flame damage that occurred in all residential structures as recorded for each group of equipment involved in ignition (1986-2005).

4.3 First Material Ignited

The numbers of fires that have occurred collectively from 1986 to 2005 in residential structures are shown in Figure 213 and in apartments only are shown in Figure 214. There are 25 classes within the category of “First Material Ignited”, therefore it is suggested that using the zoom feature on the soft copy may ease viewing of some of the figure. The ranking of the most common first material ignited (up to the first 10 classes) by number of fire events for each type of property and structure damage are presented in Table 49 and Table 50. The numbers of civilian fatalities and injuries that have occurred collectively from 1995 to 2005 on residential structures are shown in Figure 215 and Figure 216 respectively. The ranking of the most common first material ignited (up to the first 10 classes) by number of fatalities and injuries for each type of property and structure damage are presented in Table 51 and Table 52 respectively. The ratios of the number of fatalities and number of injuries to the number of fires that occurred in each first material ignited (using the collective data from 1995 to 2005) are shown in Figure 217 and Figure 218 respectively. The top 10 ratios of numbers of fatalities and injuries to numbers of fires for each first material ignited for each type of property and structure damage are presented in Table 53 and Table 54 respectively. The ratios of the number of total fatalities and the number of total injuries to the percentage of total fires that occurred in each first material ignited (using the collective data from 1995 to 2005) are shown in Figure 219 and Figure 220 respectively. The ratios of the percentage of total fatalities and the percentage of total injuries to the percentage of total fires that occurred in each first material ignited (using the collective data from 1995 to 2005) are shown in Figure 221 and Figure 222 respectively. The top 10 ratios of percentage of total fatalities and total injuries to the percentage of total fires for each first material ignited for each type of property and structure damage are presented in Table 55 and Table 56 respectively. The number of fires according to the extent of flame damage for fire events recorded for each first material ignited is shown in Figure 223 and Figure 224 for all residential structures and apartments only respectively.

4.3.1 All Classes

All classes of the first material ignited were initially analysed individually in order to gain an initial feel for the important aspects and predominant classes of the data set. A full listing of each of the classes for the first material ignited category is presented in Appendix A. The results from this analysis were then used to select the most important and appropriate groupings of the classes to be used in a finer analysis of the data set. Following is a brief discussion of the results of the analysis using the individual classes for first material ignited. The associated tables and figures are included in Appendix H.

4.3.1.1 Most Common

The three most common items of first material ignited for fire events in apartments (with and without structure damage) for the total number of fire events (from 1986 to 2005) are food (not including fats and grease) with 17%, fats and grease with 14%, then PVC with 8% (Table 50). For fire events in all residential structures (with and without structure damage) for the total number of fire events (from 1986 to 2005) the three most common items of materials first ignited are finished timber and wood with 13%, fat and grease with 10%, then PVC with 9% (Table 50).

The three most common items of first material ignited for fire injuries in both apartments and all residential structures (with and without structure damage) for the total number of fire events (from 1995 to 2005) are finished fabrics and fibre with 16% for apartments and 14% for residential, fat and grease with 13% for apartments and

14% for residential, then combustible liquid (e.g. cooking oil, linseed oil, lubricant) with 12% for apartments and 13% for residential (Table 54).

For the total number of fire events considered (1995 to 2005), the three most common items of first material ignited for fire fatalities in apartments only are unknown materials that accounted for 20%, multiple materials first ignited that accounted for 11% and cotton and rayon that accounted for 9% (Table 52). For the total number of fire events considered (1995 to 2005), the three most common items of first material ignited for fire fatalities in all residential structures are finished fabrics and fibre that accounted for 16%, unknown first material that accounted for 15% and finished timber and wood that accounted for 8% (Table 52). However, as previously discussed, the total number of fatalities resulting from fire events in New Zealand is statistically small, therefore care should be used when drawing conclusions based on this data set.

4.3.1.1 Historical Trends

The numbers of fires attributed to each item of first material ignited for each year, during the period from 1986 to 2005, are shown in Figure 242 and Figure 243 for apartments only and all residential structures respectively. A decrease in the number of fires with no information recorded for the first material ignited can be seen for both apartments and all residential property. Also the influence of a change in data collation is obvious with the change occurring in 1992.

The numbers of fatalities for each item of first material ignited for each year, during the period from 1986 to 2005, are shown in Figure 244 and Figure 246 for apartments only and all residential structures respectively. No trends are obvious. This is expected, due to the very small population sizes and the relatively large proportion of fire events with no information recorded for the first material ignited.

The number of apartment injuries for each first material ignited for each year, during the period from 1986 to 2005, is shown in Figure 248. The number of all residential injuries for each year, during the period from 1986 to 2005, is shown in Figure 250. Again no trends are obvious over the years.

4.3.1.2 Correlations

The correlations between the data sets for apartments and all residential structures are presented in Table 7, according to whether or not data for “information not recorded” is included or not and whether events “with structure damage” or “without structure damage” are considered.

The numbers of fire events for the range of first material ignited that were considered has a strong correlation for apartments and all residential structures with structure damage (0.92 and 0.92), without structure damage (0.94 and 0.96) and for the combined with and without structure damage (0.89 and 0.92), for the years 1986 to 2005 and 1995 to 2005 respectively. The correlation values for the data set when the category of “information not recorded” show little difference.

The numbers of fatalities for the range of first material ignited that were considered has a moderate correlation between apartments and all residential structures with structure damage (0.79) and no correlation when considering fire events without structure damage (0.32), for the years 1995 – 2005. Moderate correlation exists between the numbers of fire fatalities that occurred in the total apartments and all residential structures (with and without structure damage) (0.78) for years from 1995 to 2005. The number of fatalities per fire showed little correlation between apartments and all residential buildings for incidents with structure damage (0.60) and all types of incident (0.55). There was no correlation between apartments and all residential buildings for incidents without structure damage (0.32). There is no difference between the results for the datasets including and excluding the category of ‘information not recorded’.

because all events involving a fatality had a category recorded for the first material ignited even if the category was 'unknown'.

The numbers of injuries consistently have good correlations between apartments and all residential buildings for incidents with structure damage (0.96), incidents without structure damage (0.96) and all incidents (0.97). The correlations were similar when considering the data excluding incidents where information was not recorded for the material first ignited.

Table 7: Summary of correlations for cumulative totals and casualties per fire between apartment and all residential data sets for 1-level event-tree

Categories	Apartments Compared to All Residential Buildings		No. Fires ^a	No. Fires ^b	No. Fatalities ^b	No. Injuries ^b	Fatality per Fire ^b	Injury per Fire ^b
	With Structural Damage	Without Structural Damage						
First Material Ignited	✓		0.916	0.915	0.785	0.963	0.603	0.746
		✓	0.945	0.960	0.316	0.955	0.323	0.580
	✓	✓	0.885	0.923	0.783	0.971	0.553	0.413
First Material Ignited, excluding 'information not recorded'	✓		0.915	0.915	0.785	0.964	0.603	0.746
		✓	0.959	0.960	0.316	0.955	0.323	0.581
	✓	✓	0.892	0.923	0.783	0.971	0.553	0.414

Notes:

^a Number of fires considered is for years 1986 to 2005.

^b Number of casualties considered is for years

4.3.1.2 Most Costly

The "cost" of a fire has been assumed to be apportioned by the number of resulting fatalities or injuries.

The ratios of the number of fatalities to the number of fires in each first material ignited are shown in Figure 232. For apartment fires the most costly first material ignited, in terms of civilian fatalities, was primarily natural gas, fabric (including textiles, wool and hair), unable to classify, multiple first materials ignited and unknown. For all residential structure fires the most costly first material ignited was primarily fabric (including textiles, wool and hair), natural gas, petrol and fur, silk and other finished fabric goods.

The ratios of the number of injuries to the number of fires in each first material ignited are shown in Figure 233. For apartment fires the most costly items of first material ignited, in terms of civilian injuries, were acetylene, grease (non-food), linoleum, flammable combustible liquid, fur (silk and other finished fabric goods), solid chemical (e.g. explosives) and rubber. For all residential structure fires the most costly items of first material ignited, in terms of civilian injuries, were cork, human hair, toi toi, natural gas, and LPG.

4.3.1.2.1 Historical Trends

There are no obvious trends showing for the ratios of numbers of casualties to fires, as shown in Figure 245 and Figure 247 for fatalities to fire events for apartments and all residential structures respectively. The ratios of injuries to fire events for fabrics (e.g. canvas, rayon, textiles, wool, hair, silk, fur, finished fabrics, etc.), grease (fat, butter, etc.) and food (starch, etc.) have been consistently high (greater than 0.5 injuries per fire) over the years considered. However there are no obvious trends for the majority of

categories considered, as shown in Figure 249 and Figure 251 for apartments and all residential structures respectively.

4.3.1.2.2 Correlations

The average percentage of fires for each first material ignited and one standard deviation are shown in Figure 252, Figure 253 and Figure 254 for fire incidents, fatalities and injuries respectively.

The average percentages of fires were noticeably higher (outside of one standard deviation) for apartments than all residential properties where fats (including butter and cooking grease) or food (including starch) were the first material ignited. The average percentages of fires were higher for all residential properties than apartments where the first material ignited was reported as finished wood products. All other materials first ignited were reasonably similar for the average percentages for apartments and all residential buildings.

It is obvious that the smaller population size associated with civilian fatalities is consistent with the larger values for standard deviation from the average percentage. The average percentages of fatalities per fire were higher (outside of one standard deviation) for all residential properties compared to apartments only for cotton, canvas and rayon, fabric (including textiles, wool and hair), multiple materials, natural gas, and rubbish as the first material ignited.

The average percentages of injuries for apartments and all residential properties were mostly within one standard deviation of each other. The few types of material first ignited outside of one standard deviation still showed similar values for the average percentages.

4.3.2 Grouped Classes

The results from the analysis of the individual classes were used to select the most important and appropriate groupings of the classes to be used in finer analysis. A listing of each of the classes that form each grouped classification for the first material ignited category is presented in Appendix B. Following is a discussion of the results of the analysis using the grouped classes for first material ignited.

4.3.2.1 Most Common

The numbers of fires with no information recorded for the material first ignited category was not as significant as it is for equipment involved in ignition (Figure 76, Figure 77 and Figure 78). For the years 1995 to 2005, the proportions for which no information on the material first ignited was recorded was approximately 10% and 8% for fires (Figure 83 and Figure 84), for apartments only and all residential structures respectively. The most numerous fires were reported for fats or food as the first material ignited, for both apartments only and all residential structures, as shown in Figure 76, Figure 83 and Figure 84. For both apartments only and all residential structures, for the combinations of first material ignited considered, the next most common materials ignited were the "other", polymers, fabric and then flammable or combustible liquids (Figure 76, Figure 83 and Figure 84).

For apartments only, other than the "other" category and "information not recorded" the recorded group of first materials ignited that is associated with the most fatalities are fabric (12%) and polymers (11%) then flammable or combustible liquid (8%), as shown in Figure 77 and Figure 83. For all residential structures, (other than the "other" category and "information not recorded") the recorded group of first materials ignited that is associated with the most fatalities are fabric (21%) followed by flammable or combustible liquid (14%) then polymers (13%), as shown in Figure 77 and Figure 84.

For apartments only, the groups of first materials ignited that are associated with the most injuries are fat or food (25%), fabric (18%), flammable or combustible liquid (15%) then polymers (13%), as shown in Figure 79, Figure 83. For all residential properties, the groups of first material ignited that are associated with the most injuries are fat or food (21%), flammable or combustible liquid (18%), fabric (17%) then polymers (15%), as shown in Figure 79, Figure 84.

4.3.2.11 Historical Trends

Considering the number of yearly fires (1986 – 2005), for apartments and all residential properties, it is clear that there is a distinct change in the data after 1992 (Figure 97 and Figure 98). In 1995 there was a change in the framework for collecting the data, therefore trends in the data from 1995 onwards only are considered here.

From 1995 onwards, the percentage of fires where fats or foods were the first material ignited shows a marked increase for both apartments only (Figure 91) and for all residential structures (Figure 92).

Considering the number and percentages of yearly fires (1986 – 2005), for apartments and all residential properties (Figure 97, Figure 91, Figure 98 and Figure 92, respectively), the number of fires with the first material ignited recorded as cooking fats or food, or combustible or flammable liquid increased over time. No significant trend was observed for the other groups of first material ignited considered.

In apartments and all residential property incidents, no clear trend was evident for the data available for the percentage of fatalities each year (1995 – 2005) that occur in each of the groups of items of first material ignited (Figure 93 and Figure 94, respectively). Similarly there is no clear trend observed for the number of fatalities each year (Figure 99 and Figure 100). This is attributed to the small sample sizes.

Yearly percentages of injuries in apartment and residential incidents were approximately constant over the years considered (1995 – 2005) (Figure 95 and Figure 96), except for a slight decrease for fabric and a slight increase for finished timber as the first material ignited in apartment incidents. For apartments, the number of injuries shows an increase for fabrics and finished timber materials first ignited (Figure 101). For residential structures, the number of injuries is approximately constant for the years considered (Figure 102).

4.3.2.12 Correlations

For apartments (1995 – 2005), for the combination of items of first material ignited, there is no linear correlation between fires and fatalities (-0.08). The linear correlation between numbers of fires and injuries is moderate (0.83). No linear correlation exists between fatalities and injuries for the groups of first material ignited considered (0.12). The correlation between numbers of fires where the flame damage was confined to the first material ignited and fatalities is poor (0.42) and injuries is also poor (0.46). The correlation between numbers of fires where the flame damage extended beyond the first material ignited and fatalities is low (0.68) and injuries is none (-0.05).

For all residential properties (1995 – 2005), for the combination of items of first material ignited, the linear correlation between fires and fatalities is poor (-0.29). The linear correlation between numbers of fires and injuries is low (0.60). No linear correlation exists between fatalities and injuries for the combined items of first material ignited considered (0.12). No correlation exists between numbers of fires where the flame damage was confined to the first material ignited and fatalities (0.01) and injuries (0.10). Poor correlation also exists between numbers of fires where the flame damage extended beyond the first material ignited and fatalities (0.40) and injuries (-0.25).

In general, for the groups of materials first ignited considered, the number of fire incidents for apartments from the years 1995 – 2005 had a good linear correlation (0.98) to the number of incidents for the years 1986 – 2005. Similarly for all residential structures, there was good linear correlation between the number of fire incidents for each group of materials first ignited each year for the years 1995 – 2005 and 1985 – 2005. There was moderate linear correlation between apartments and residential yearly fire incidents for each group considered for 1995 – 2005 (0.86) and 1986 – 2005 (0.77). There was low correlation between apartments and all residential structures for fatalities each year for the groups of materials first ignited (0.66). Good linear correlation existed between apartments and all residential structures for injuries each year for the groups of materials first ignited (0.94).

A summary of these correlations are included in Appendix D, Table 12, Table 13, Table 14, Table 15, Table 16, Table 17, Table 18 and Table 19.

4.3.2.2 Most Costly

Assuming the 'cost' of a fire is apportioned by the number of resulting fatalities or injuries. Assuming the 'cost' of a fire is apportioned by the number of resulting fatalities or injuries. The term 'local' fire or casualty is used to refer to data pertaining to the group of interest within each category.

The ratios of the number of casualties to the number of local fires in each group of items of first material ignited are shown in Figure 79 and Figure 80 for apartments and all residential structures respectively.

For apartment fires the most costly first material ignited, in terms of civilian fatalities, was primarily for incidents where the first material ignited was not recorded (~0.04 fatalities/fire) followed by the collective incidents for other materials first ignited (~0.01 fatalities/fire), fabrics (~0.01 fatalities/fire) and flammable or combustible liquids (~0.01 fatalities/fire) (Figure 79). For fires in all residential structures the most costly first material ignited, in terms of civilian fatalities, was primarily where information was not recorded (~0.02) followed by fabrics (~0.02) then flammable or combustible liquids (~0.01), finished timber (~0.01) and polymers (~0.01) (Figure 80). Except for fabrics and flammable or combustible liquids, where the ratio of fatalities to fires was higher for all residential structures than apartments, the values for the ratios for apartments and all residential structures were similar.

In terms of civilian injuries, for apartment fires the most costly first material ignited was primarily fabrics (0.18) followed by flammable or combustible liquids (0.16), where information was not recorded (0.15), polymers (0.08) then fats or food (0.07) (Figure 79). For all residential structure fires the most costly first material ignited, in terms of civilian injuries, flammable or combustible liquids (0.17) followed by fabrics (0.12), fats or food (0.07), other first materials not included in the groups considered (0.07) then polymers (0.06) (Figure 80). The ratios of fatalities to fires for apartments and all residential structures are similar. However the values for the ratios of injuries to fires are consistently higher for apartments than for all residential properties for instances where fabric, flammable or combustible liquid or polymers were recorded as the first material ignited.

Another approach to apportioning a measurement of 'cost' to a fire is in terms of the resulting flame damage. However the proportion for which no information for the level of flame damage was recorded is consistently high (~20 – 90% of fires that occurred at each group of areas of fire origin for apartments, as shown in Figure 81, and ~15 – 85% for all residential structures, as shown in Figure 82). With such a large amount of data lacking detail, it is difficult to perform a useful analysis. However to provide a general indication, one approach is to assume that the fires with less detailed data attributed to them were relatively small fires (i.e. incidents with no information recorded

would be grouped together with no flame damage and flame damage confined to object) and to use what data is available.

4.3.2.2.1 Historical Trends

For ratios of numbers of fatalities to local fires (1995 – 2005), there are no obvious trends over the years considered for either apartments only (Figure 99) or all residential structures (Figure 100).

Considering ratios of the numbers of injuries to local fires (1995 – 2005), for apartments there are slight increases in values for fabric, fats or food, combustible or flammable liquid, finished timber, where information was not recorded and the remainder of recorded materials first ignited (Figure 101), especially considering from 2000 onwards, when a change in the data collection method was implemented. For all residential structures, there is a slight decrease in values per year for fat or food, and no obvious trends for the other areas considered (Figure 102).

4.3.2.2.2 Correlations

The correlation between ratios of numbers of fatalities to local fires for apartments and for all residential structures is high (0.88) (Table 18).

The correlation between ratios of numbers of injuries to local fires for apartments and for all residential structures is high (0.91).

The correlation between ratios of numbers of fatalities to local fires for apartments and ratios of numbers of injuries to local fires is negligible for both apartments (0.18) and all residential structures (0.08). The correlation for all residential structures between ratios of numbers of fatalities to local fires and ratios of numbers of injuries to local fires is negligible (0.31). The correlation between the ratios of numbers of injuries to local fires for apartments and the ratios of numbers of fatalities to local fires for all residential structures is also negligible (0.47).

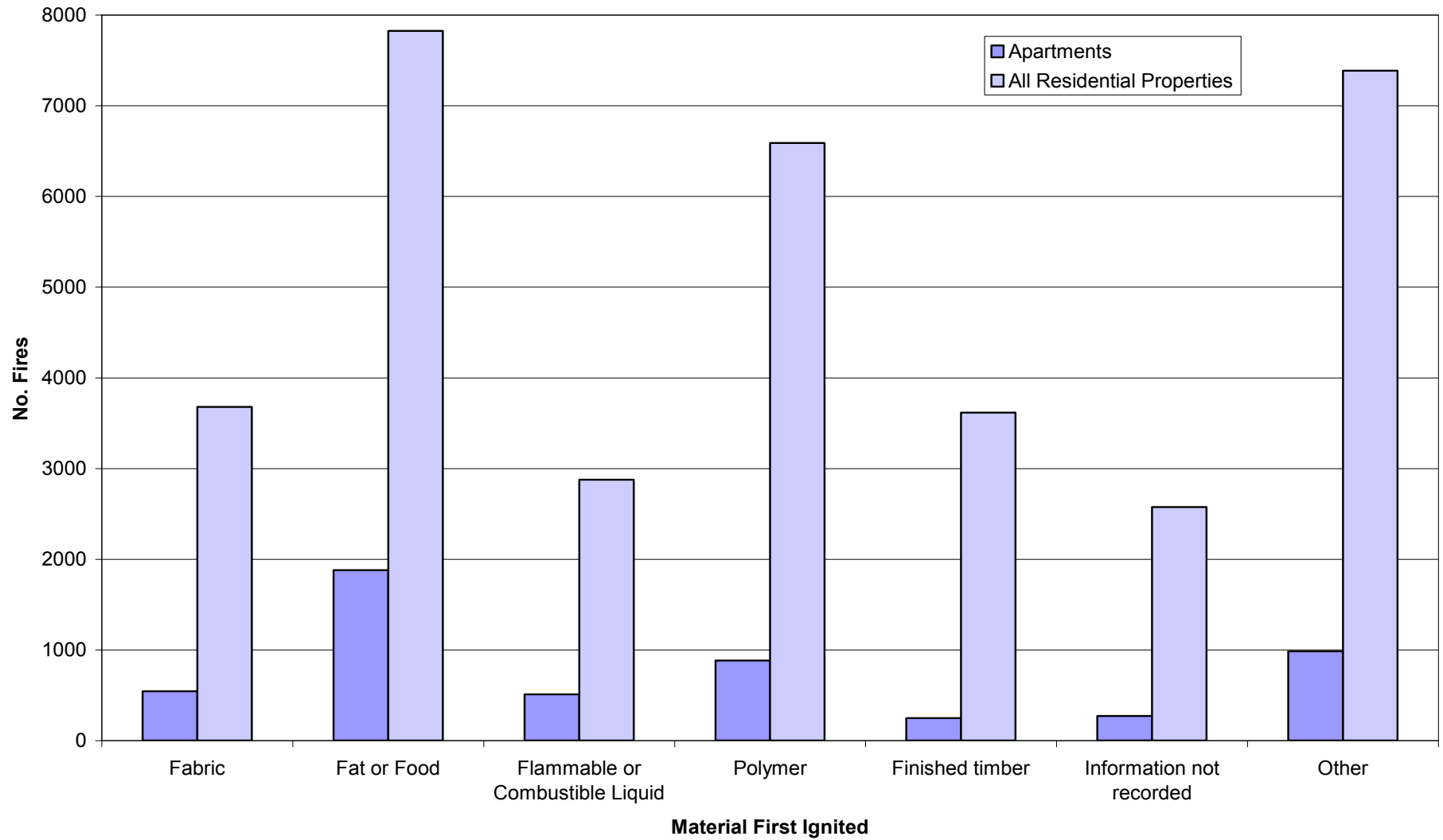


Figure 75: Number of fires in residential properties for groups of material first ignited (1995 – 2005).

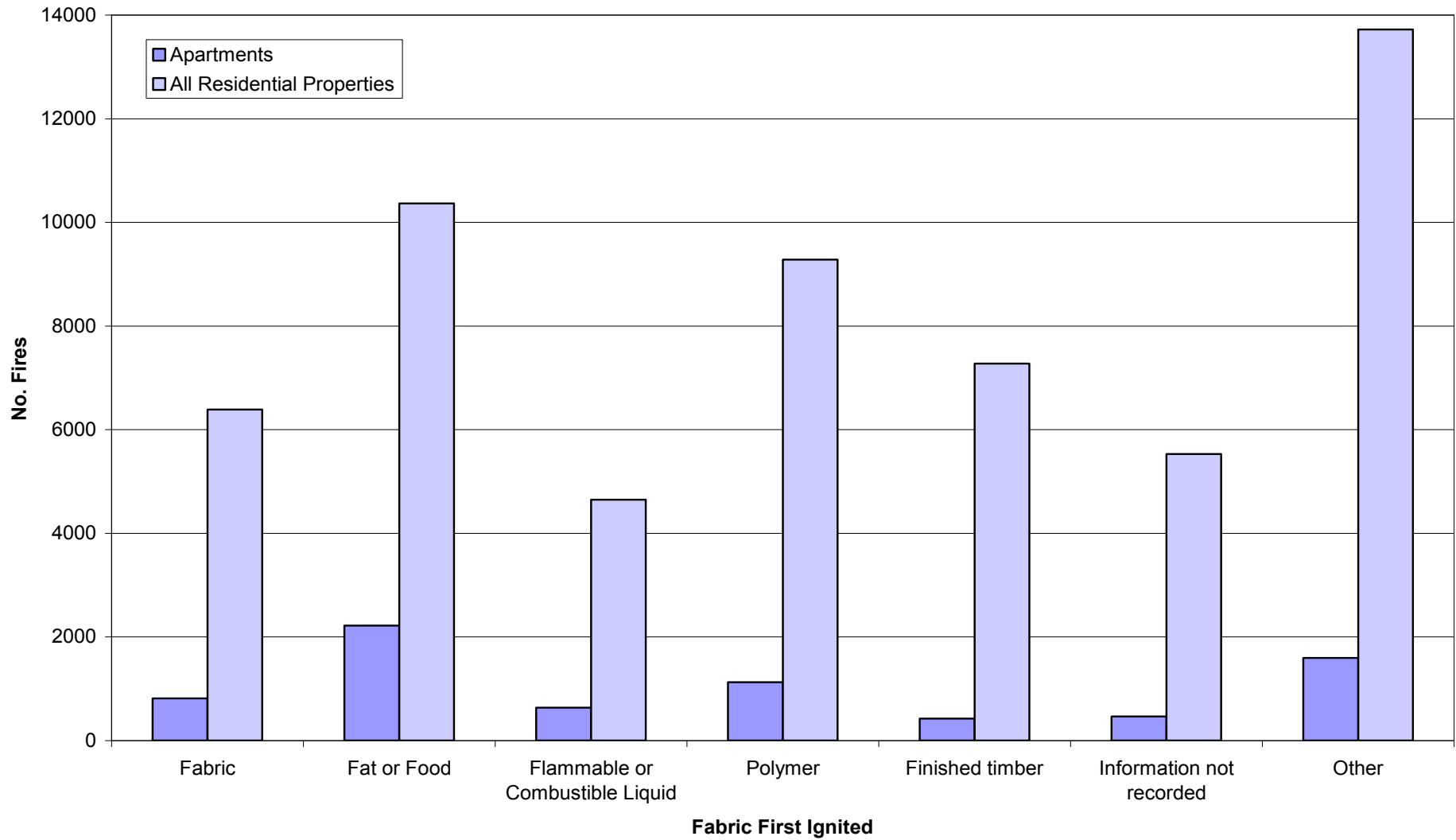


Figure 76: Number of fires in residential properties for groups of material first ignited (1986 – 2005).

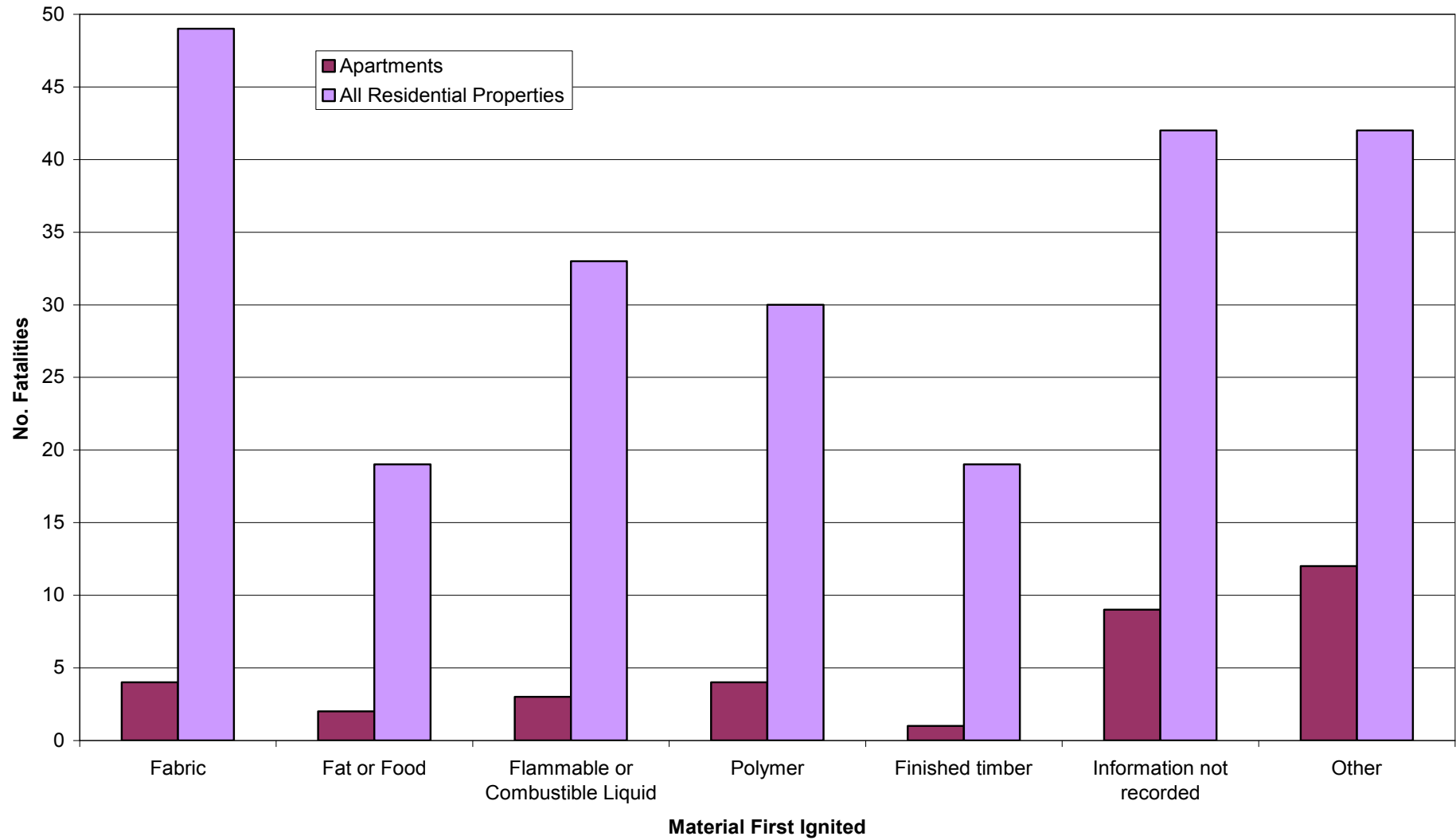


Figure 77: Number of fatalities in residential properties for groups of material first ignited (1995 – 2005).

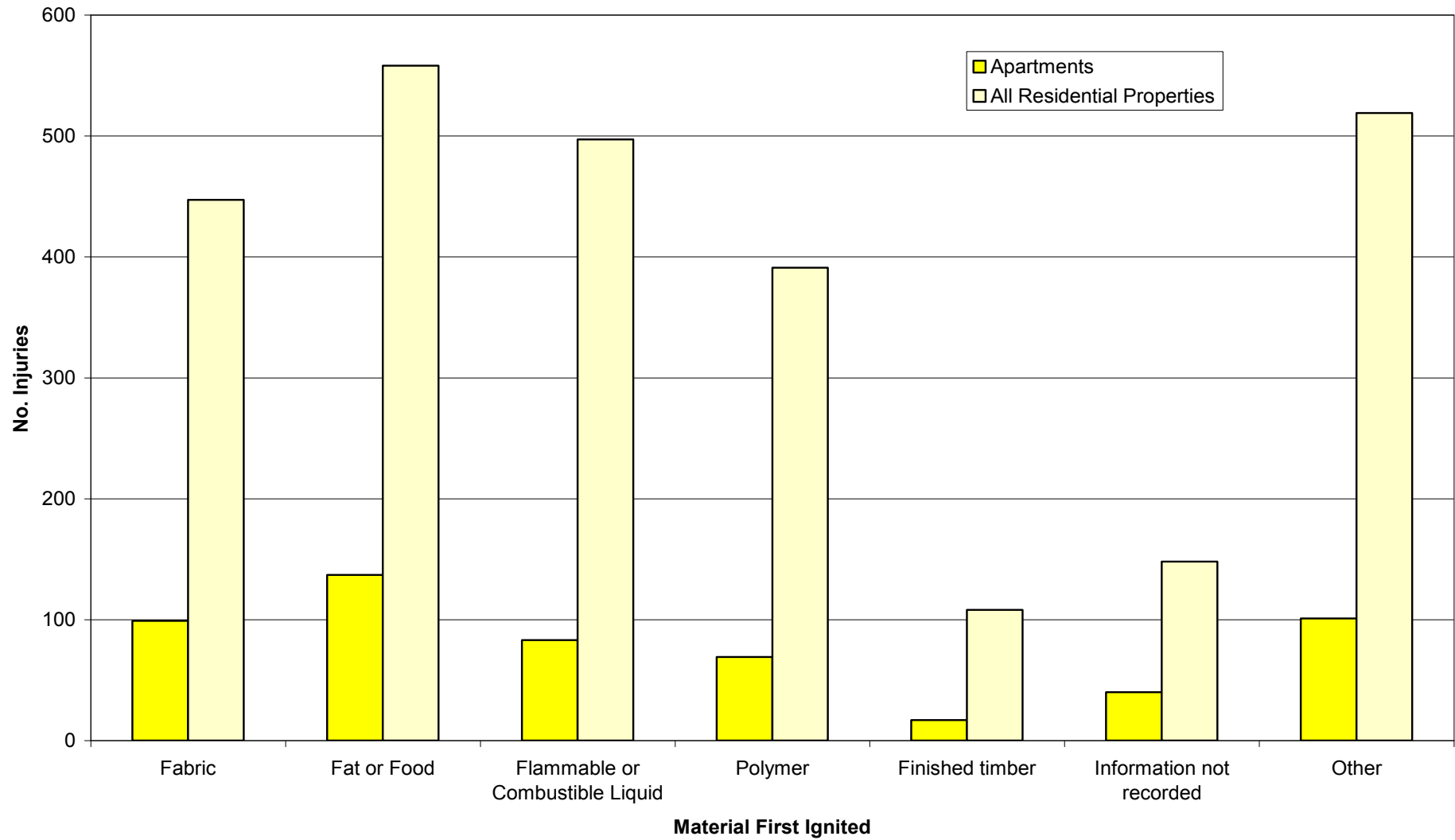


Figure 78: Number of injuries in residential properties for groups of material first ignited (1995 – 2005).

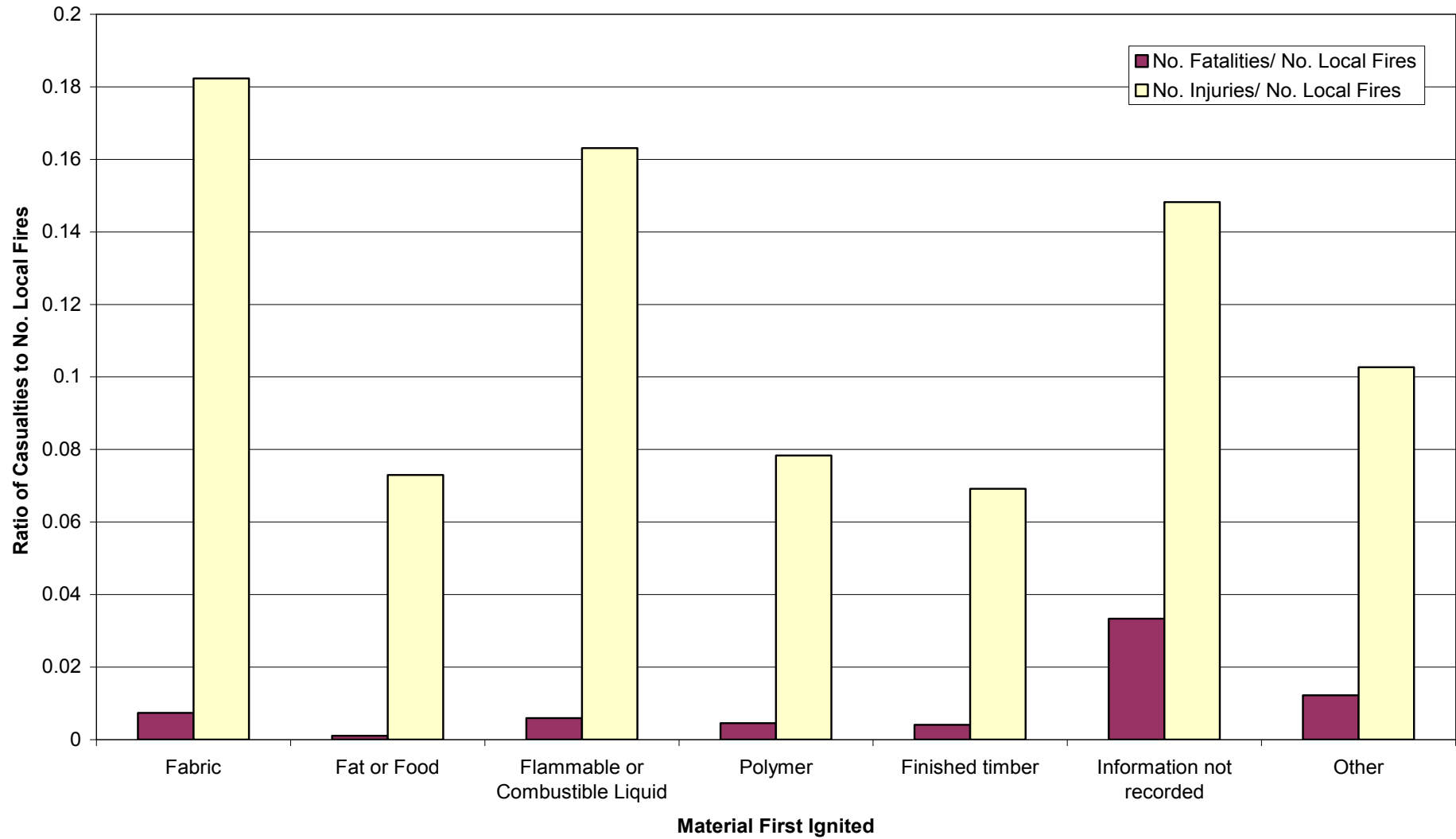


Figure 79: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in apartments as recorded for each group of material first ignited (1995-2005).

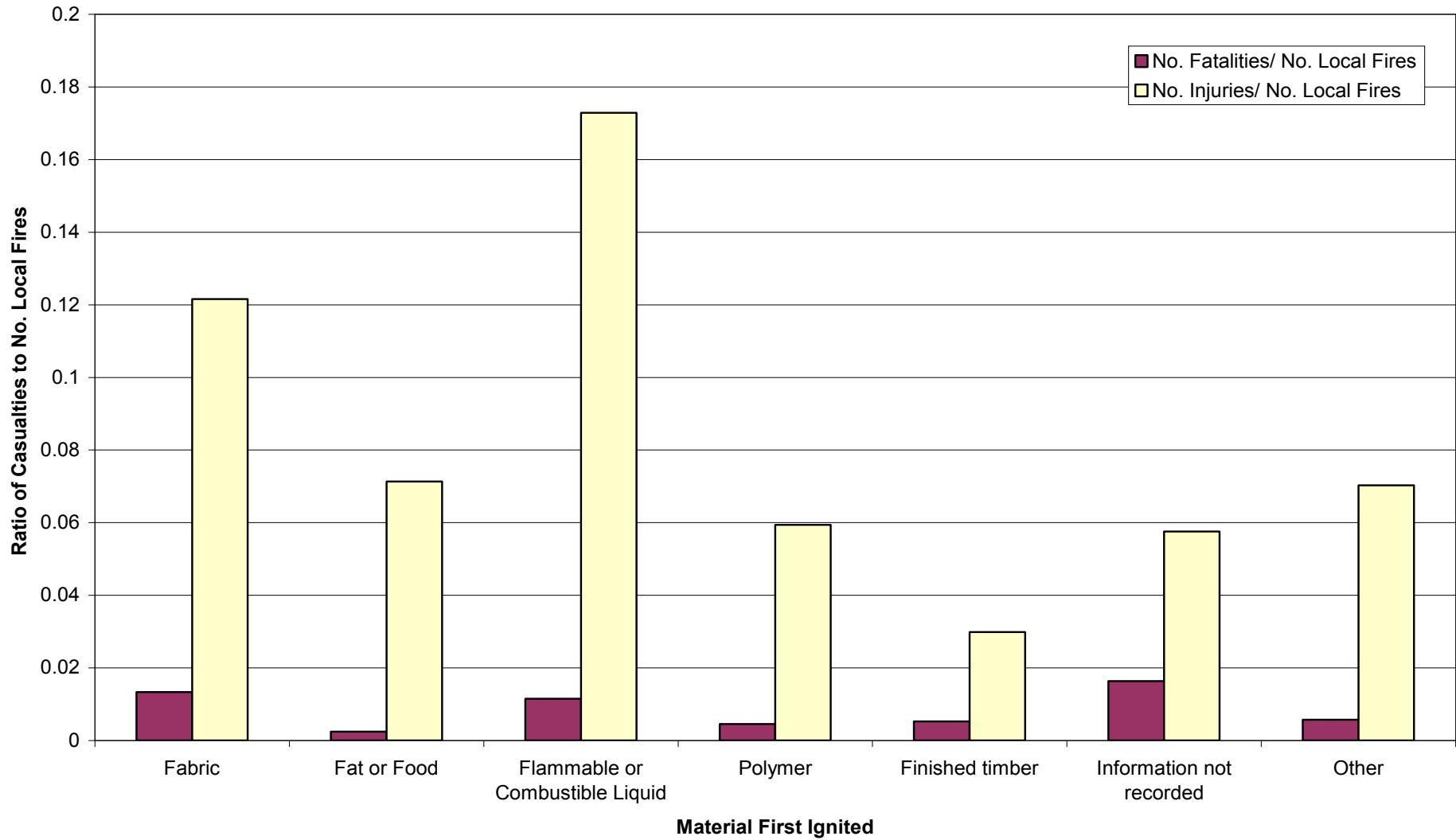


Figure 80: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of material first ignited (1995-2005).

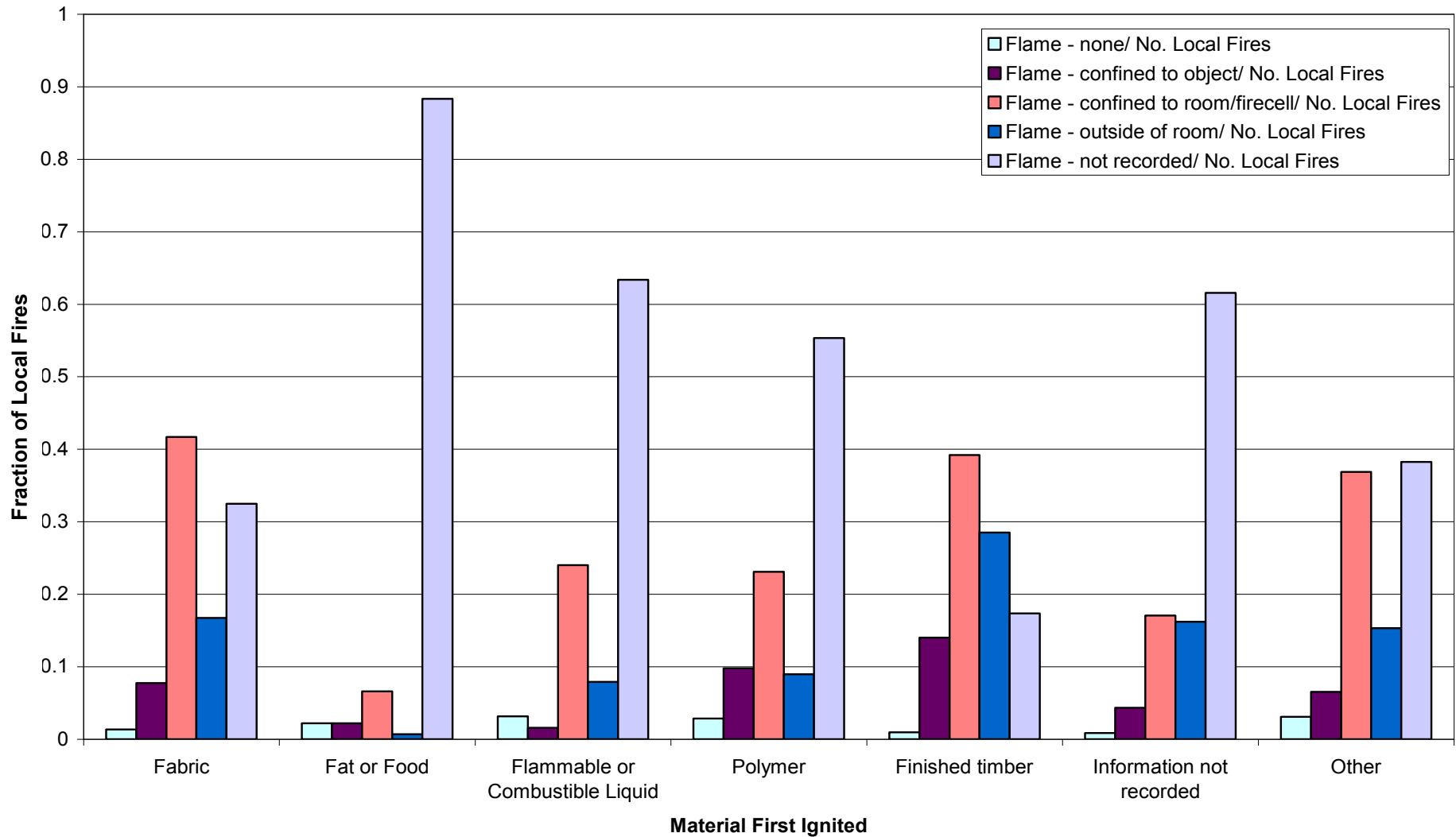


Figure 81: Fractions of fires with flame damage to numbers of total local fires that occurred in apartments as recorded for each group of material first ignited (1986-2005).

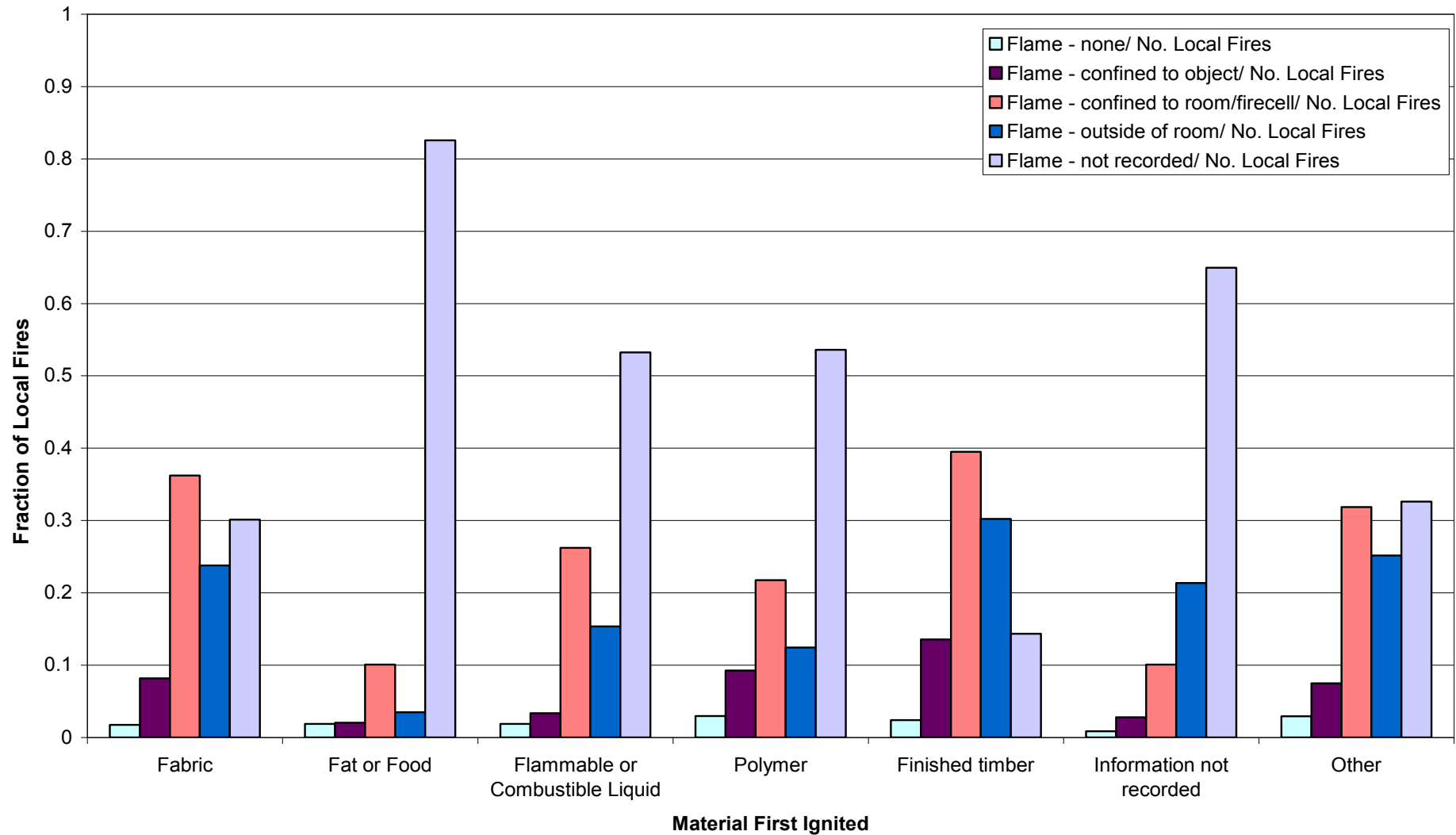


Figure 82: Fractions of fires with flame damage to numbers of total local fires that occurred in all residential structures as recorded for each group of material first ignited (1986-2005).

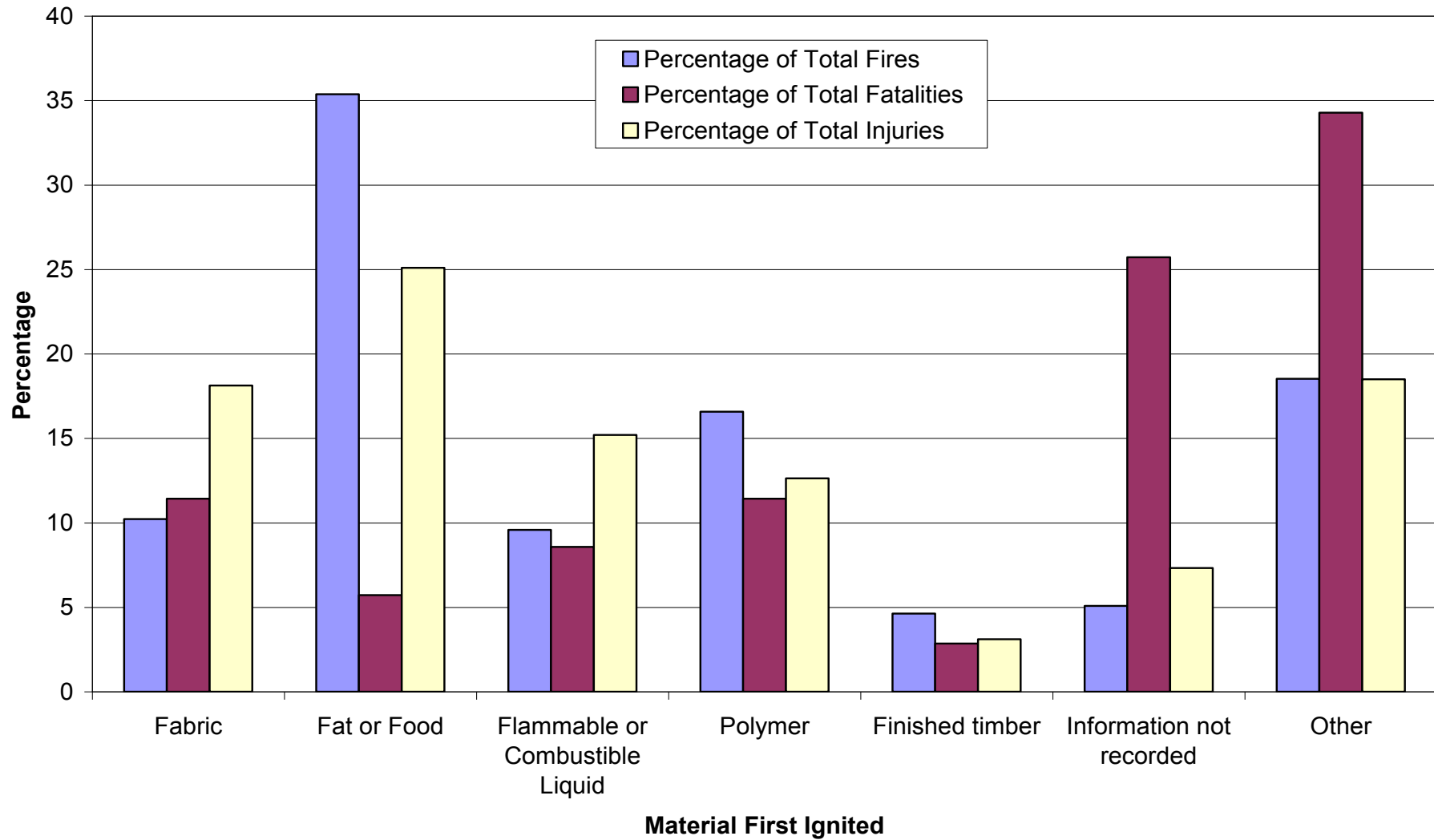


Figure 83: Percentage of totals for fires, fatalities and injuries that occurred in apartments as recorded for each group of first material ignited (1995-2005).

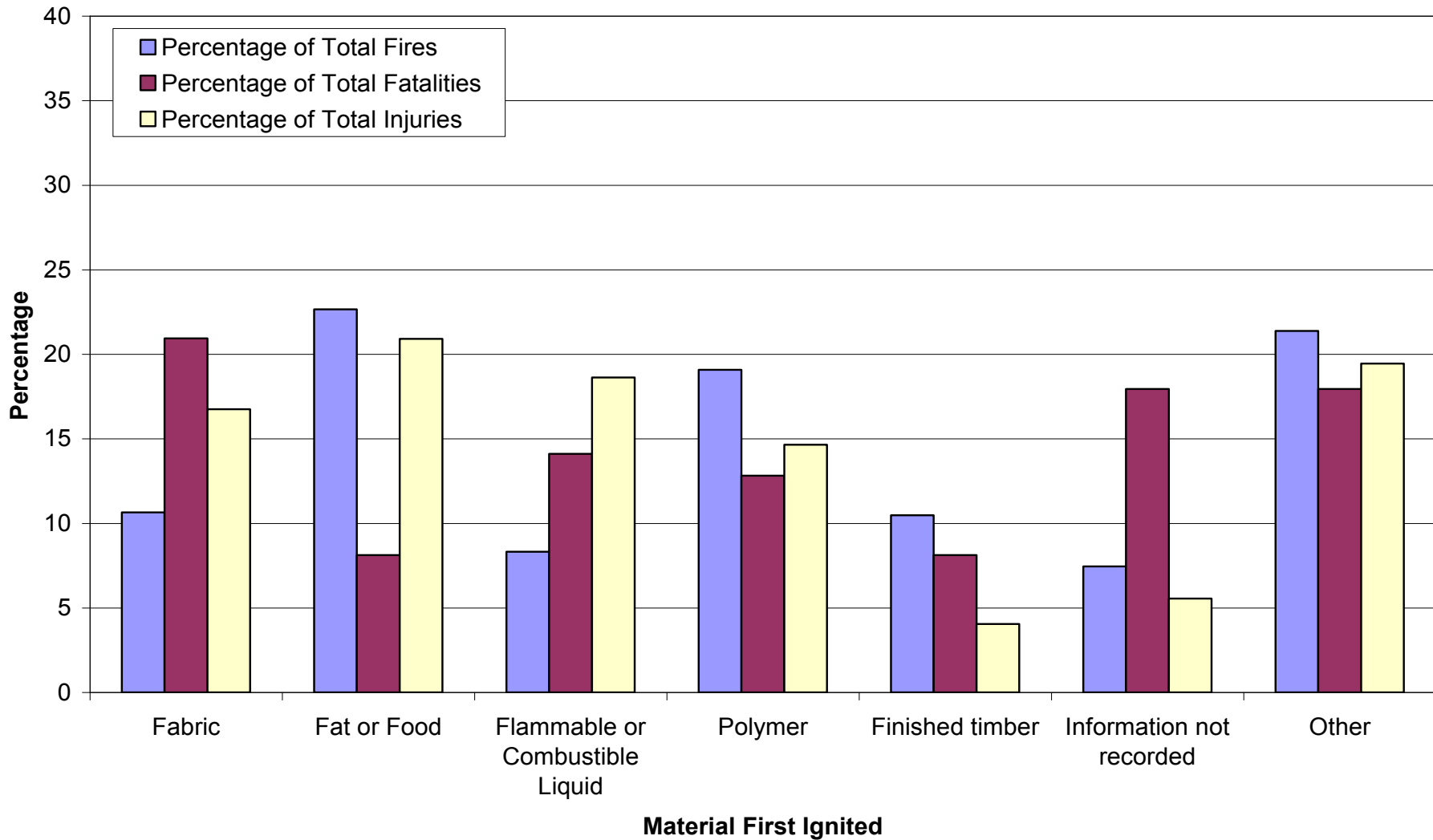


Figure 84: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of first material ignited (1995-2005).

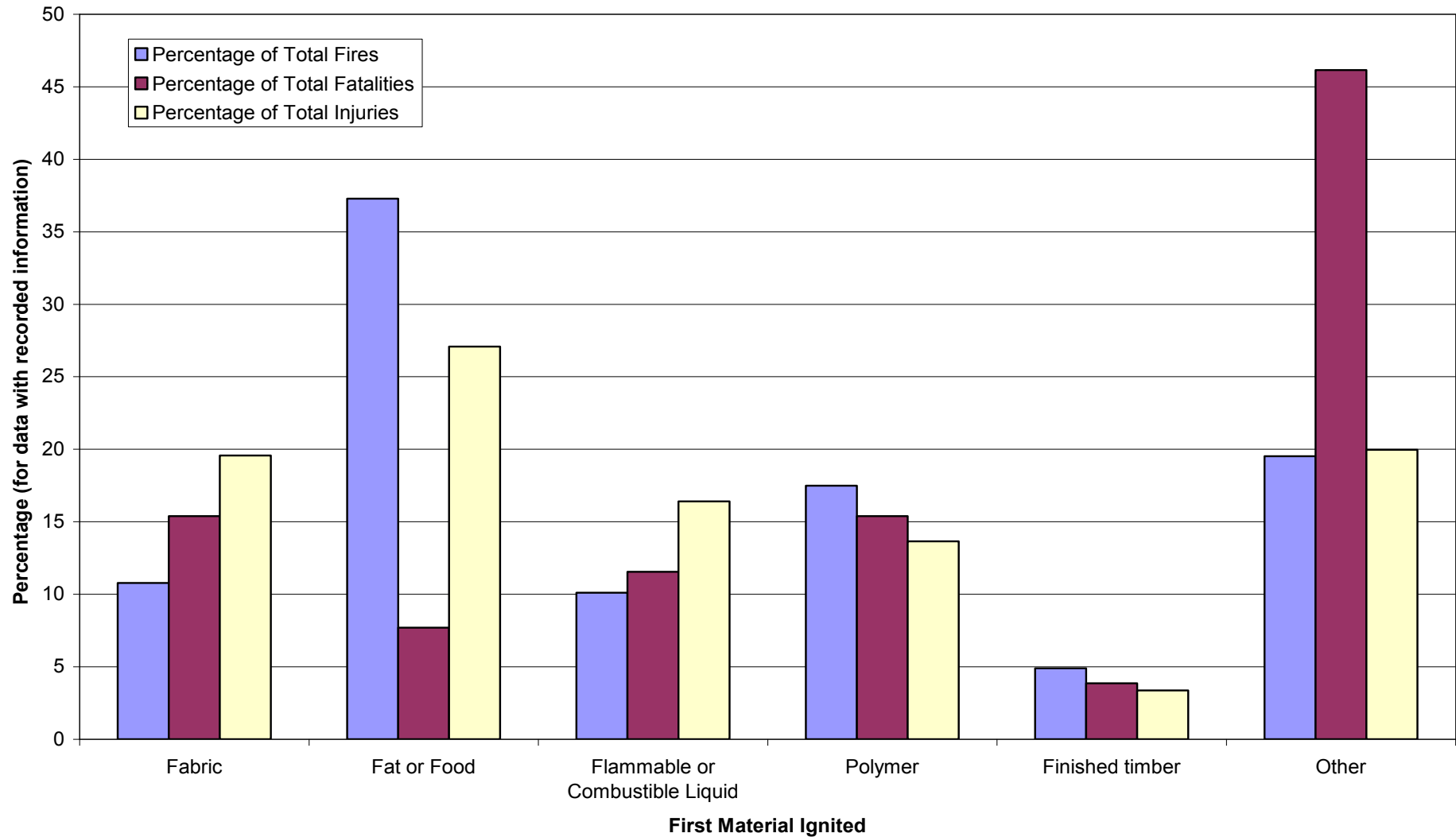


Figure 85: Percentage of totals excluding data where information was not recorded for fires, fatalities and injuries that occurred in apartments as recorded for each group of first material ignited (1995-2005).

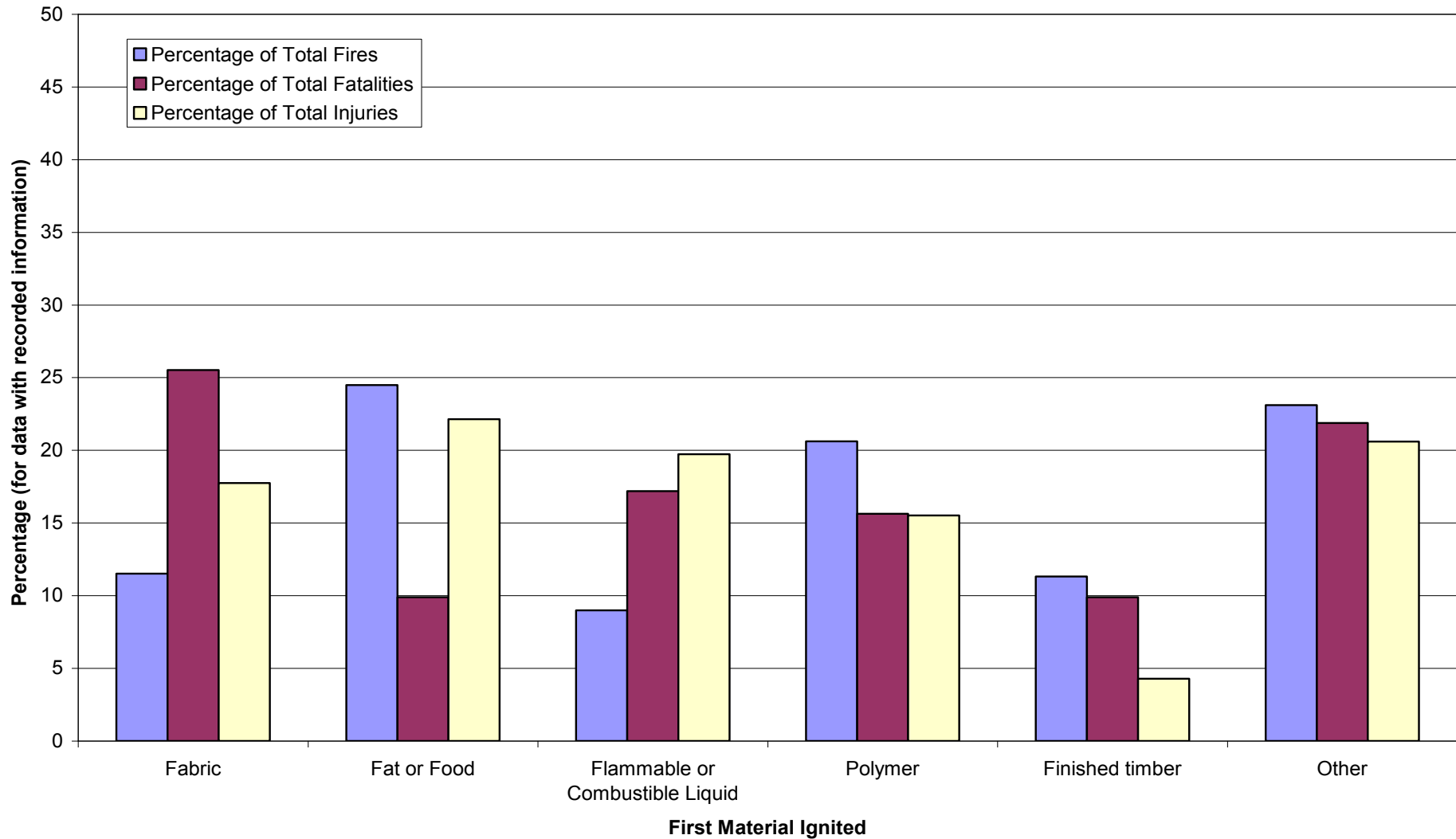


Figure 86: Percentage of totals excluding data where information was not recorded for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of first material ignited (1995-2005).

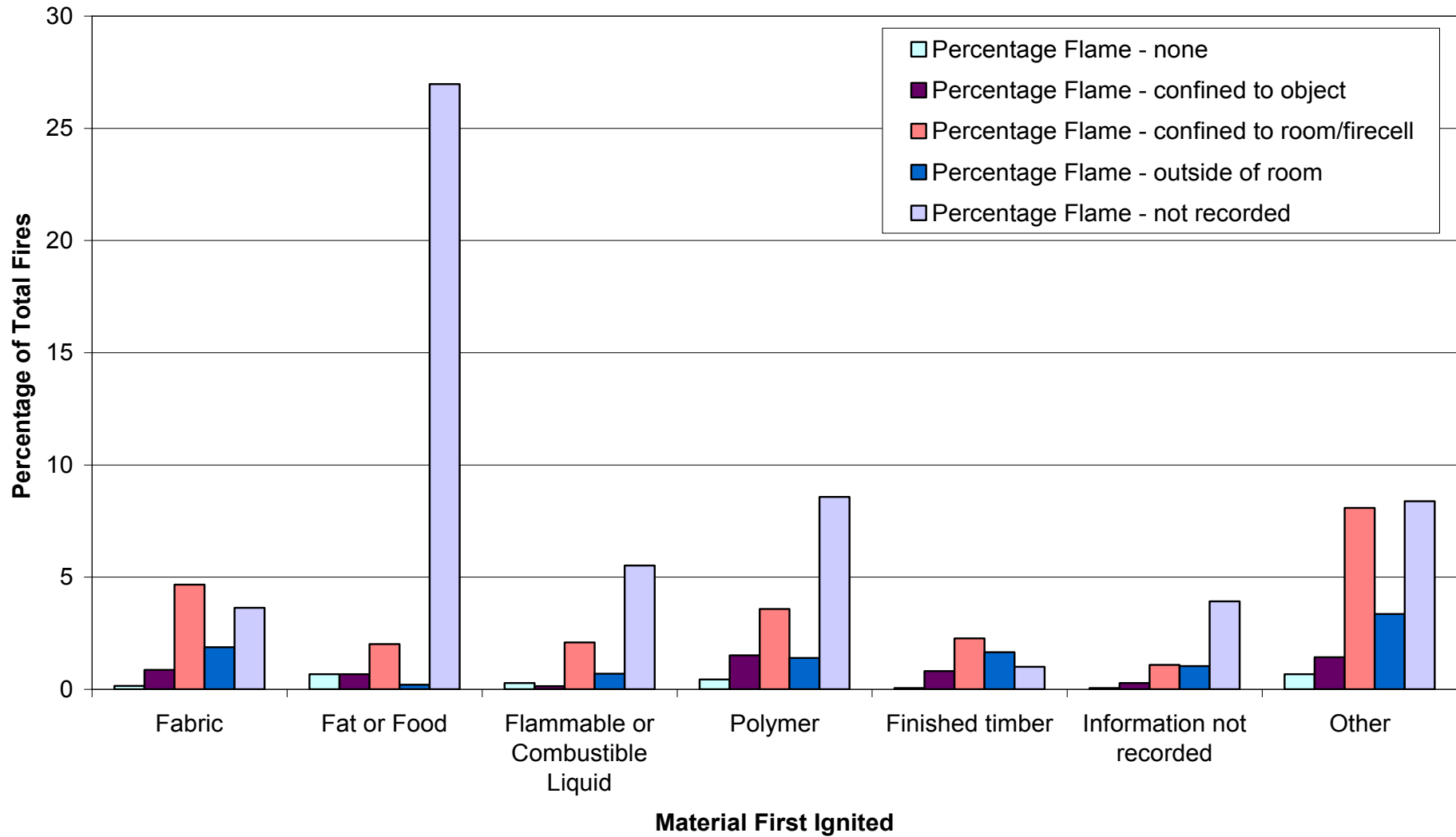


Figure 87: Percentage of total fires for fires with flame damage that occurred in apartments as recorded for each group of first material ignited (1986-2005).

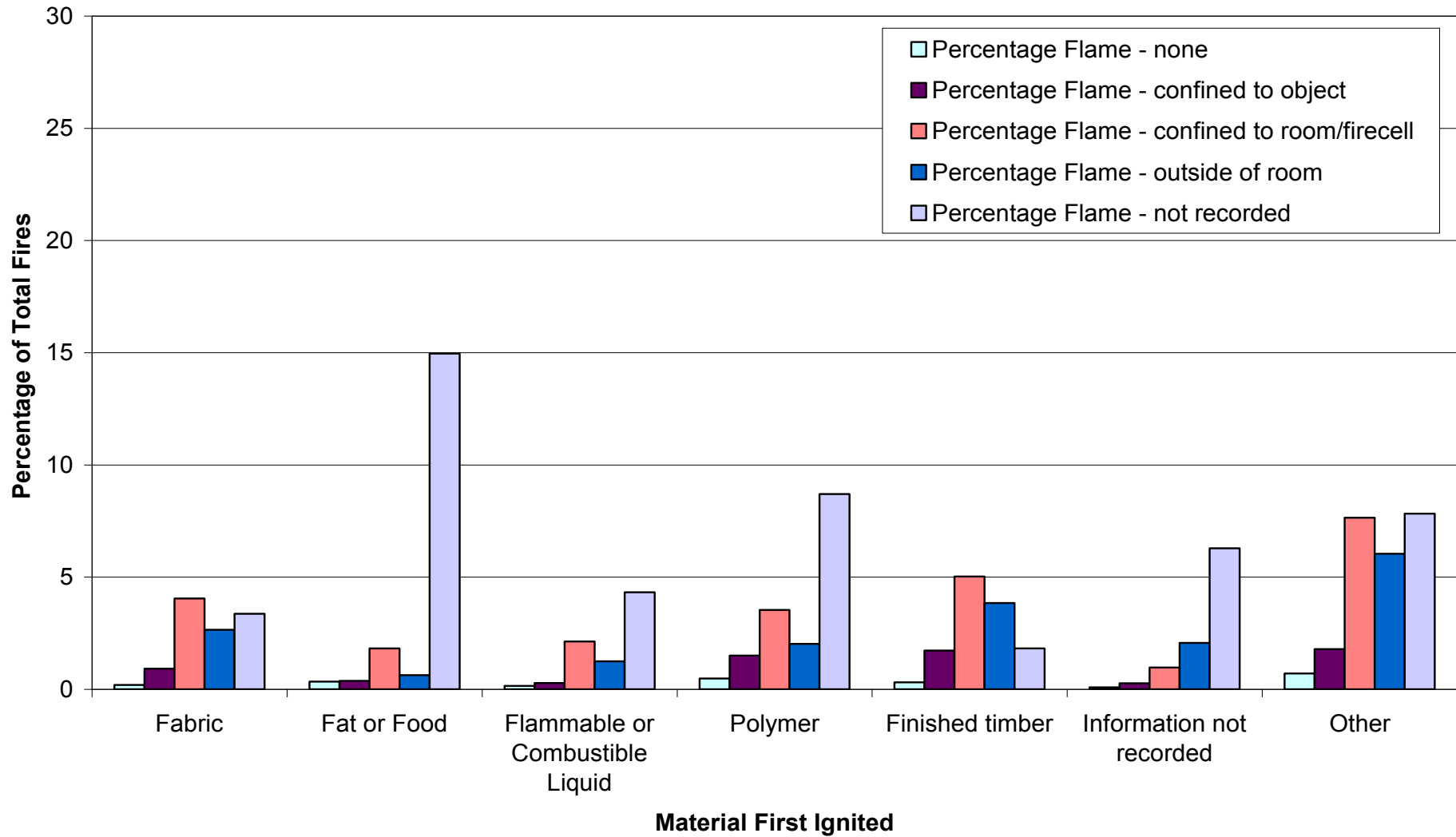


Figure 88: Percentage of total fires for fires with flame damage that occurred in all residential structures as recorded for each group of first material ignited (1986-2005).

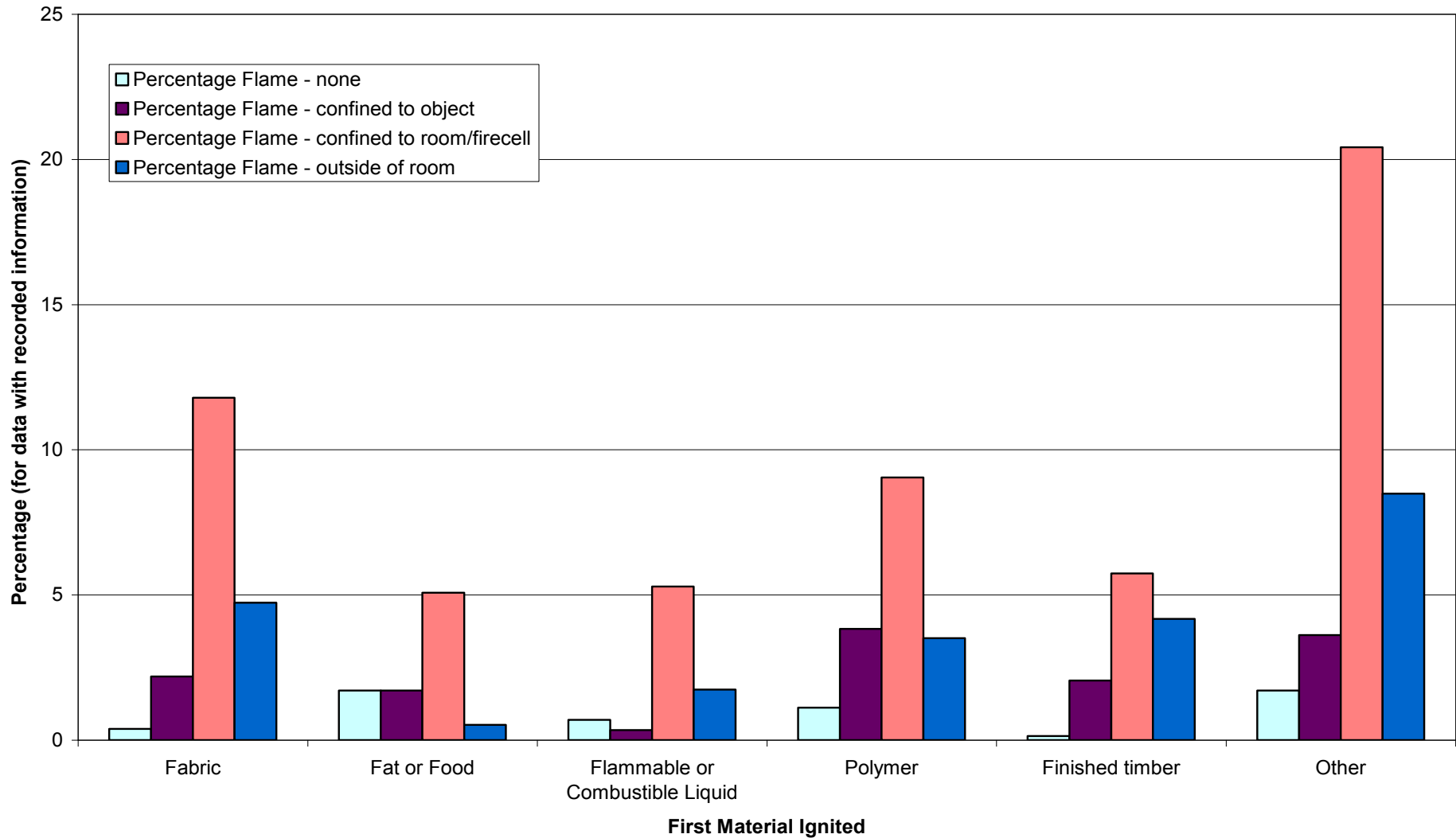


Figure 89: Percentage of total fires, excluding data where information was not recorded, for fires with flame damage that occurred in apartments as recorded for each group of first material ignited (1986-2005).

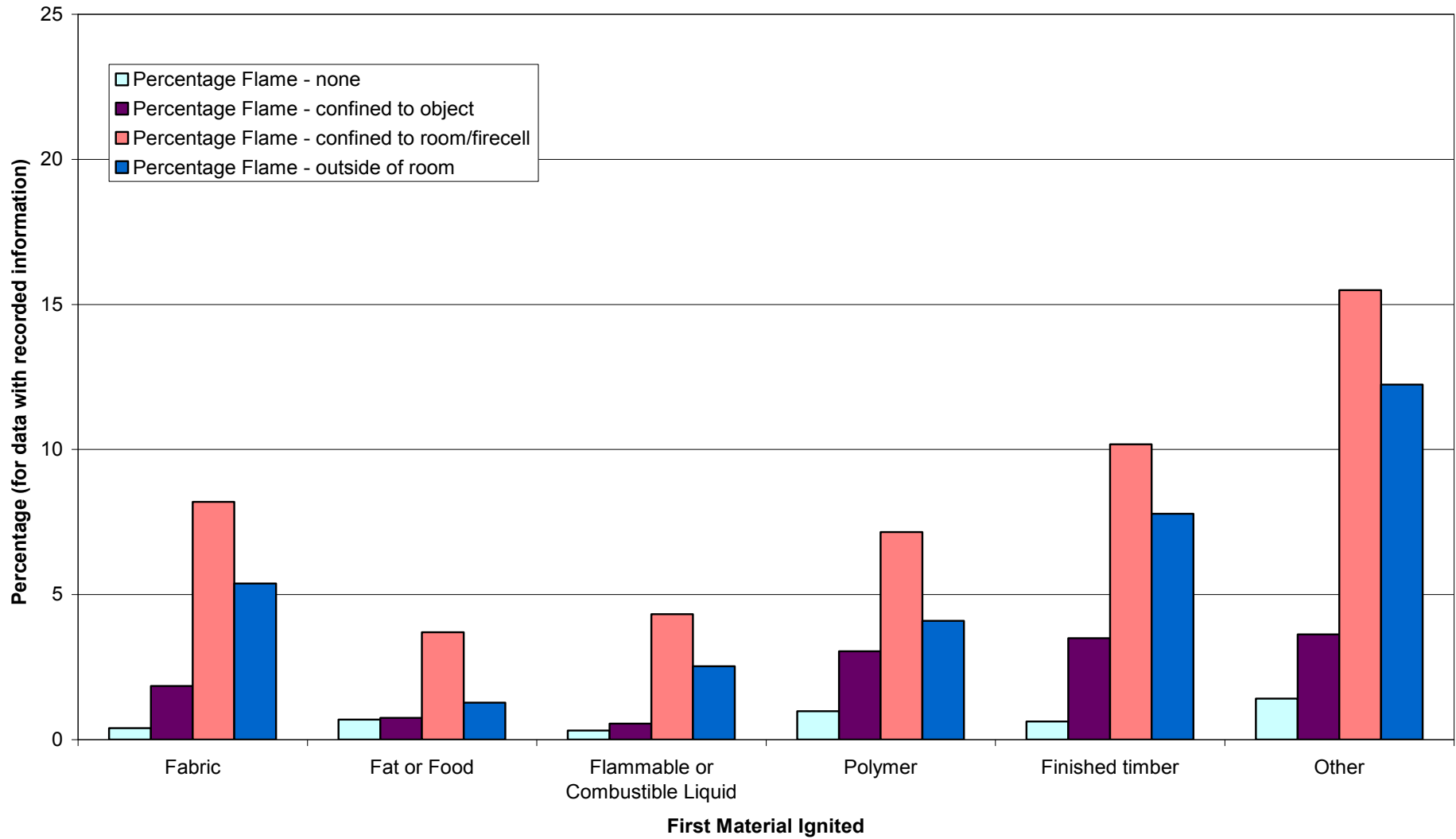


Figure 90: Percentage of total fires, excluding data where information was not recorded, for fires with flame damage that occurred in all residential structures as recorded for each group of first material ignited (1986-2005).

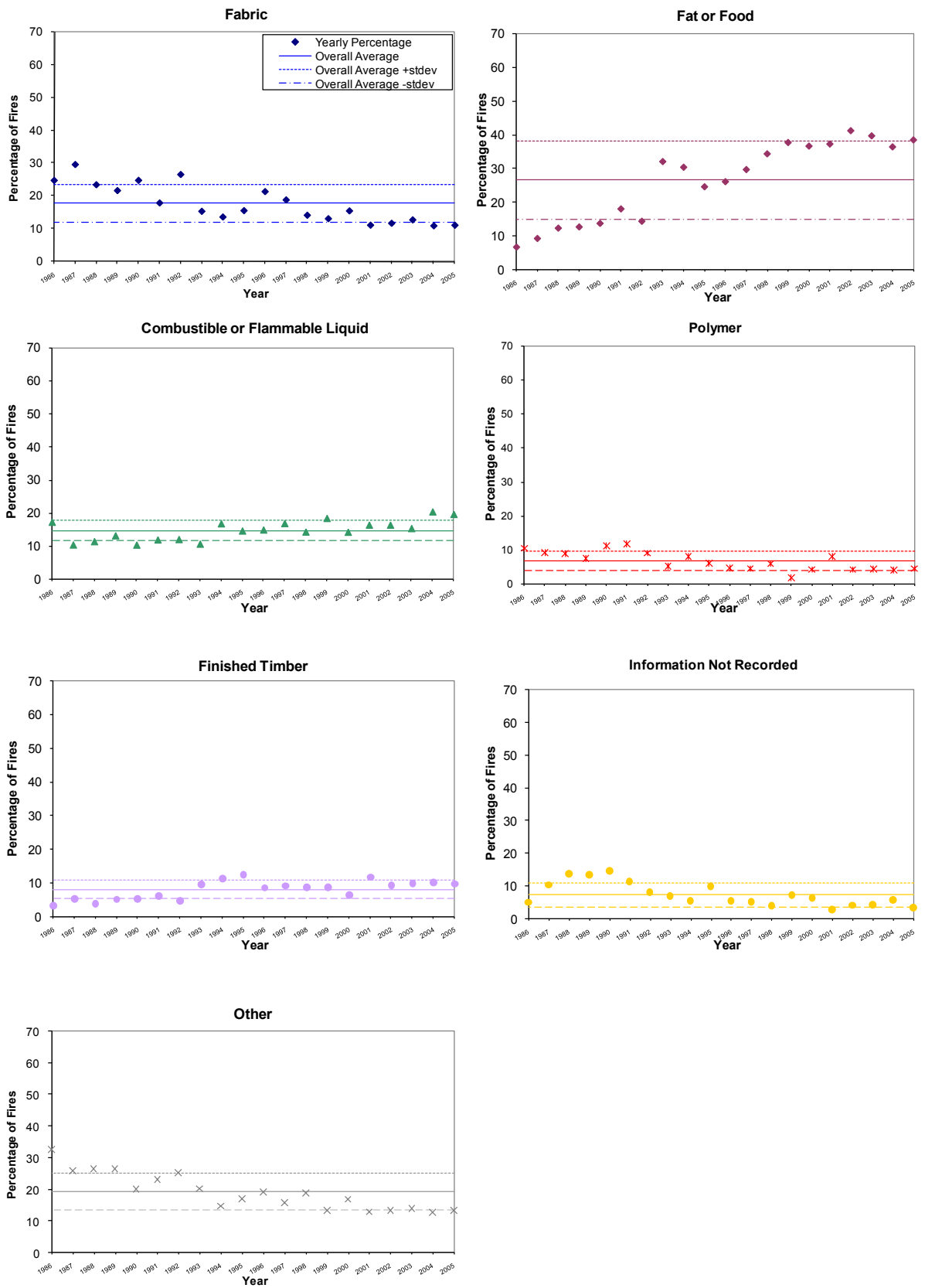


Figure 91: Yearly percentage of total apartment structure fire incidents for each group of materials first ignited (1986 – 2005).

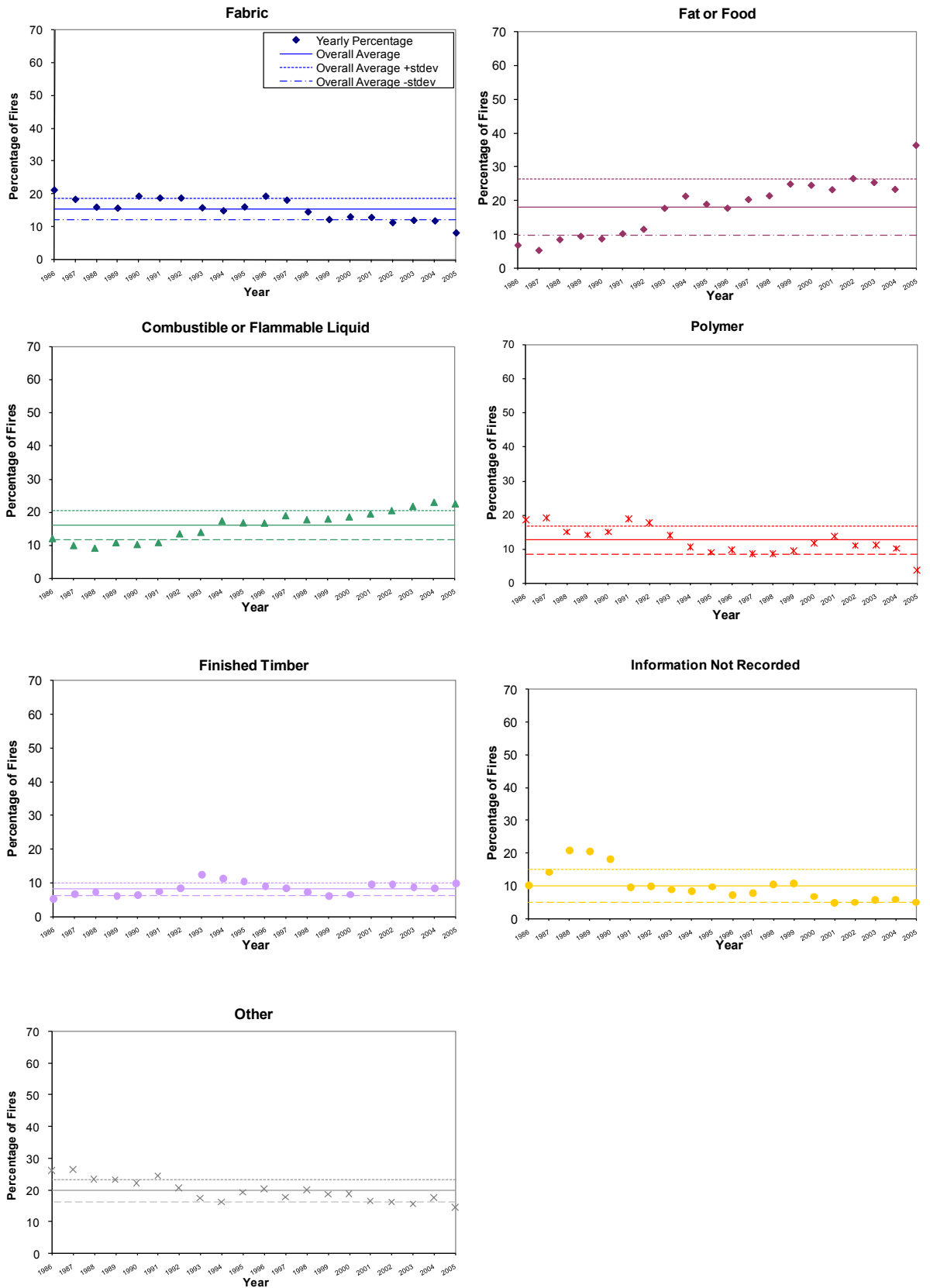


Figure 92: Yearly percentage of total all residential structure fire incidents for each group of materials first ignited (1986 – 2005).

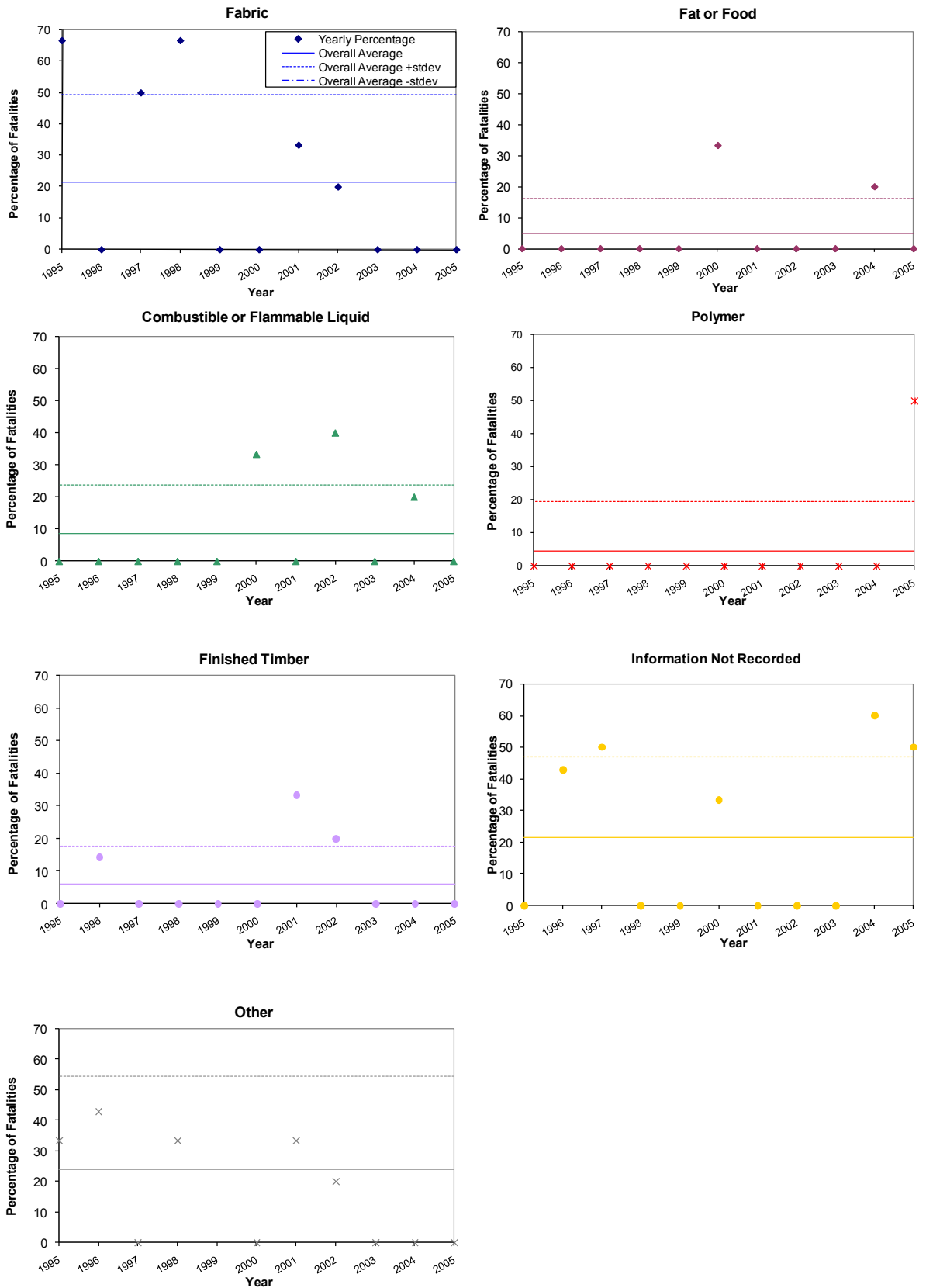


Figure 93: Yearly percentage of total apartment structure fire fatalities for each group of materials first ignited (1995 – 2005).

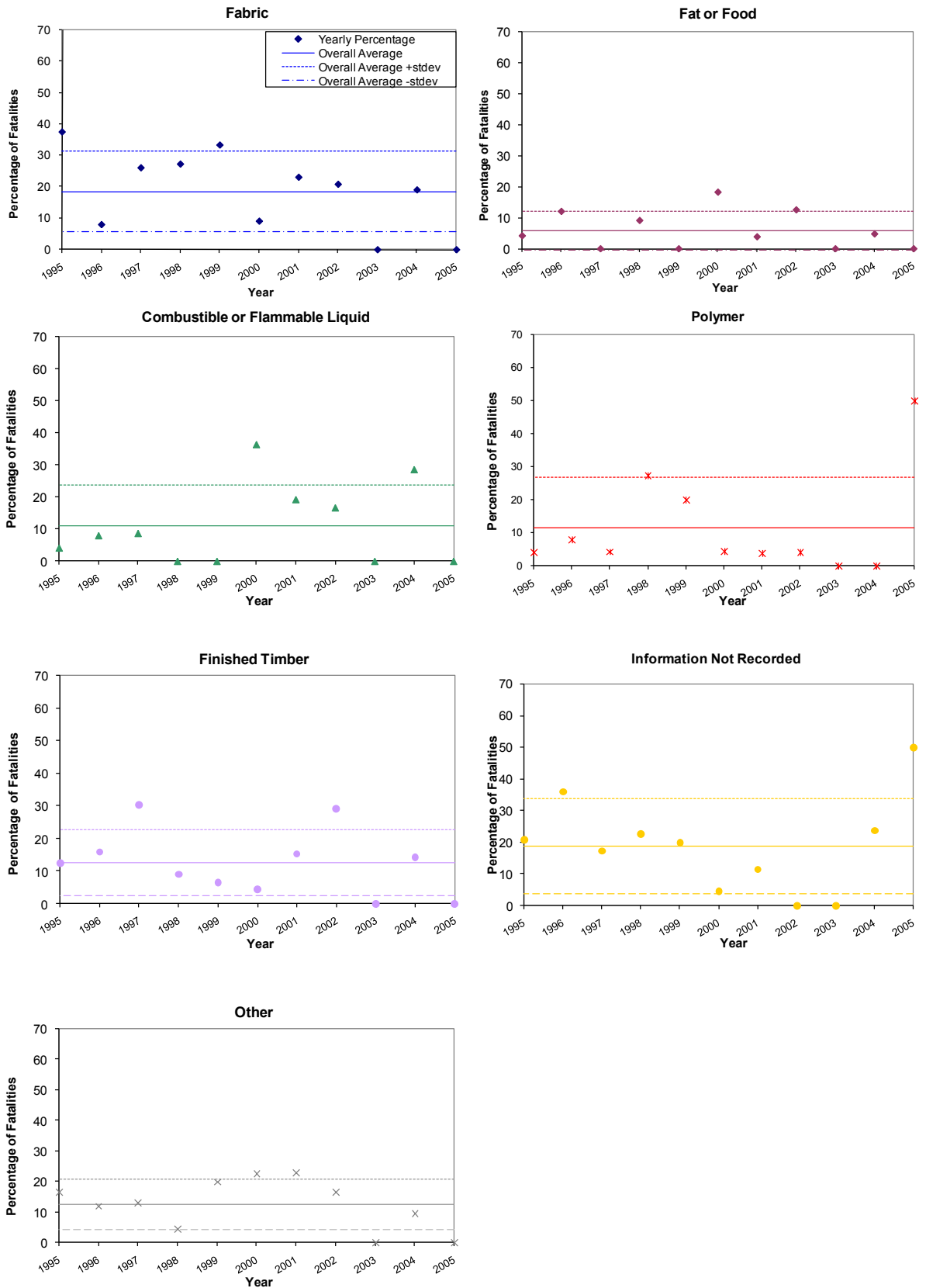


Figure 94: Yearly percentage of total residential structure fire fatalities for each group of materials first ignited (1995 – 2005).

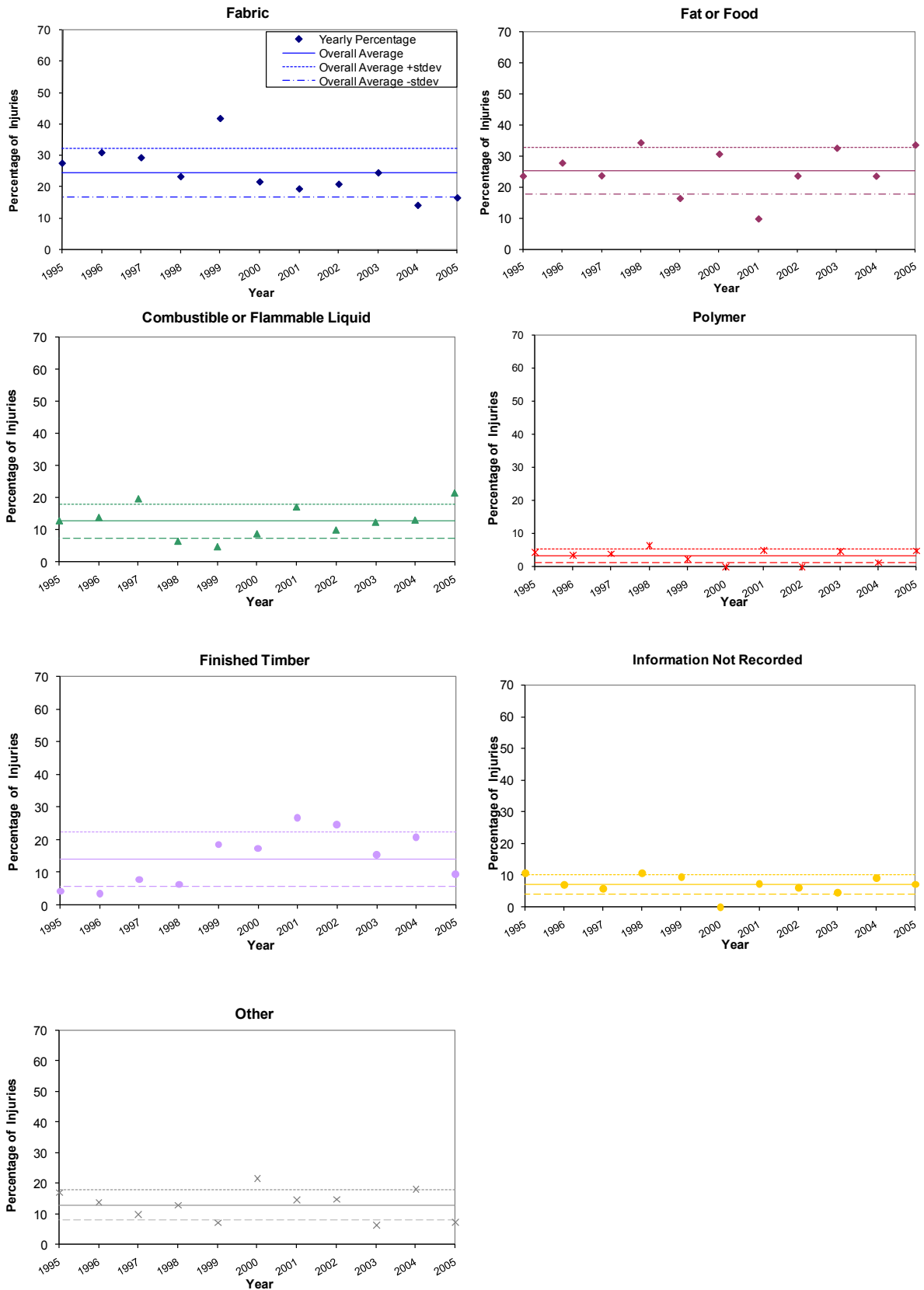


Figure 95: Yearly percentage of total apartment structure fire injuries for each group of materials first ignited (1995 – 2005).

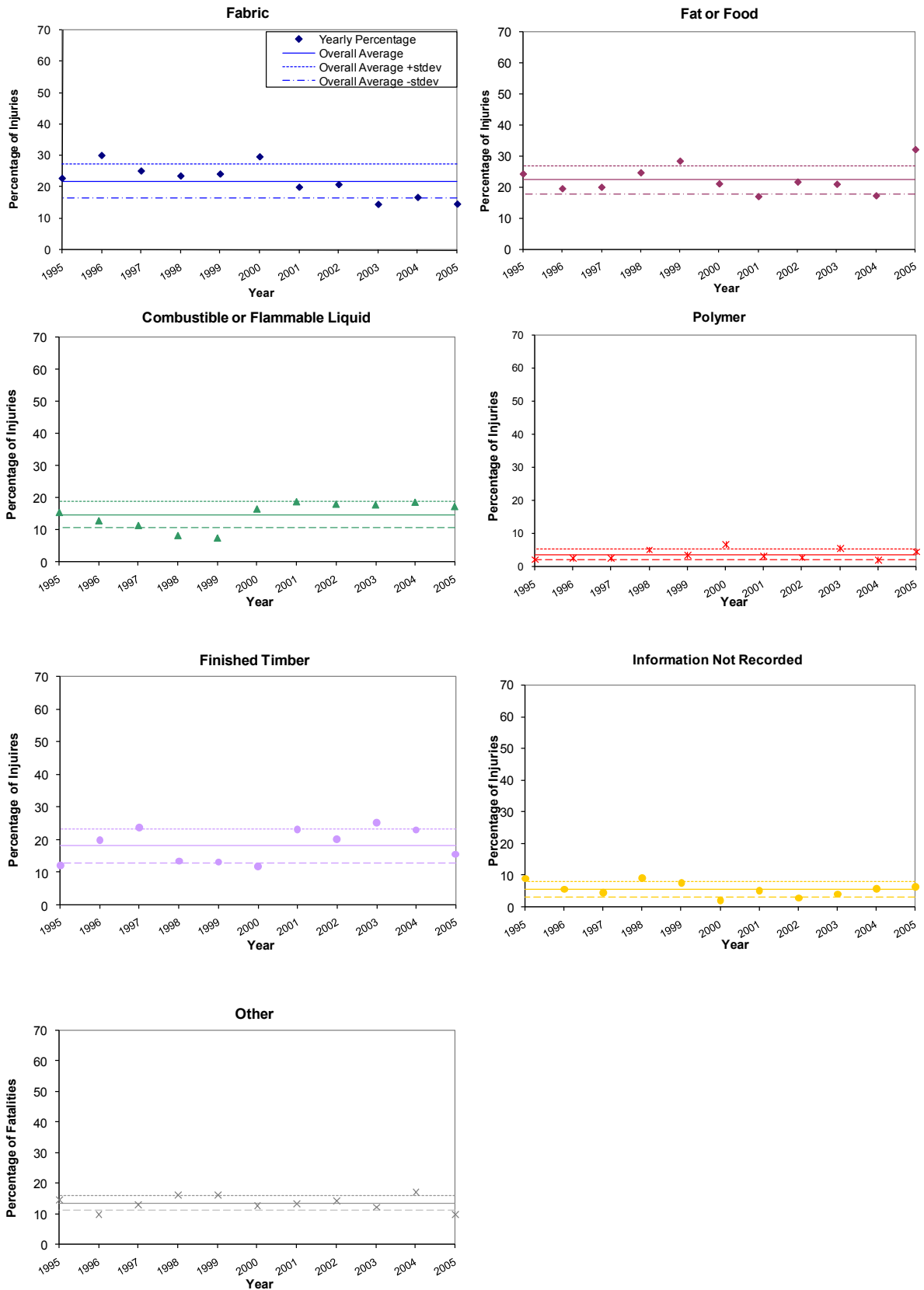


Figure 96: Yearly percentage of total residential structure fire injuries for each group of materials first ignited (1995 – 2005).

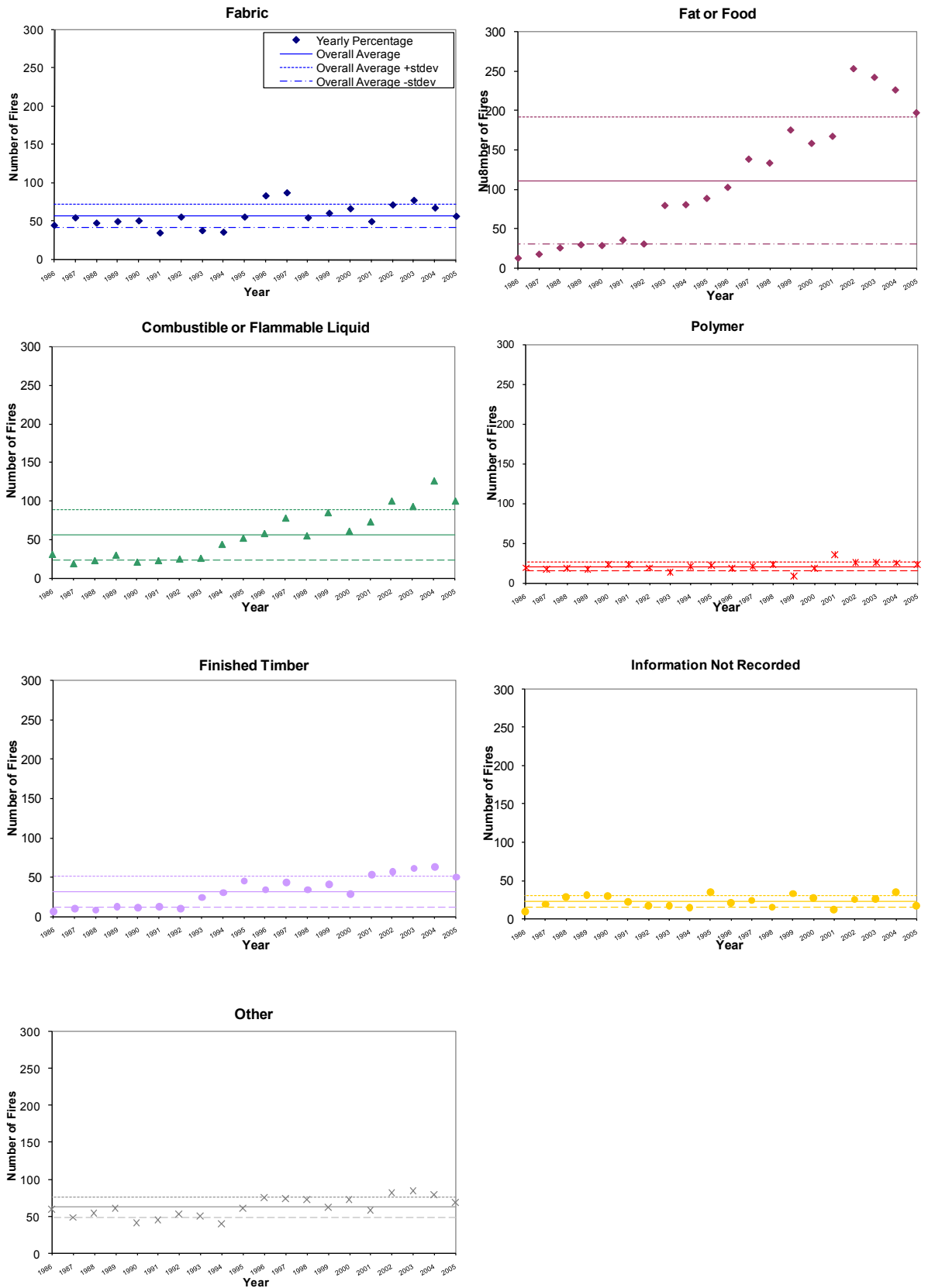


Figure 97: Number of fire incidents for each group of materials first ignited that occurred each year in apartments (1986 – 2005).

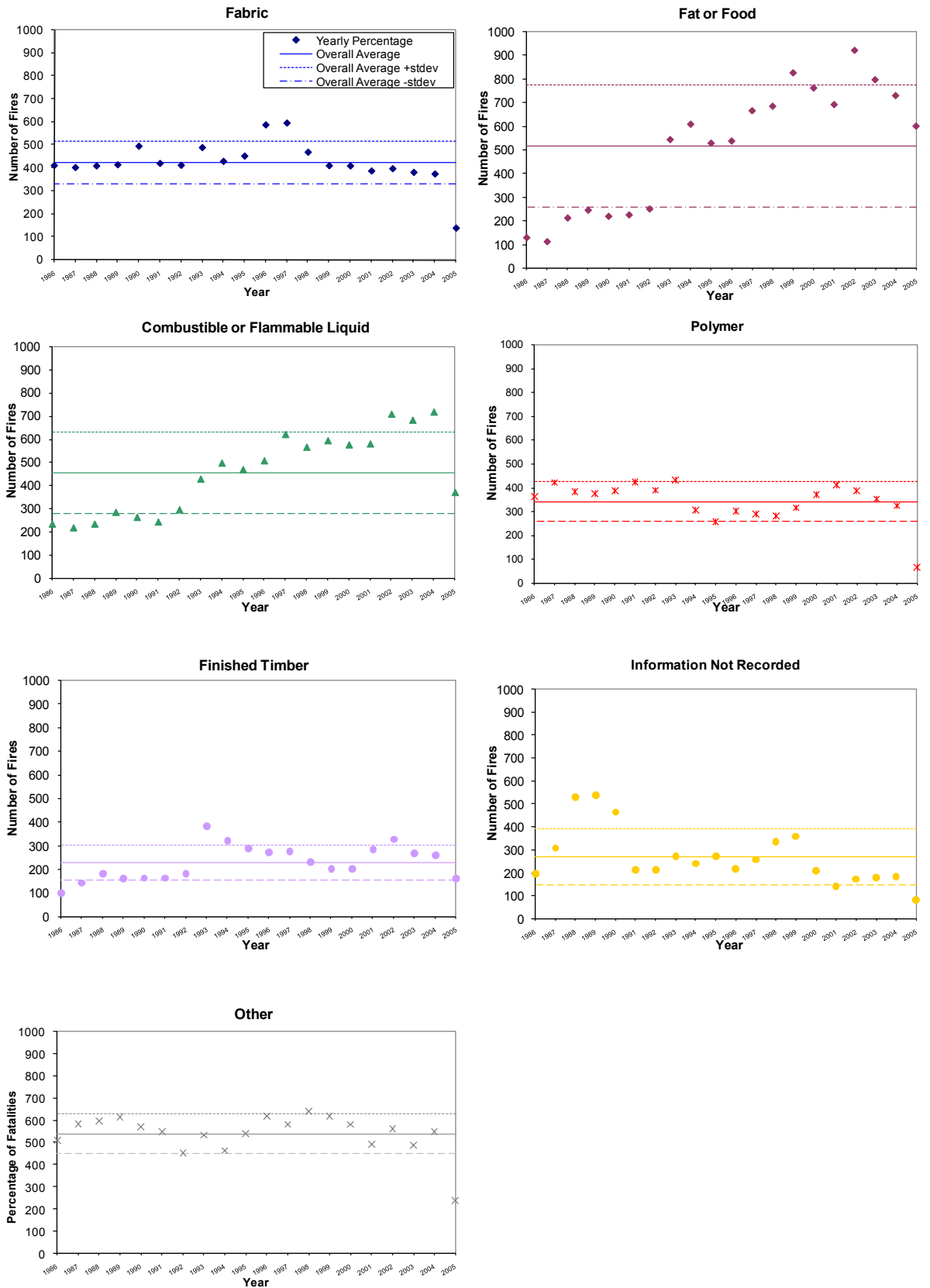


Figure 98: Number of fire incidents for each group of materials first ignited that occurred each year in all residential structures (1986 – 2005).

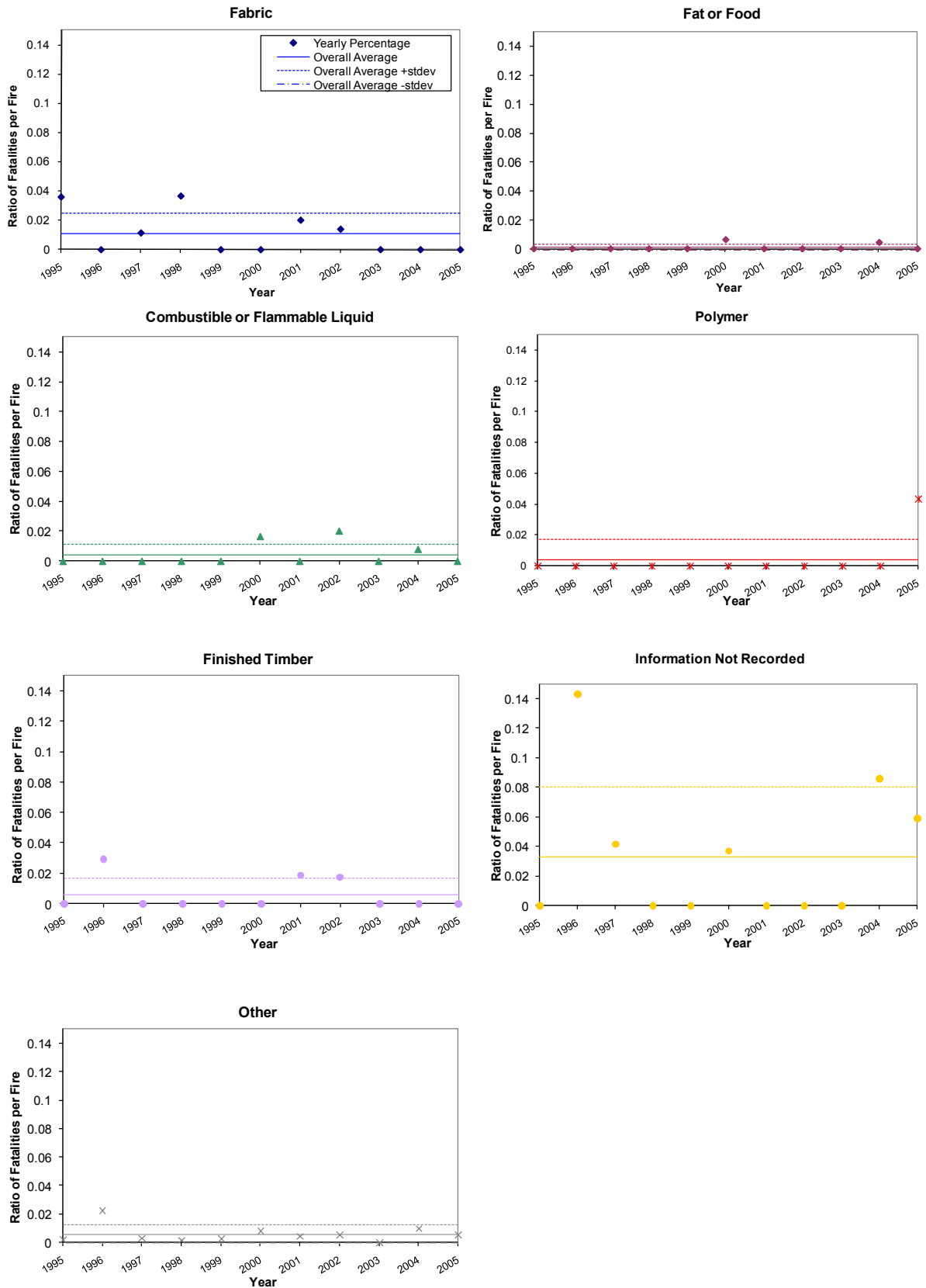


Figure 99: Number of fatalities for each group of materials first ignited that occurred each year in apartments (1995 – 2005).

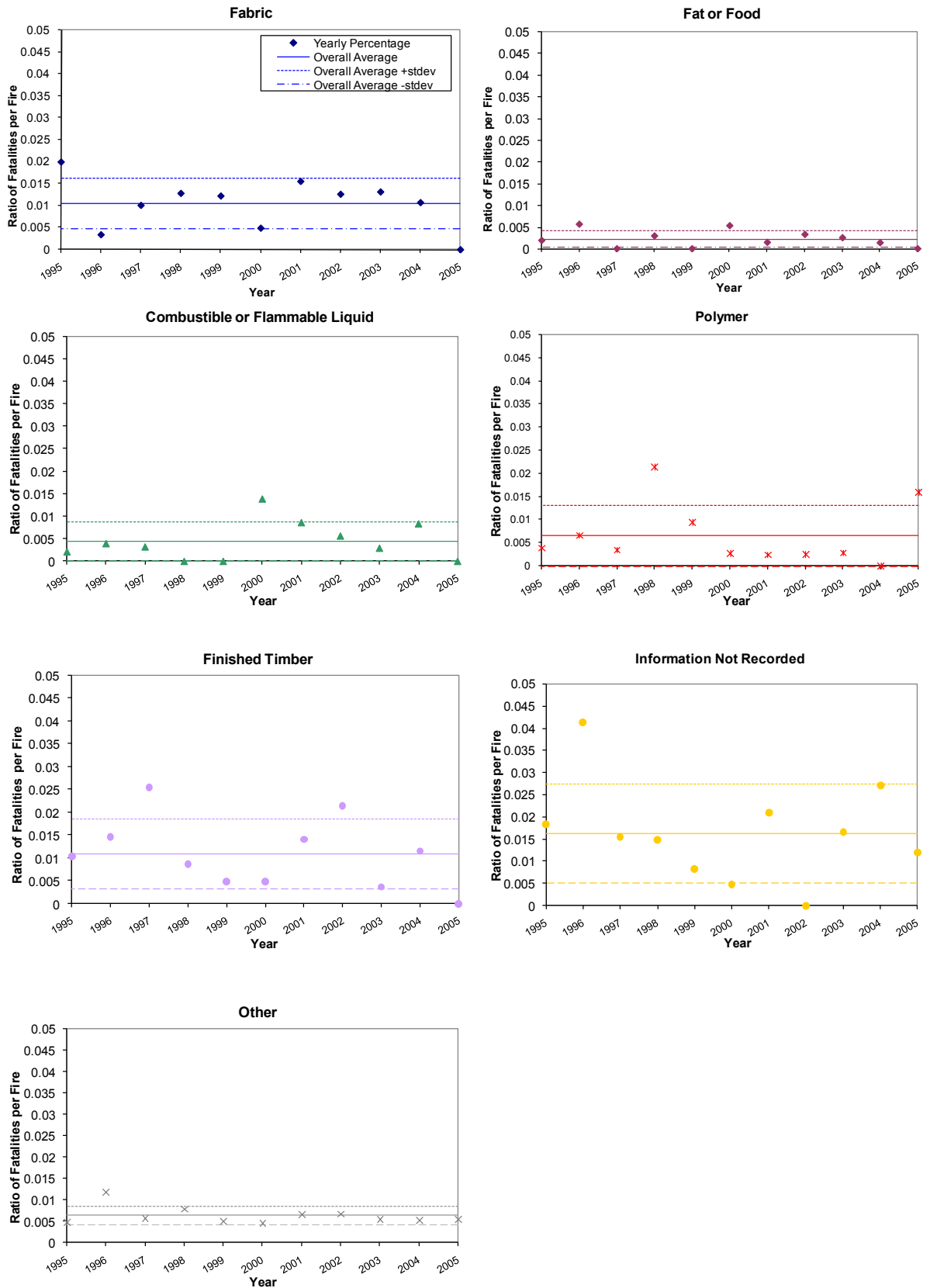


Figure 100: Number of fatalities for each group of materials first ignited that occurred each year in all residential structures (1995 – 2005).

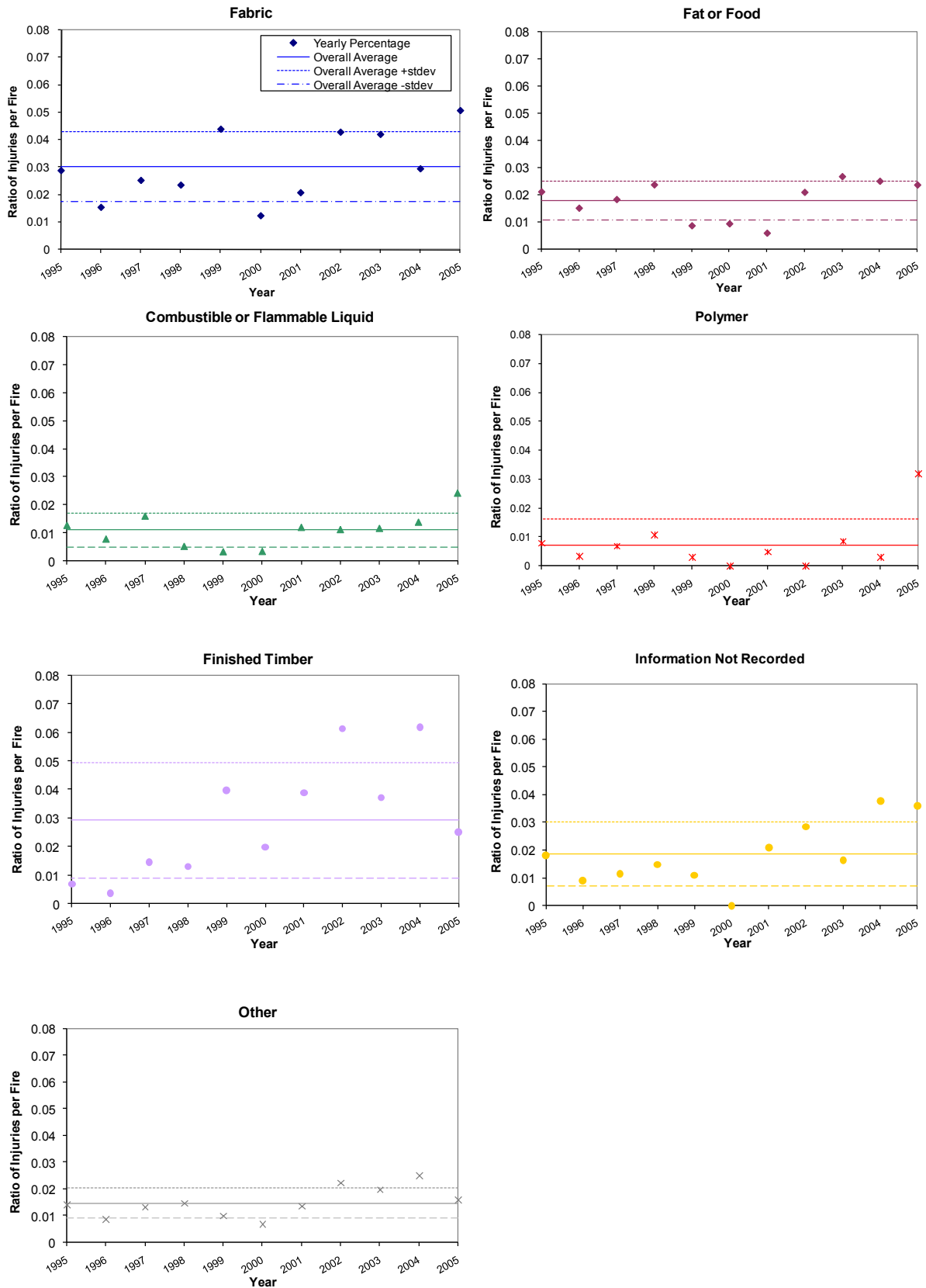


Figure 101: Number of injuries for each group of materials first ignited that occurred each year in apartments (1995 – 2005).

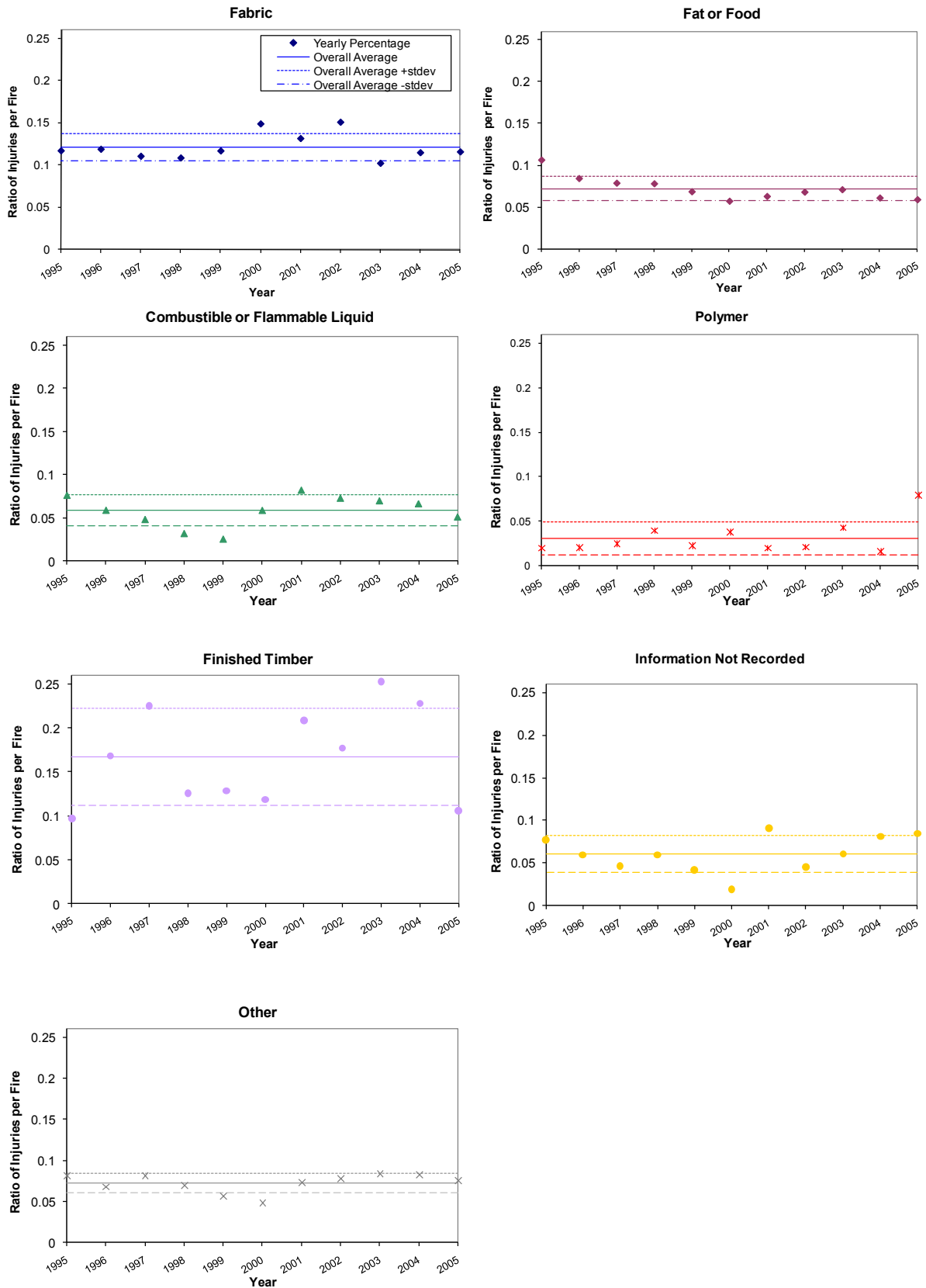


Figure 102: Number of injuries for each group of materials first ignited that occurred each year in all residential structures (1995 – 2005).

4.4 Cause of Ignition

The numbers of fires that have occurred collectively from 1986 to 2005 in residential structures are shown in Figure 255 and in apartments only are shown in Figure 256. There are 74 classes within the category of “Cause of Ignition” (as listed in Appendix A), therefore it is suggested that using the zoom feature on the soft copy may ease viewing of some of the figure. The ranking of the most common cause of ignition (up to the first 10 classes) by number of fire events for each type of property and structure damage are presented in Table 70 and Table 71. The numbers of civilian fatalities and injuries that have occurred collectively from 1995 to 2005 on residential structures are shown in Figure 258 and Figure 260 respectively. The ranking of the most common cause of ignition (up to the first 10 classes) by number of fatalities and injuries for each type of property and structure damage are presented in Table 72 and Table 73 respectively. The ratios of the number of fatalities and number of injuries to the number of fires that occurred in each cause of ignition (using the collective data from 1995 to 2005) are shown in Figure 261 and Figure 262 respectively. The top 10 ratios of numbers of fatalities and injuries to numbers of fires for each cause of ignition for each type of property and structure damage are presented in Table 74 and Table 75 respectively. The ratios of the number of total fatalities and the number of total injuries to the percentage of total fires that occurred in each cause of ignition (using the collective data from 1995 to 2005) are shown in Figure 263 and Figure 264 respectively. The top 10 ratios of percentage of total fatalities and total injuries to the percentage of total fires for each cause of ignition for each type of property and structure damage are presented in Table 80 and Table 81 respectively. The number of fires according to the extent of flame damage for fire events recorded for each cause of ignition is shown in Figure 265 for all residential structures.

4.4.1 All Classes

All classes of the cause of ignition were initially analysed individually in order to gain an initial overview of the important aspects and predominant classes of the data set. A full listing of each of the classes for the cause of ignition category is presented in Appendix A. The results from this analysis were then used to select the most important and appropriate groupings of the classes to be used in a finer analysis of the data set. Following is a brief discussion of the results of the analysis using the individual classes for cause of ignition. The associated tables and figures are included in Appendix I.

4.4.1.1 Most Common

The proportion of incidents recorded with no information reported for the cause of fire is low (approximately < 3% for the years considered).

The three most common identified causes of ignition for fire events in apartments and all residential structures (from 1986 to 2005) are unattended cooking fires (20% and 9% respectively), unattended equipment (12% and 11% respectively) and careless disposal of cigarettes, etc. (6% and 6% respectively) (Table 70).

For the total number of fire events considered (from 1995 to 2005), the three most common causes of ignition for fire fatalities in apartments was unattended cooking fires (20%), other falling asleep (e.g. smoking in bed) (17%) and careless disposal of cigarettes, etc. (14%) and in residential structures were unattended cooking fire (16%), unknown cause (15%) and falling asleep other than when cooking was involved (e.g. smoking in bed) (11%) (Table 73). However, as previously discussed, the total number of fatalities resulting from fire events in New Zealand is statistically small, therefore care should be used when drawing conclusions based on this data set.

The three most common causes of ignition for fire injuries (including both with and without structure damage) (for 1995 to 2005) were unattended cooking fire (27%), unattended equipment (8%) and careless disposal of cigarettes, etc. (6%) in apartments and were unattended cooking fire (21%), unattended equipment (11%) and people playing with heat sources (7%) in residential structures (Table 75).

4.4.1.1 Historical Trends

The numbers of fires attributed to each item of cause of ignition for each year, during the period from 1995 to 2005, are shown in Figure 283 and Figure 284 for apartments and residential structures respectively. For both fire incidents in apartments and residential structures, unattended cooking fires increased markedly after 2001 and unattended equipment fires decreased markedly after 2001. This may be related to a change in the way the data was recorded.

The numbers of fatalities for each item of cause of ignition for each year, during the period from 1986 to 2005, are shown in Figure 285 and Figure 287 for apartments and residential structures respectively. No trends are obvious. This is expected, due to the very small population sizes and the relatively large proportion of fire events with no information recorded for the cause of ignition.

The number of apartment injuries for each cause of ignition for each year, during the period from 1986 to 2005, is shown in Figure 289. The number of all residential injuries for each year, during the period from 1986 to 2005, is shown in Figure 291. Again no trends are obvious. A marked increase is observed in the number of injuries per year from statistics before 2001 to the statistics from 2001 and later.

4.4.1.2 Correlations

The numbers of reported fire events for the range of causes of ignition that were considered had a strong correlation for apartments and all residential structures with structure damage (0.94 and 0.94), without structure damage (0.93 and 0.96) and incidents with and without structure damage (0.90 and 0.94), for the years 1986 – 2005 and 1995 – 2005 respectively (Table 12).

The numbers of fatalities for the range of causes of ignition that were considered had a strong correlation for apartments and all residential structures with structure damage (0.93) and poor correlation when considering fire events “without structure damage” (0.60), for the years 1986 – 2005 (Table 12). Strong correlation exists between the numbers of fire injuries that occurred in apartments (with and without structure damage) and all residential structures (with and without structure damage) (0.92) for years 1995 – 2005 (Table 12).

The numbers of fatalities per fire for the range of causes of ignition that were considered had a moderate correlation for apartments and all residential structures with structure damage (0.84) and for apartments (with and without structure damage) and all residential structures (with and without structure damage) (0.82), for the years 1986 – 2005 (Table 12). Poor correlation exists between the numbers of fatalities per fire for apartments and residential structures without structure damage (0.74), for the years 1986 – 2005 (Table 12).

The correlations between fires and fatalities (1995 – 2005) were poor for apartments with damage (0.74), residential structures with damage (0.74), apartments (with and without damage) (0.64) and residential structures (with and without damage) (0.74) (Table 13). There was no correlation between fires and fatalities for either apartments without damage (0.00) or residential structures without damage (0.20) (Table 13).

The numbers of injuries for the range of causes of ignition that were considered had a strong correlation for apartments and all residential structures with structure damage

(0.94), without structure damage (0.96) and apartments (with and without structure damage) and all residential structures (with and without structure damage) (0.96), for the years 1986 – 2005 (Table 12).

The numbers of injuries per fire for the range of causes of ignition that were considered had a poor correlation for apartments and all residential structures with structure damage (0.56) and for apartments (with and without structure damage) and all residential structures (with and without structure damage) (0.64), for the years 1986 – 2005 (Table 12). Negligible correlation exists between apartments and residential structures without structure damage (0.40), for the years 1986 – 2005 (Table 12).

The correlations between fires and fatalities (1995 – 2005) were strong for apartments without damage (0.96), residential structures without damage (0.95), and apartments (with and without damage) (0.96) (Table 13). There was moderate correlation between fires and fatalities for apartments with damage (0.90), residential structures with damage (0.81) and residential structures (with and without damage) (0.93) (Table 13).

4.4.1.2 Most Costly

The “cost” of a fire has been assumed to be apportioned by the number of resulting fatalities or injuries.

The ratios of the number of fatalities to the number of fires in each cause of ignition are shown in Figure 261 and summarised in Table 78 and Table 79. For apartment fires the most costly causes of ignition, in terms of civilian fatalities, were primarily mechanical malfunction, falling asleep (other than cooking), accidentally spilled flammable liquid or gas, unknown, careless disposal of cigarettes or embers, etc., and unattended or asleep kitchen fire. For residential structures, the most costly causes of ignition in terms of civilian fatalities were primarily falling asleep in bed (other than cooking fires), mechanical failure or malfunction, people impaired by drugs or alcohol, legality not known, unattended cooking fire, automatic control failure, and deliberately lit fires (other than lawful).

The ratios of the number of injuries to the number of fires in each cause of ignition are shown in Figure 262 and summarised in Table 80 and Table 81. For apartment fires the most costly causes of ignition, in terms of civilian injuries, were recklessness involving fire (other than other reckless causes specified), sun, falling asleep other than cooking fire (e.g. smoking in bed, etc.), pyrophoric, accidental spillage of flammable liquid or gas, equipment not being operated properly, and equipment being used for a purpose not intended. For residential structure fires the most costly causes of ignition, in terms of civilian injuries, were falling asleep other than when cooking (e.g. smoking in bed, etc.), deliberately lit fire, people otherwise impaired (e.g. unconscious, mental or physical impairment, etc.), sun, equipment not being operated properly, and unattended cooking fires.

4.4.1.2.1 Historical Trends

There are no obvious trends showing across the years considered for the ratios of numbers of casualties to fires, as shown in Figure 286 and Figure 288 for fatalities to fire events for apartments and all residential structures respectively and Figure 290 and Figure 292 for injuries to fire events for apartments and all residential structures respectively.

4.4.1.2.2 Correlations

The average percentage of fires for each cause of ignition and one standard deviation are shown in Figure 293, Figure 294 and Figure 295 for fires, fatalities and injuries respectively. It is obvious that the smaller population size associated with civilian fatalities is consistent with the larger values for standard deviation from the average

percentage. However the average percentages of fires, fatalities and injuries per cause of ignition are reasonably consistent between the apartment and all residential structures.

4.4.2 Grouped Classes

The results from the analysis of the individual classes was used to select the most important and appropriate groupings of the classes to be used in finer analysis. A listing of each of the classes that form each grouped classification for the cause of ignition category is presented in Appendix B. Following is a discussion of the results of the analysis using the grouped classes for cause of ignition.

4.4.2.1 Most Common

The number of incidents where information was not recorded was not overly substantial, as shown in Figure 103 and Figure 104. The group labelled “other” consists of all other causes, of which the number of incidents recorded for any individual cause listed was less than the smallest group listed.

The most numerous fires were reported as unattended/asleep kitchen fire, carelessness, deliberate/suspicious/unlawful, and electrical failure for apartments (Figure 111).

The most numerous fires were reported as unattended/asleep kitchen fire, carelessness, electrical failure, deliberate/suspicious/unlawful for all residential structures (Figure 112).

For both apartments and all residential properties, the most common recorded cause of ignition that was associated with the most fatalities is unattended/asleep kitchen fires, falling asleep, and then careless disposal of cigarette ashes etc., as shown in Figure 105, Figure 111 and Figure 112.

For both apartments and all residential properties, the most common recorded cause of ignition that was associated with the most injuries is unattended/asleep kitchen fire, carelessness, and then play or recklessness, as shown in Figure 106, Figure 111 and Figure 112.

4.4.2.1.1 Historical Trends

The percentage of the “information not recorded” class of the cause of ignition is relatively low throughout the years considered, especially for the years after 1995 (Figure 119 and Figure 120).

Unlike other sections, there is not a distinct change in the data for the earlier year compared to after the collection framework was changed (Figure 119 and Figure 120). However for consistency with other sections, trends in the data from 1995 onwards only are considered here.

From 1995 onwards, for both apartments only and all residential structures, the percentage of fires remain consistent with no obvious trends evident (Figure 119 and Figure 120) except for firstly a sudden increase in unattended/asleep kitchen fires from 2001 and, secondly, a general decrease in the number of incidents with information not recorded.

For fatalities (1995 – 2005), for apartments and all residential properties, considering the percentage of fatalities each year that occur in each of the groups of causes of ignition, no clear trend was evident for the data available (Figure 121 and Figure 122). Similarly, no clear trend is evident for the yearly percentages of injuries over the same

period for injuries (Figure 123 and Figure 124) except for a sudden increase in the percentage of injuries reported for unattended/asleep kitchen fires from 2001. The lack of clear trends is attributed to the small sample sizes.

4.4.2.1.2 Correlations

For apartments (1995 – 2005), for the combination of causes of ignition considered, the linear correlation between fires and fatalities is moderate (0.79). The linear correlation between numbers of fires and injuries is high (0.97). Moderate linear correlation exists between fatalities and injuries for the combined causes of ignition considered (0.77). The correlation between numbers of fires where the flame damage was confined to the cause of ignition and fatalities is moderate (0.72) and injuries is good (0.87). The correlation is low between numbers of fires where the flame damage extended beyond the cause of ignition and fatalities (0.60) and injuries (0.64).

For all residential properties (1995 – 2005), for the combination of causes of ignition, the linear correlation between fires and fatalities is good (0.85). The linear correlation between numbers of fires and injuries is good (0.85). High linear correlation exists between fatalities and injuries for the combined causes of ignition considered (0.96). The correlation between numbers of fires where the flame damage was confined to the cause of ignition and fatalities is moderate (0.76) and injuries is high (0.92). Moderate correlation exists between numbers of fires where the flame damage extended beyond the cause of ignition and fatalities (0.76) and injuries (0.75).

For 1995 – 2005, for the groups of causes of ignition, moderate correlation exists between apartment and all residential fire incidents (0.75), with high correlation between apartment and all residential fatalities (0.98) and injuries (0.96).

A summary of these correlations are included in Appendix D, Table 12, Table 13, Table 14, Table 15, Table 16, Table 17, Table 18 and Table 19.

4.4.2.2 Most Costly

Assuming the 'cost' of a fire is apportioned by the number of resulting fatalities or injuries. Assuming the 'cost' of a fire is apportioned by the number of resulting fatalities or injuries. The term 'local' fire or casualty is used to refer to data pertaining to the group of interest within each category.

The ratios of the number of casualties to the number of local fires in each group of causes of ignition are shown in Figure 107 and Figure 108 for apartments and all residential structures, respectively. For apartment fires the most costly cause of ignition, in terms of civilian fatalities, was primarily falling asleep (includes smoking in bed) (0.08 fatalities/fire) followed by careless disposal of cigarette ashes etc. (0.02 fatalities/fire) and play or recklessness (0.009 fatalities/fire). For all residential fires the most costly cause of ignition, in terms of civilian fatalities, was primarily falling asleep (includes smoking in bed) (0.09 fatalities/fire) followed by unattended/asleep kitchen fires (0.01 fatalities/fire) and play or recklessness (0.009 fatalities/fire).

Except for careless disposal of cigarette ashes, etc., where the ratio of fatalities to fires was twice as high for apartments (0.02) as for all residential structures (0.009) and unattended/asleep kitchen fires, where the ratio of fatalities to fires was twice as high for all residential (0.01) as for apartment fires (0.006), the values for the ratios for apartments and all residential structures were similar.

In terms of civilian injuries, for apartment fires the most costly cause of ignition was primarily falling asleep (includes smoking in bed) (0.1 injuries/fire) followed by play or recklessness (0.02), and careless disposal of cigarette ashes, etc. (0.02). For all residential structure fires the most costly cause of ignition, in terms of civilian injuries,

was again primarily falling asleep (including smoking in bed) (0.3) followed by play or reckless (0.1), and unattended/asleep kitchen fire (0.1). The values for the ratios of injuries to fires are consistently higher for all residential properties than for apartments.

Another approach to apportioning 'cost' to a fire is in terms of the resulting flame damage. However the proportion for which no information for the level of flame damage was recorded is consistently high (approximately 30 – 80% of fires that occurred at each group of causes of ignition for both apartments and for all residential structures), as shown in Figure 109 and Figure 110. With such a large amount of data lacking detail, it is difficult to perform a useful analysis. However to provide a general indication, one approach is to assume that the fires with less detailed data attributed to them were relatively small fires and to use the detailed data available. Excluding data with no information recorded (for either the cause of ignition or the amount of flame damage), the flame damage for fires of the grouped causes of ignition are shown as a percentage of total fires with recorded details in Figure 113 and Figure 114 for apartments and all residential structures, respectively.

For both apartments and all residential structures, of the detailed data available for the groups of causes of ignition considered, the ranking of reported causes from the highest proportion of fires where flame damage beyond the area of ignition was recorded was deliberate/suspicious/unlawful, carelessness and then play or recklessness (Figure 117 and Figure 118). However the ratio of fires with flame damage to the total number of fires with detailed information recorded was consistently slightly higher for all residential structures than for apartments only. For apartments only, of the fires that started for each cause of ignition considered, the ranking from the highest proportion of local fires resulting in flame damage beyond the room of fire origin was deliberate/suspicious/unlawful, carelessness and then careless disposal of cigarette ashes, etc. (Figure 117). Similarly for all residential fires, the ranking was carelessness, careless disposal of cigarette ashes, etc. and then electrical failure (Figure 117).

4.4.2.1 Historical Trends

For ratios of numbers of fatalities to local fires (1995 – 2005), there are no obvious trends for either apartments only (Figure 127) or all residential structures (Figure 128). For apartments only, for ratios of numbers of injuries to local fires (1995 – 2005), there values are approximately constant for the data considered (Figure 129). For all residential structures, for ratios of numbers of injuries to local fires (1995 – 2005), there is a slight rising trend for carelessness, play or recklessness and deliberate/suspicious/unlawful with other groups having relatively constant values for the years considered (Figure 130).

4.4.2.2 Correlations

The correlation between ratios of numbers of fatalities to local fires for apartments and for all residential structures is high (0.97) (Table 18).

The correlation between ratios of numbers of injuries to local fires for apartments and for all residential structures is high (0.98).

The correlation between ratios of numbers of fatalities to local fires for apartments and ratios of numbers of injuries to local fires is high for both apartments (0.91) and for all residential structures (0.87). The correlation for all residential structures between ratios of numbers of fatalities to local fires and ratios of numbers of injuries to local fires is high (0.92). The correlation between the ratios of numbers of injuries to local fires for apartments and the ratios of numbers of fatalities to local fires for all residential structures is also high (0.95).

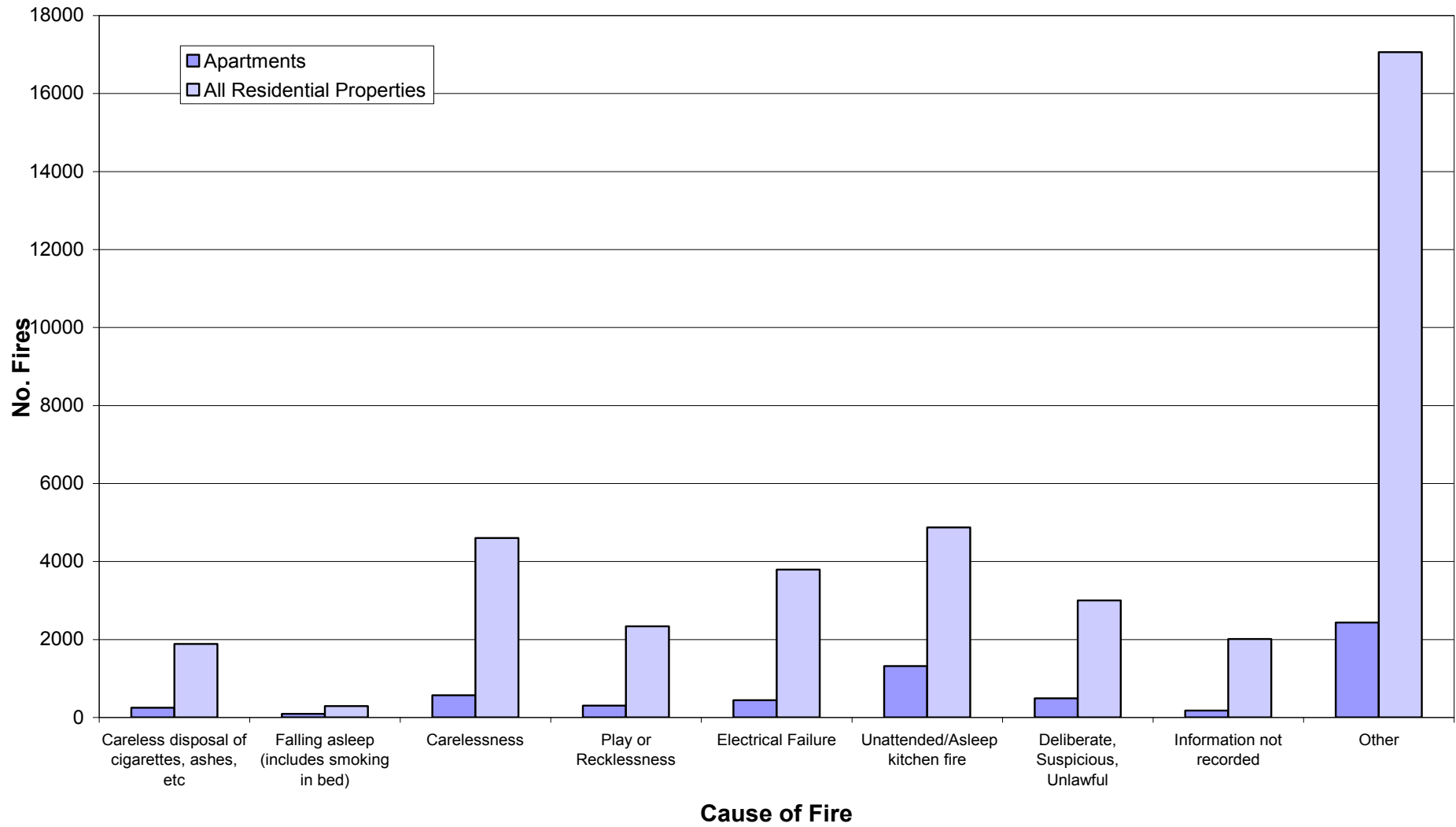


Figure 103: Number of fires in residential properties for groups of causes of fire (1995-2005).

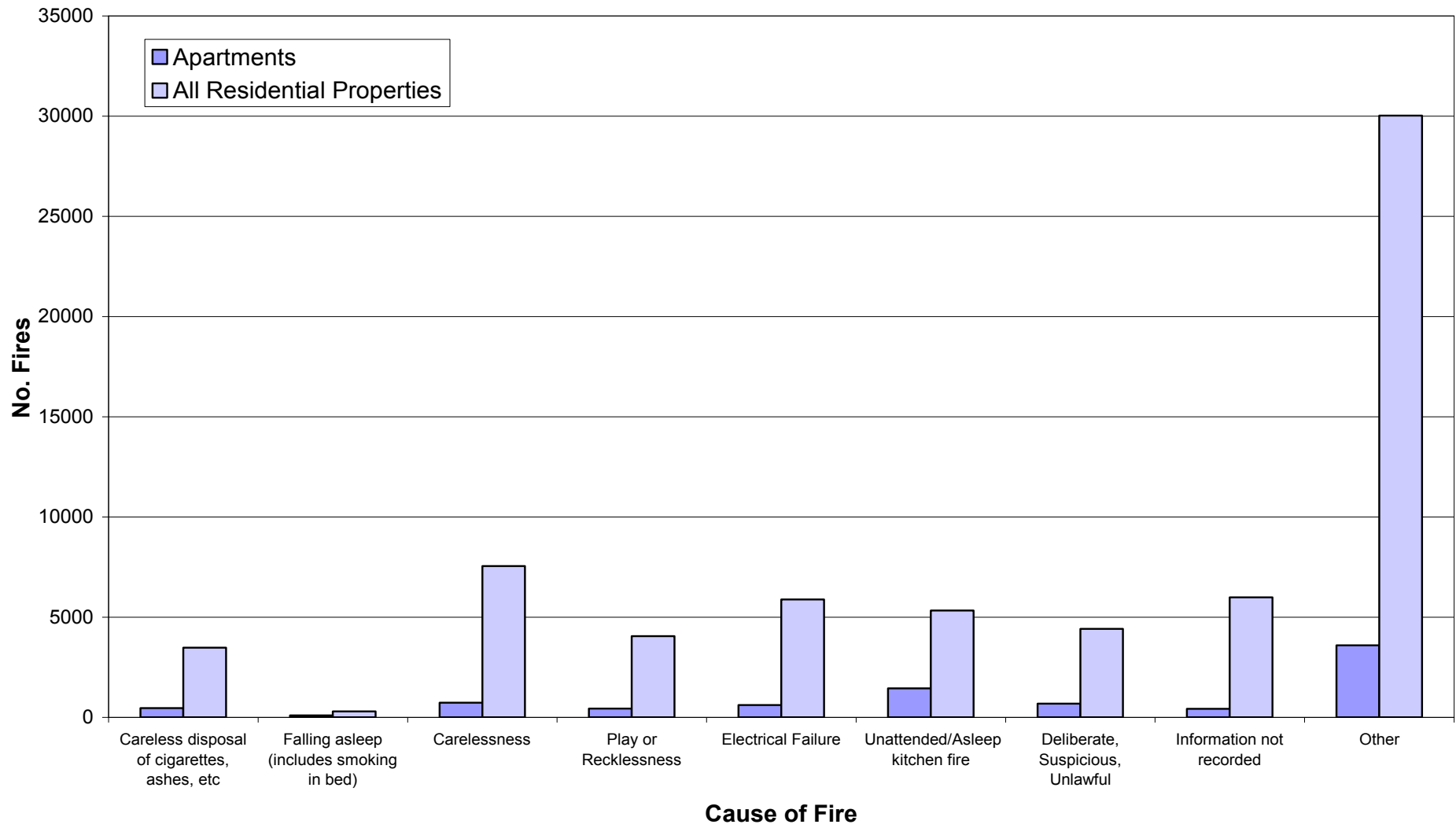


Figure 104: Number of fires in residential properties for groups of causes of fire (1986-2005).

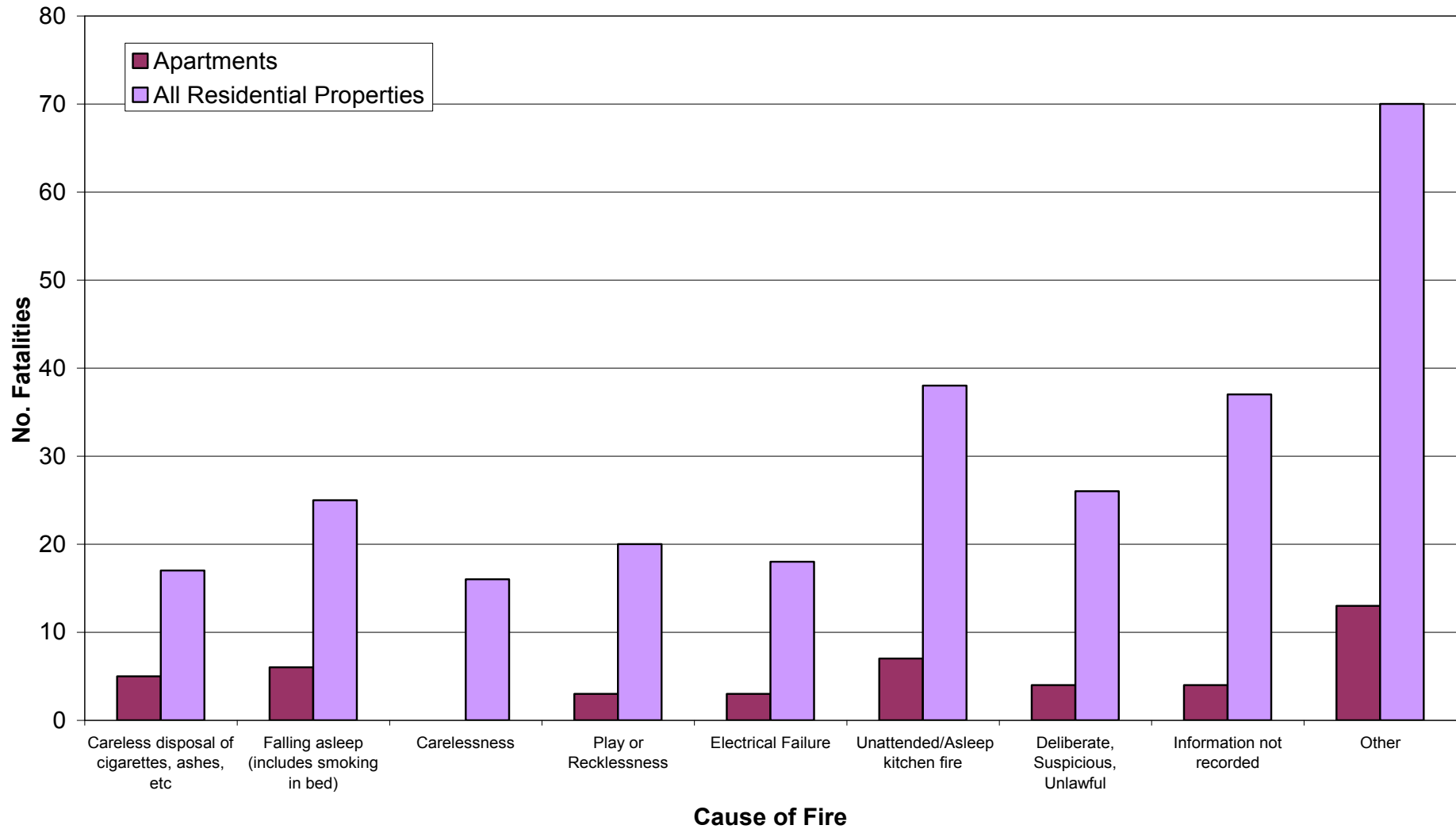


Figure 105: Number of fatalities in residential properties for groups of causes of fire (1995-2005).

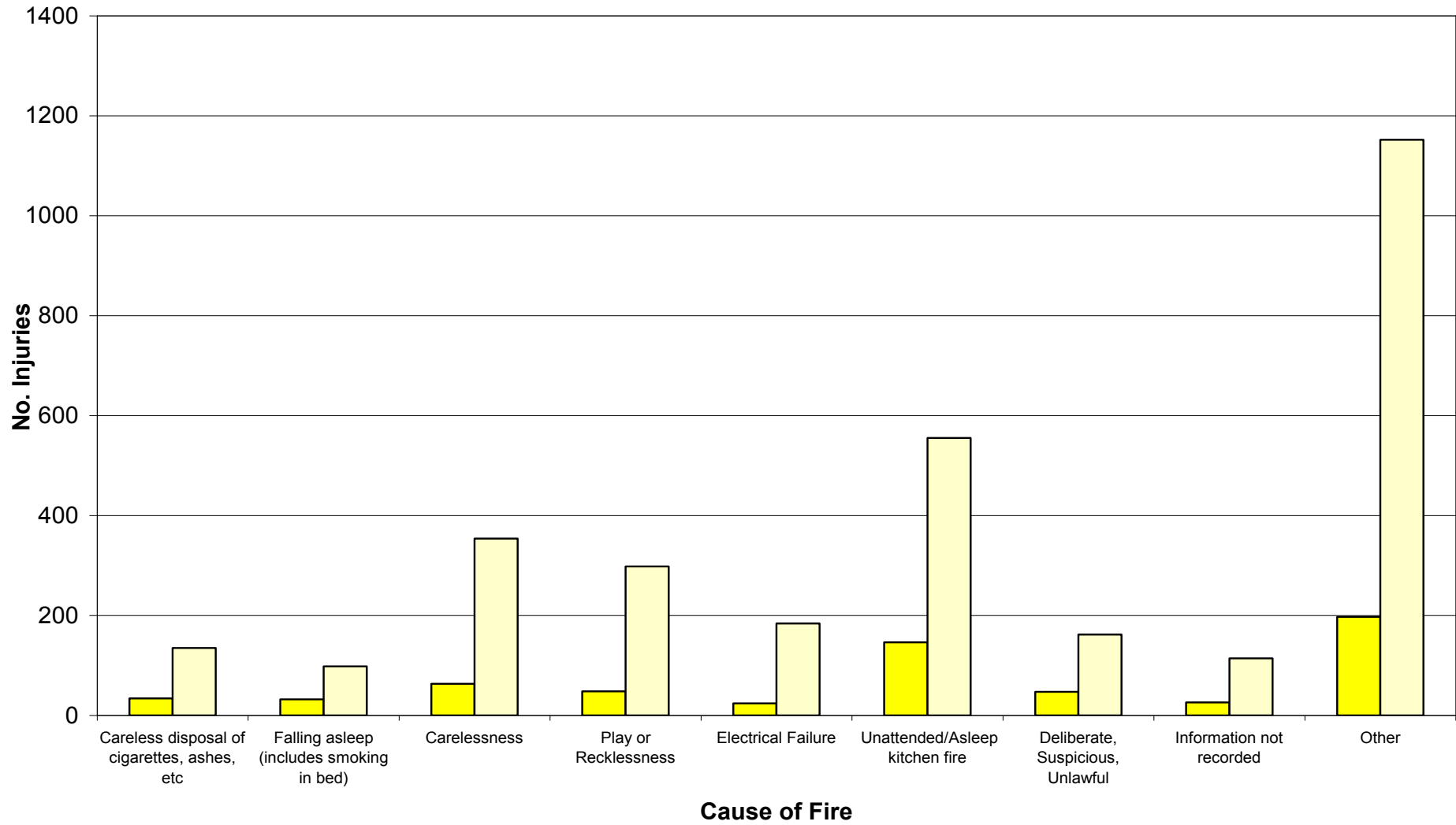


Figure 106: Number of injuries in residential properties for groups of causes of fire (1995-2005).

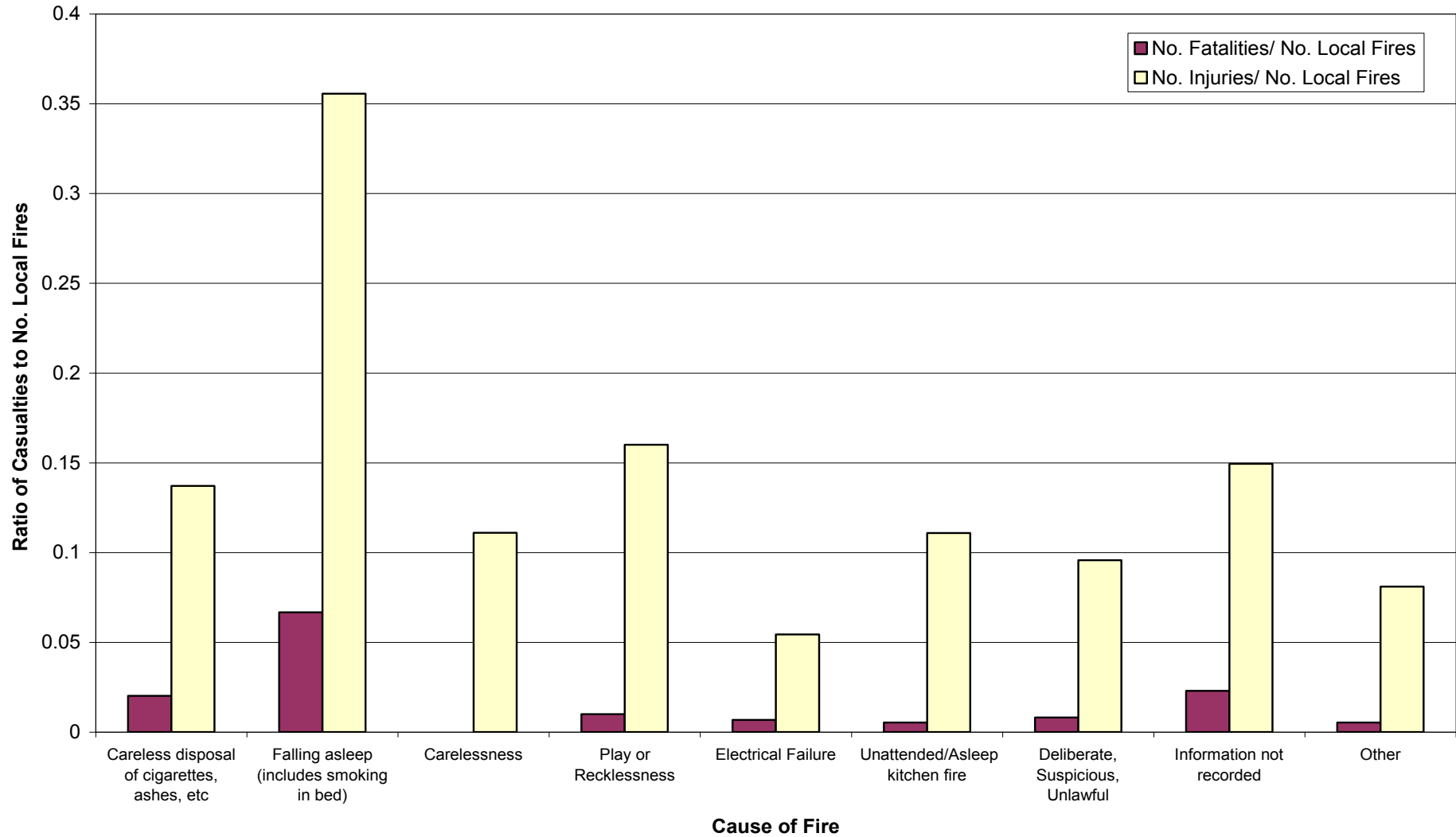


Figure 107: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in apartments as recorded for each group of cause of ignition (1995-2005).

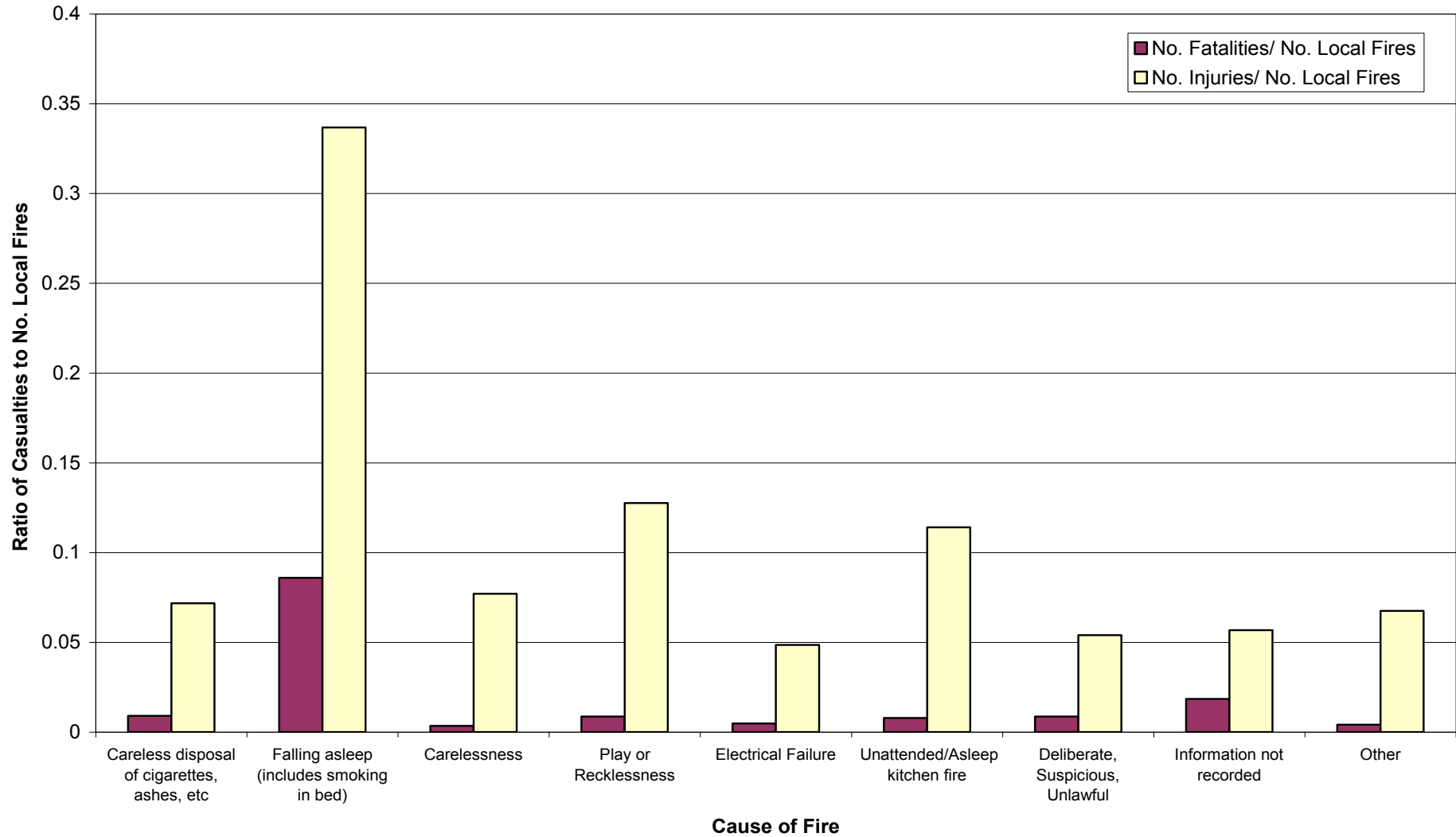


Figure 108: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of cause of ignition (1995-2005).

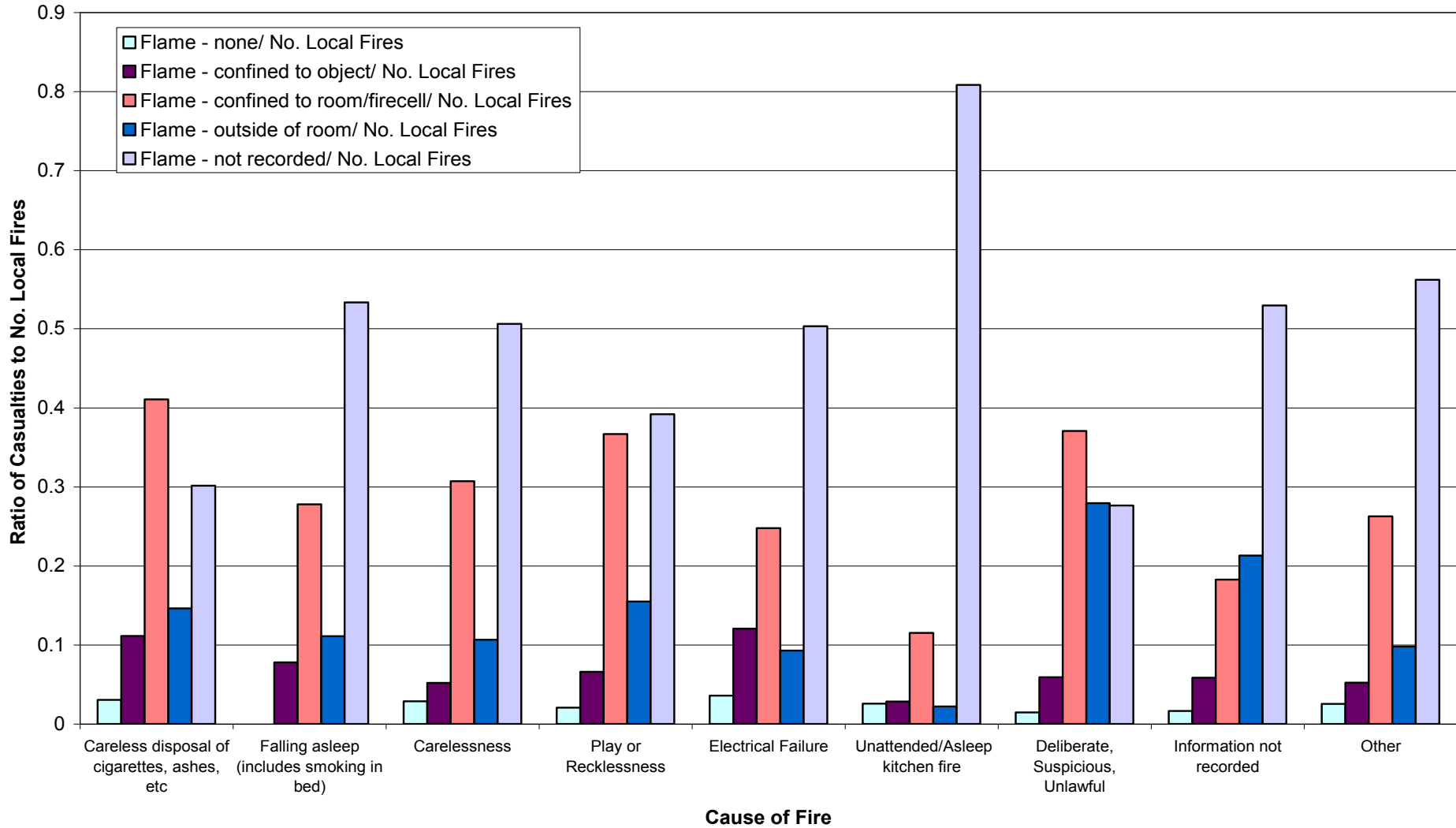


Figure 109: Ratios of numbers of fires with flame damage to numbers of local fires that occurred in apartments as recorded for each group of cause of ignition (1986-2005).

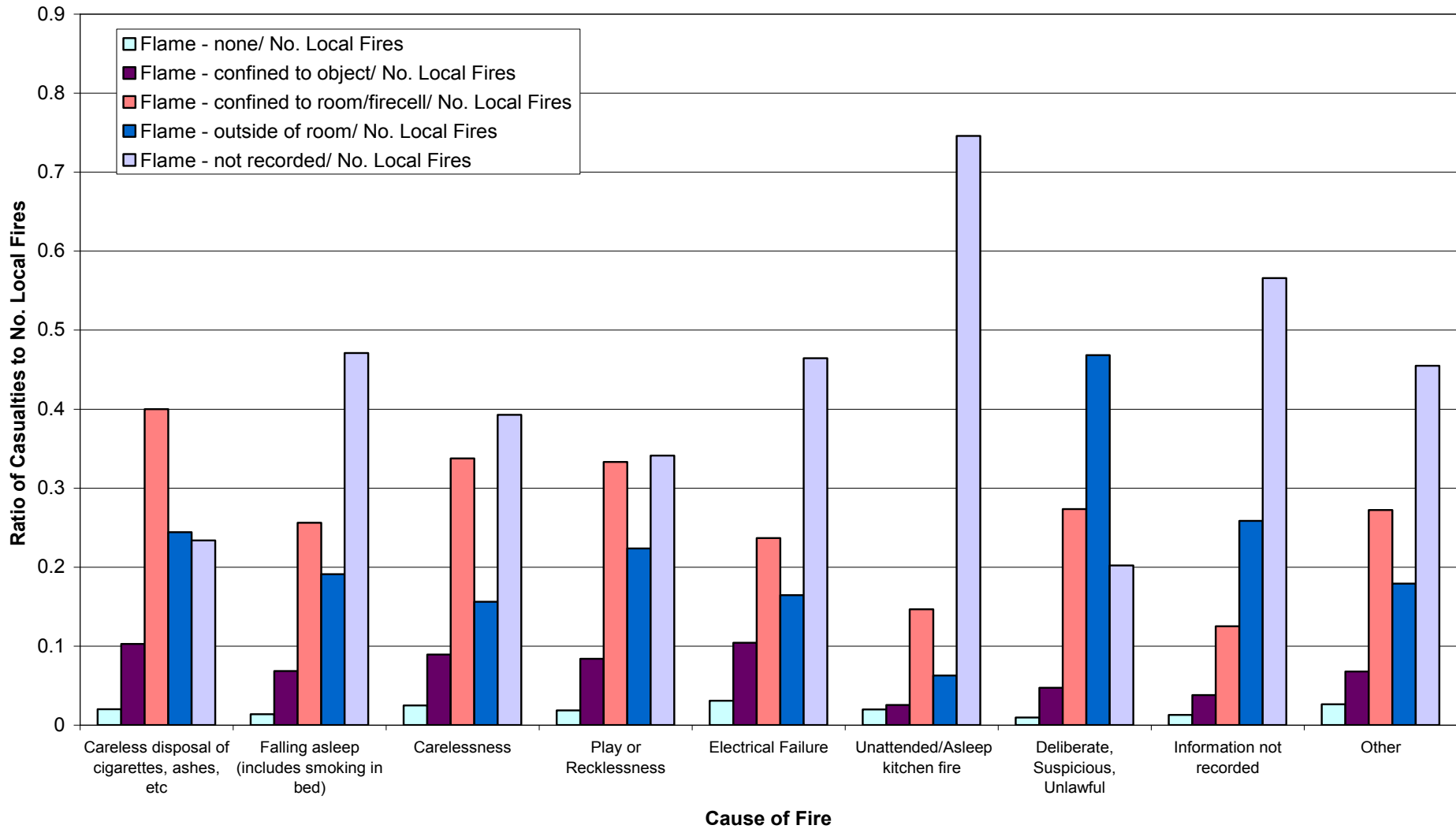


Figure 110: Ratios of numbers of fires with flame damage to numbers of local fires that occurred in all residential structures as recorded for each group of cause of ignition (1986-2005).

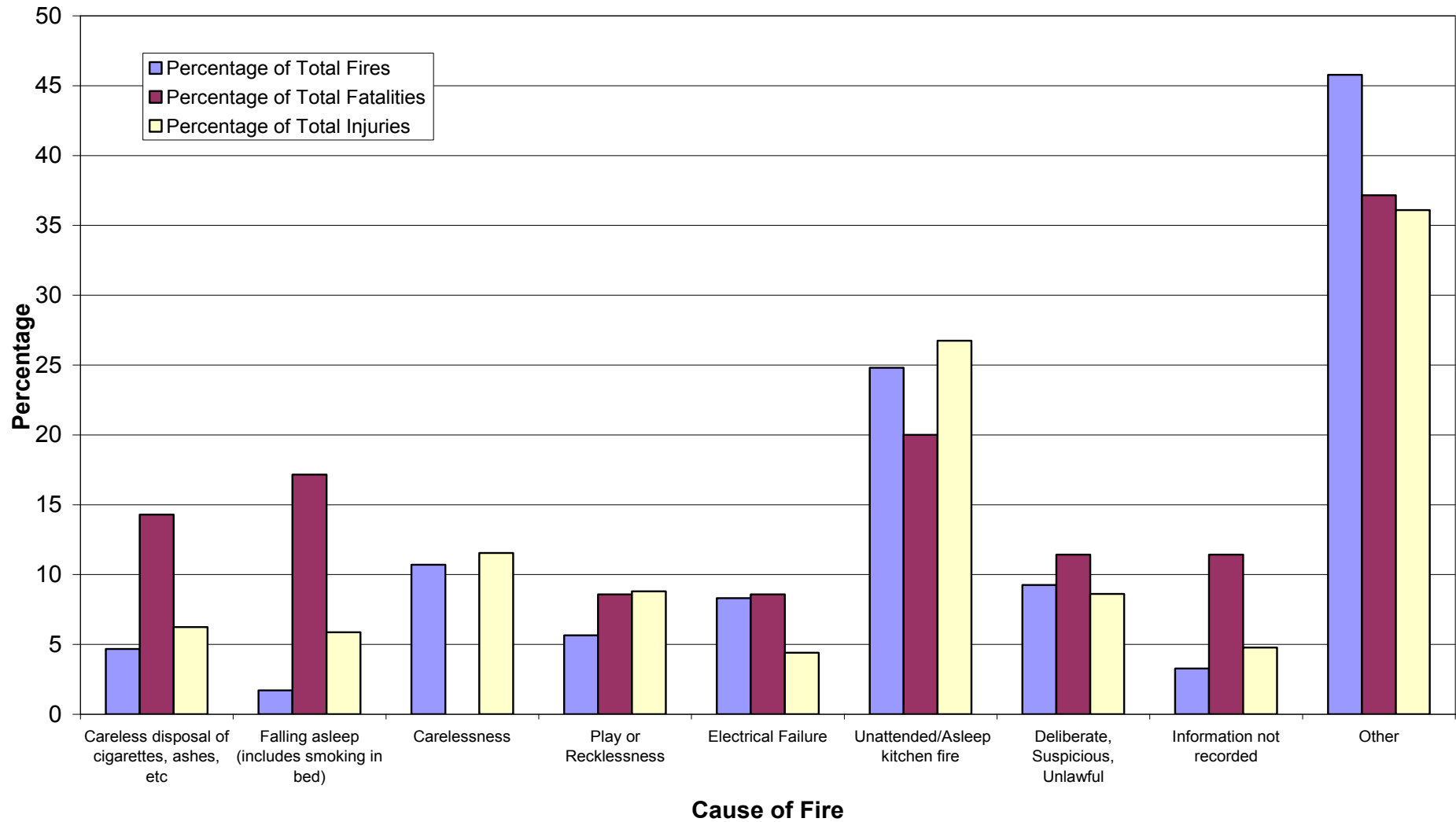


Figure 111: Percentage of totals for fires, fatalities and injuries that occurred in apartments as recorded for each group of cause of ignition (1995-2005).

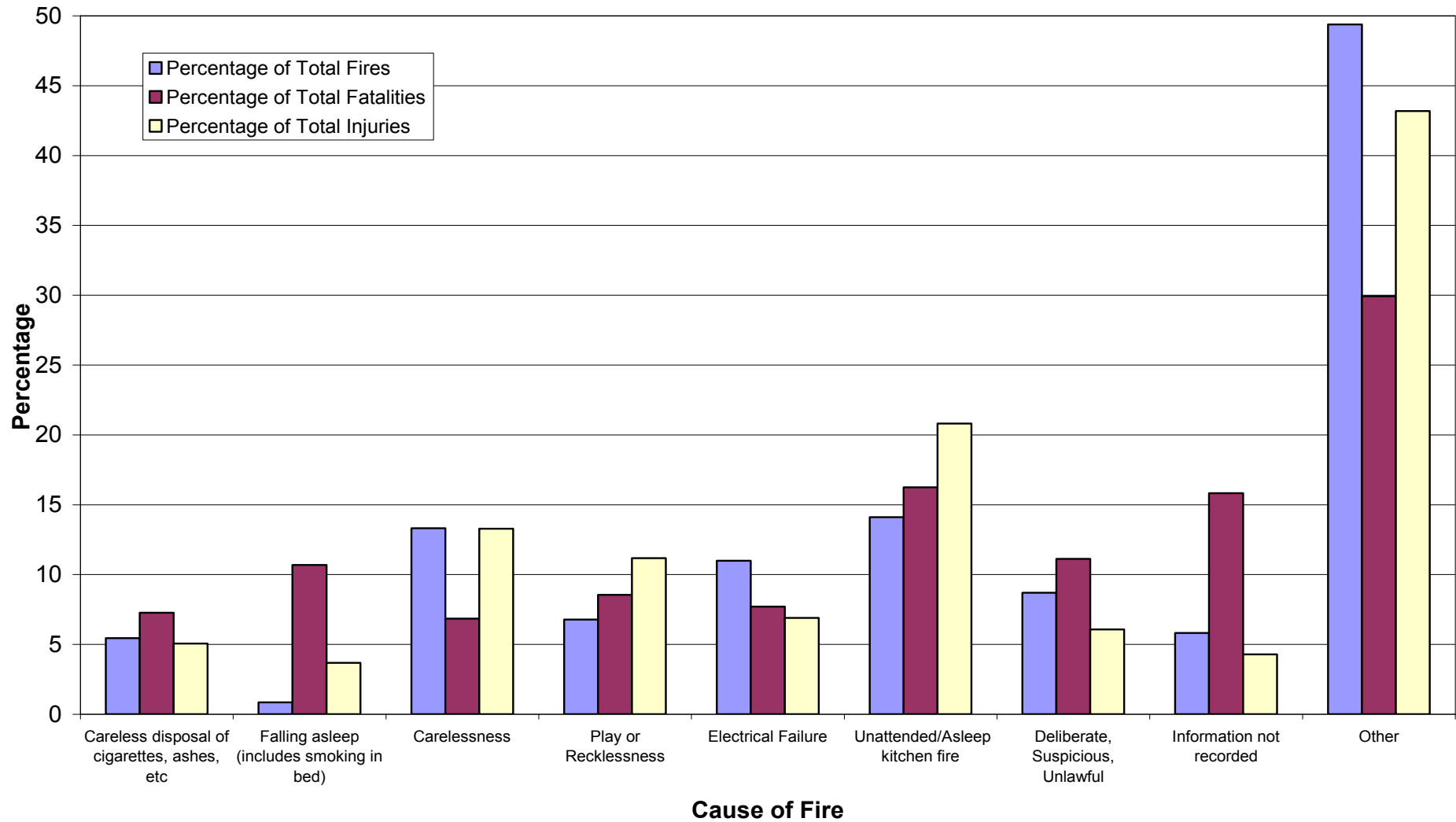


Figure 112: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of cause of ignition (1995-2005).

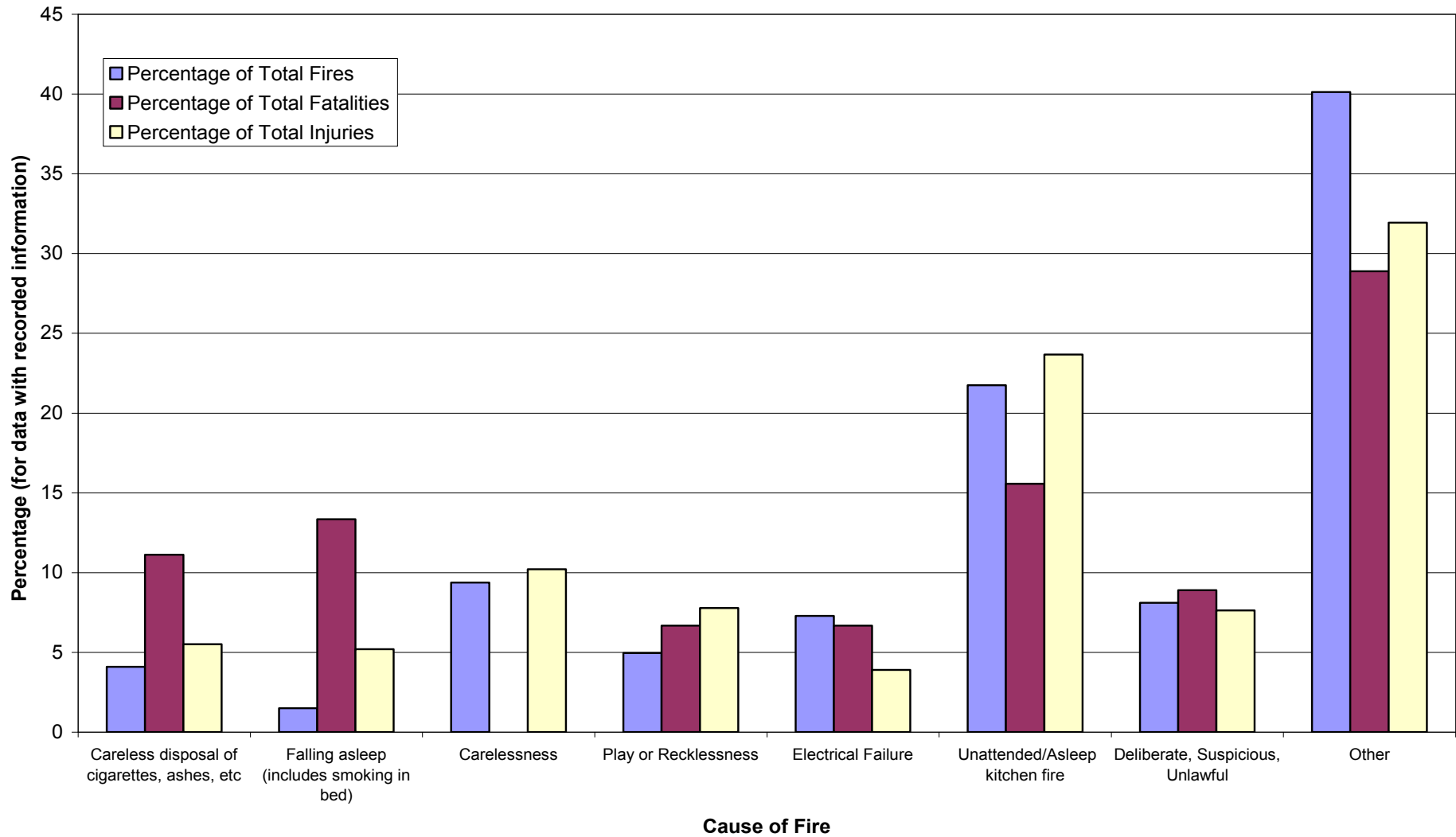


Figure 113: Percentage of totals excluding data where information was not recorded for fires, fatalities and injuries that occurred in apartments as recorded for each group of cause of ignition (1995-2005).

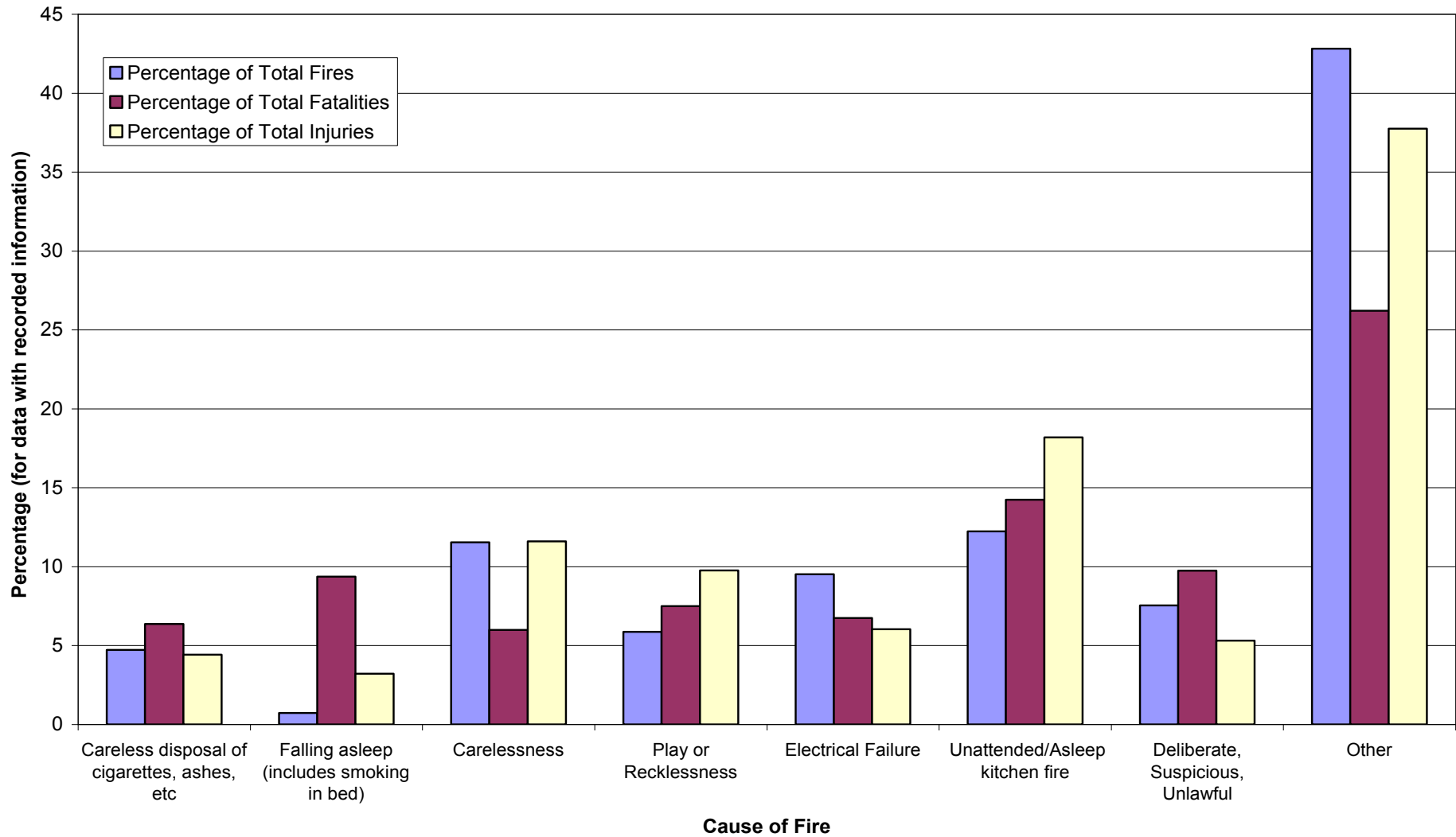


Figure 114: Percentage of totals excluding data where information was not recorded for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of cause of ignition (1995-2005).

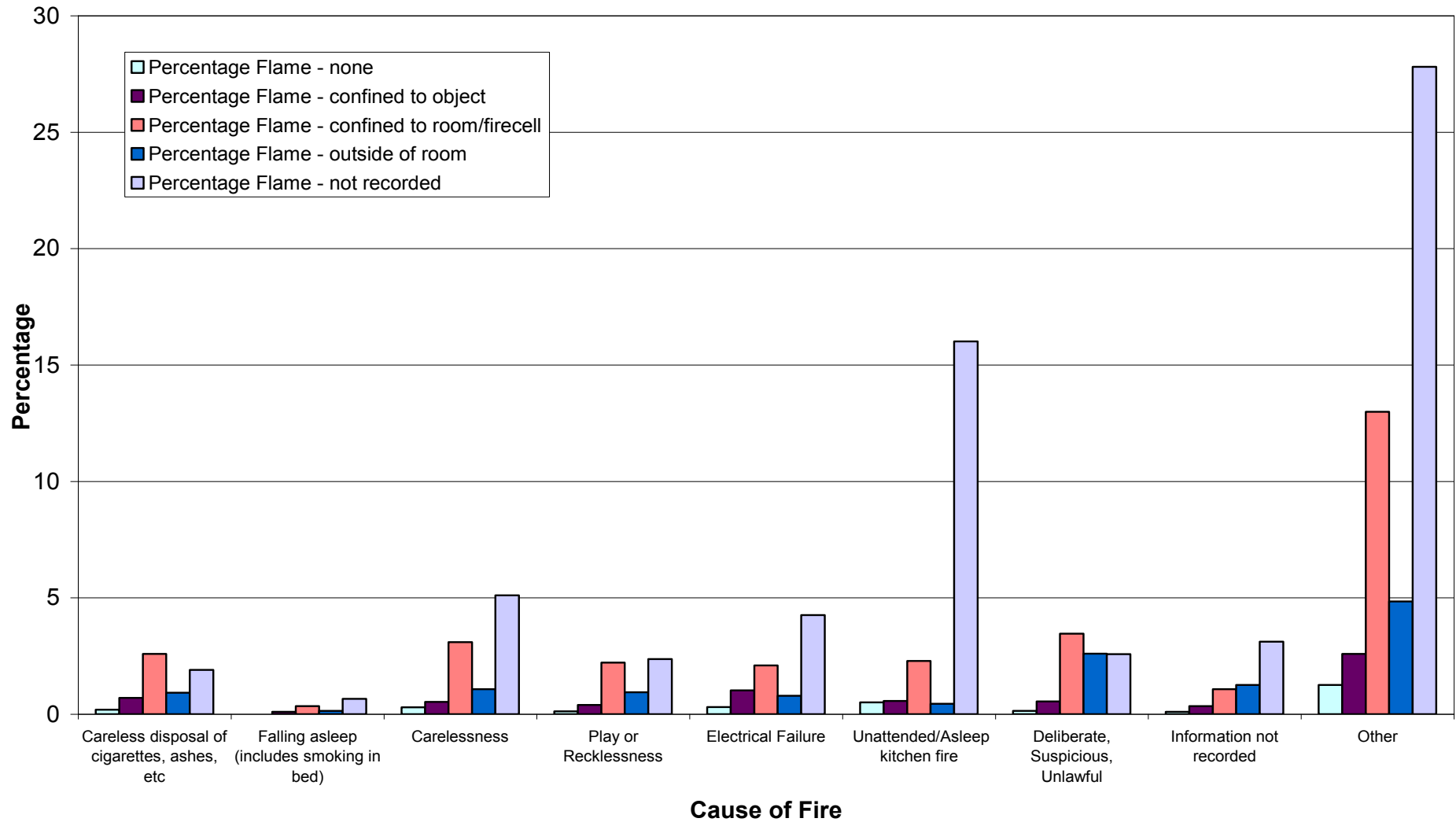


Figure 115: Percentage of total fires for fires with flame damage that occurred in apartments as recorded for each group of cause of ignition (1986-2005).

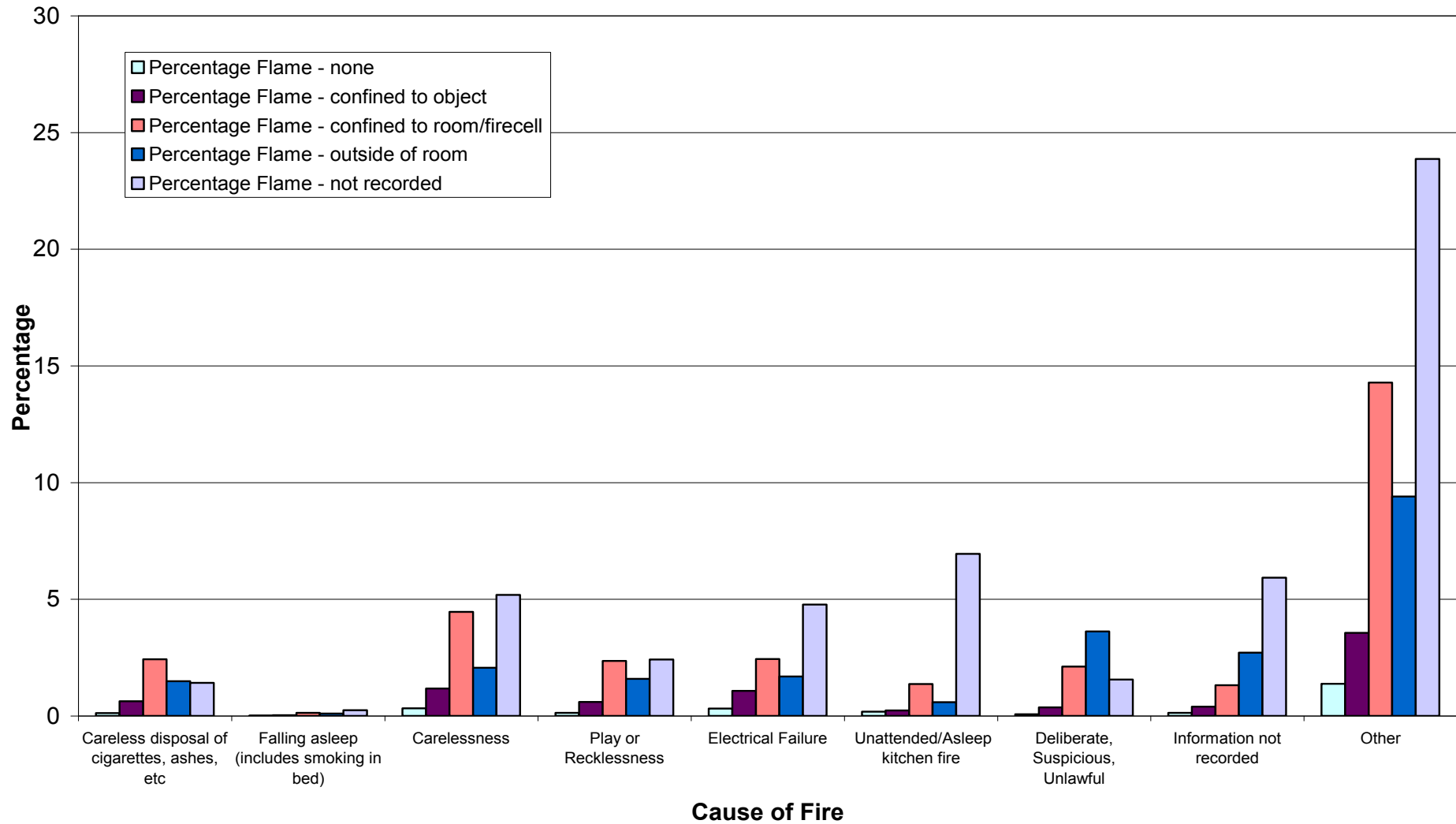


Figure 116: Percentage of total fires for fires with flame damage that occurred in all residential structures as recorded for each group of cause of ignition (1986-2005).

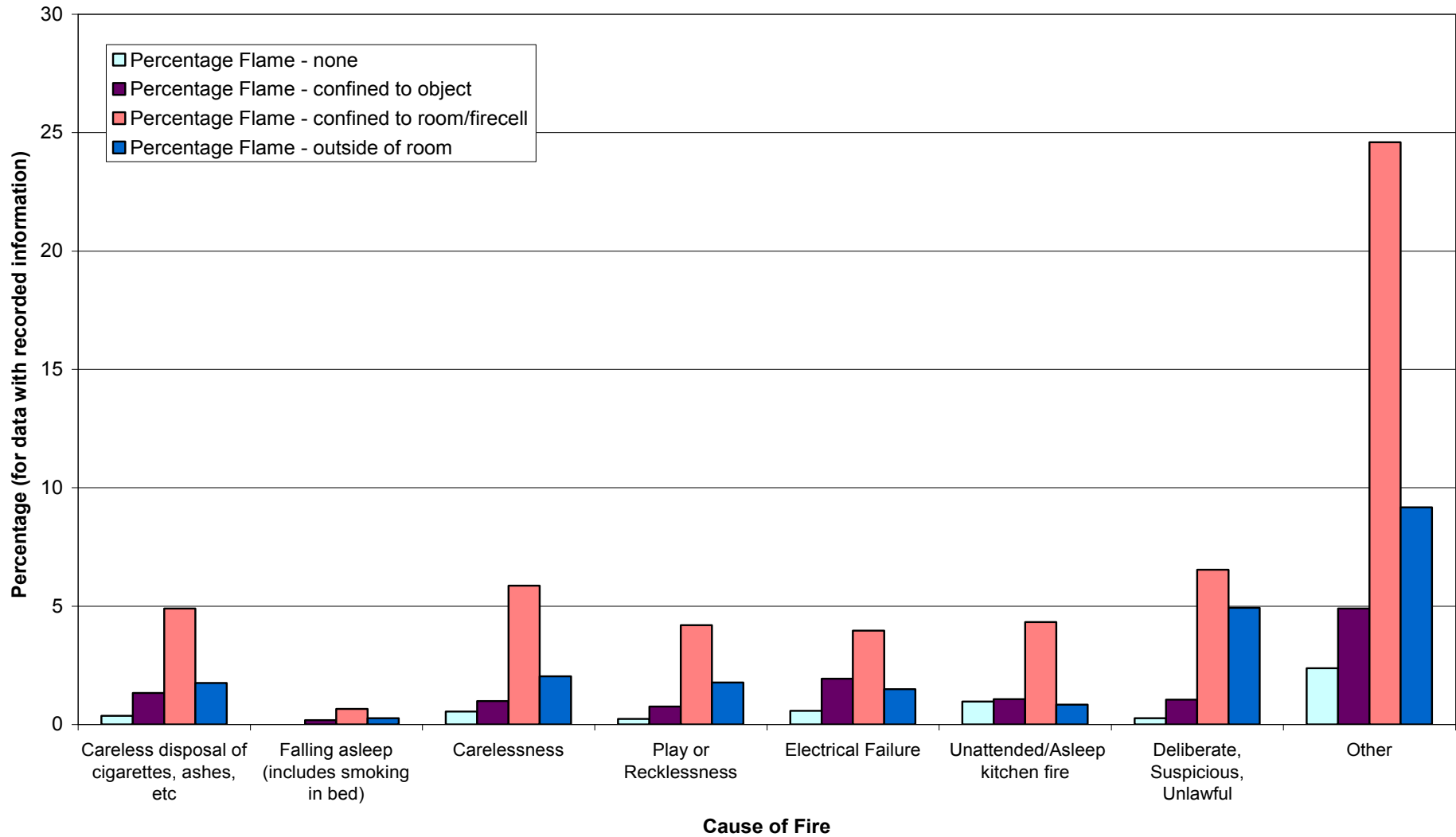


Figure 117: Percentage of total fires excluding data where information was not recorded for fires with flame damage that occurred in apartments as recorded for each group of cause of ignition (1986-2005).

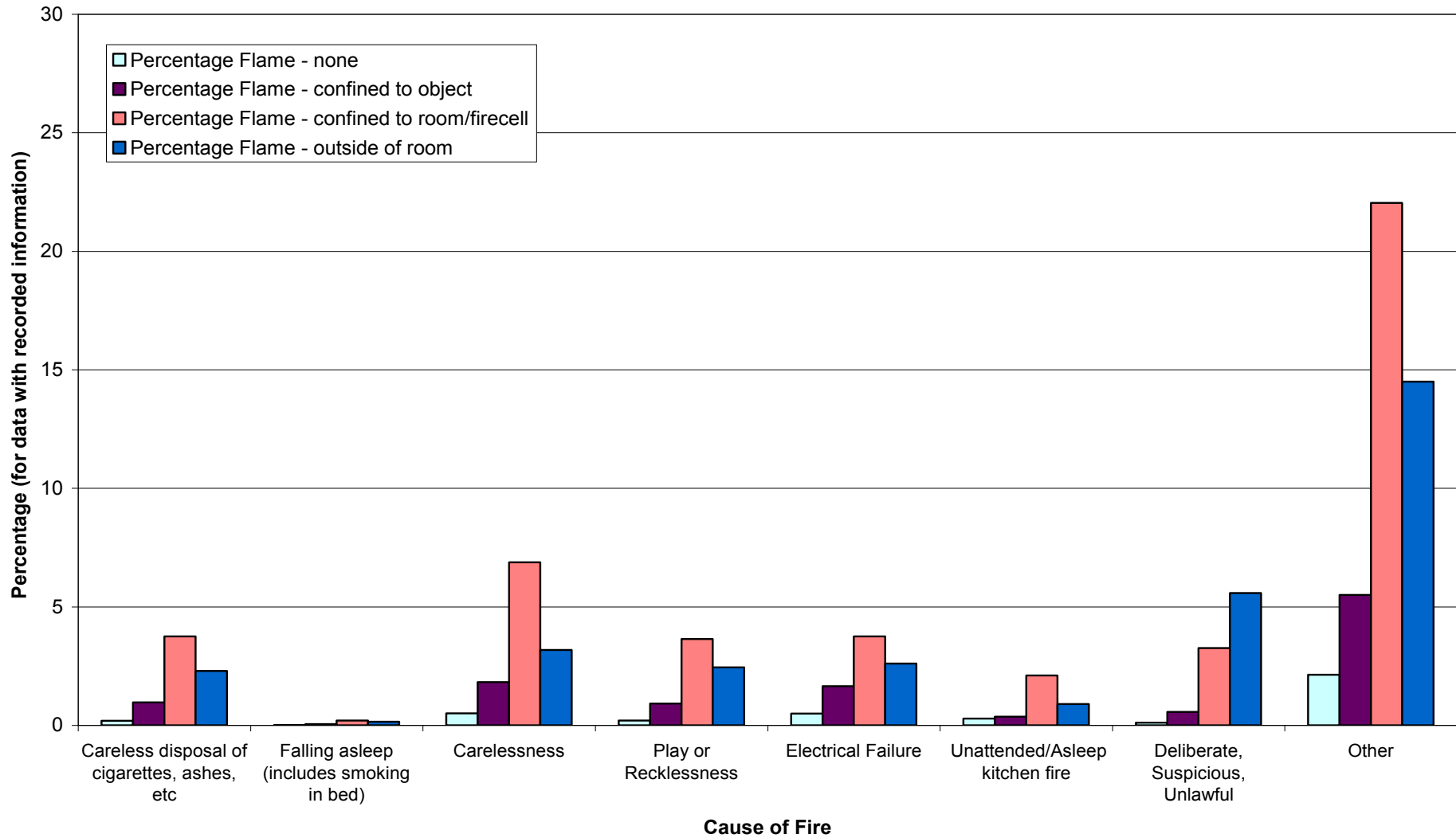


Figure 118: Percentage of total fires excluding data where information was not recorded for fires with flame damage that occurred in all residential structures as recorded for each group of cause of ignition (1986-2005).

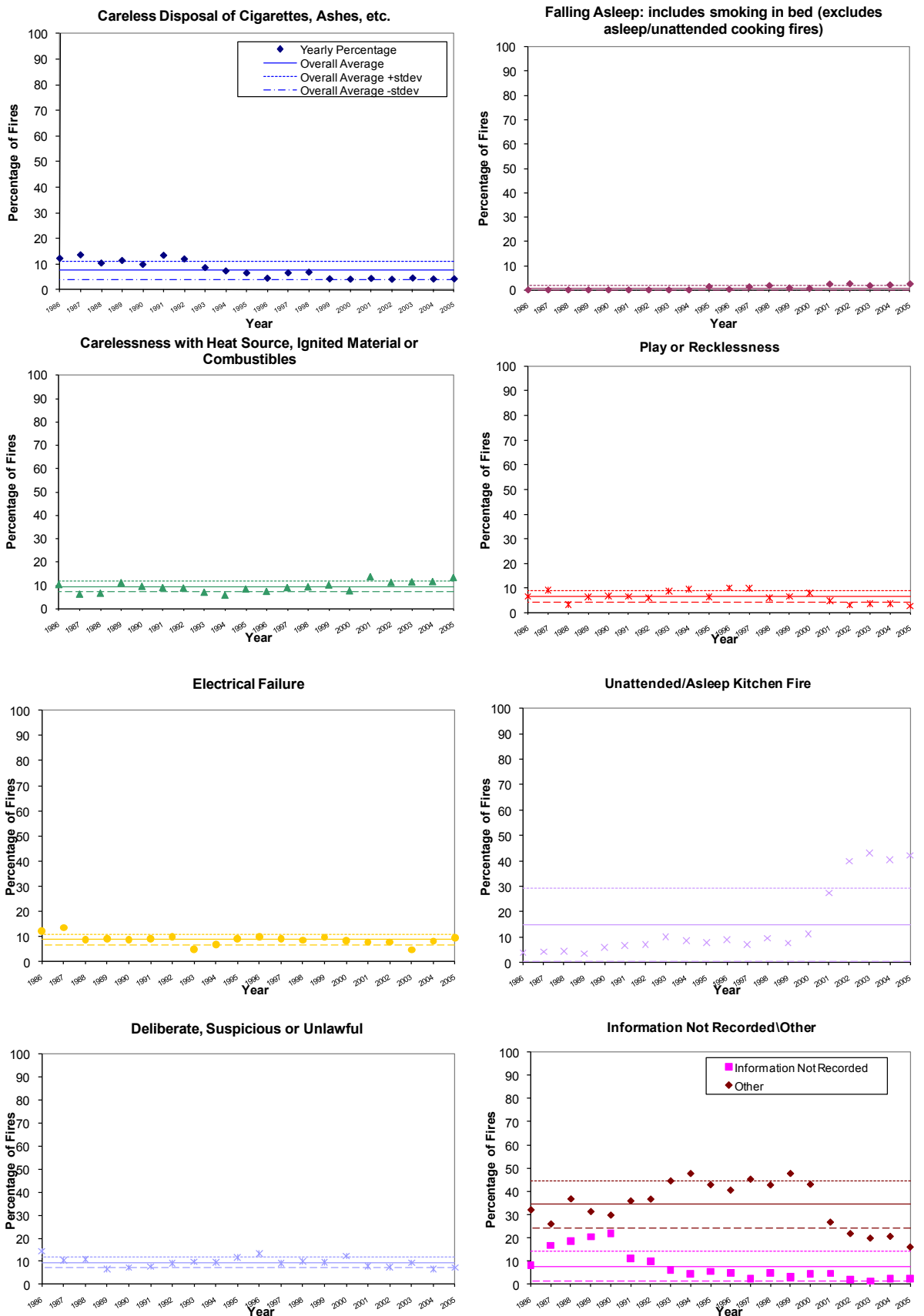


Figure 119: Yearly percentage of total apartment structure fire incidents for each group of cause of ignition (1986 – 2005).

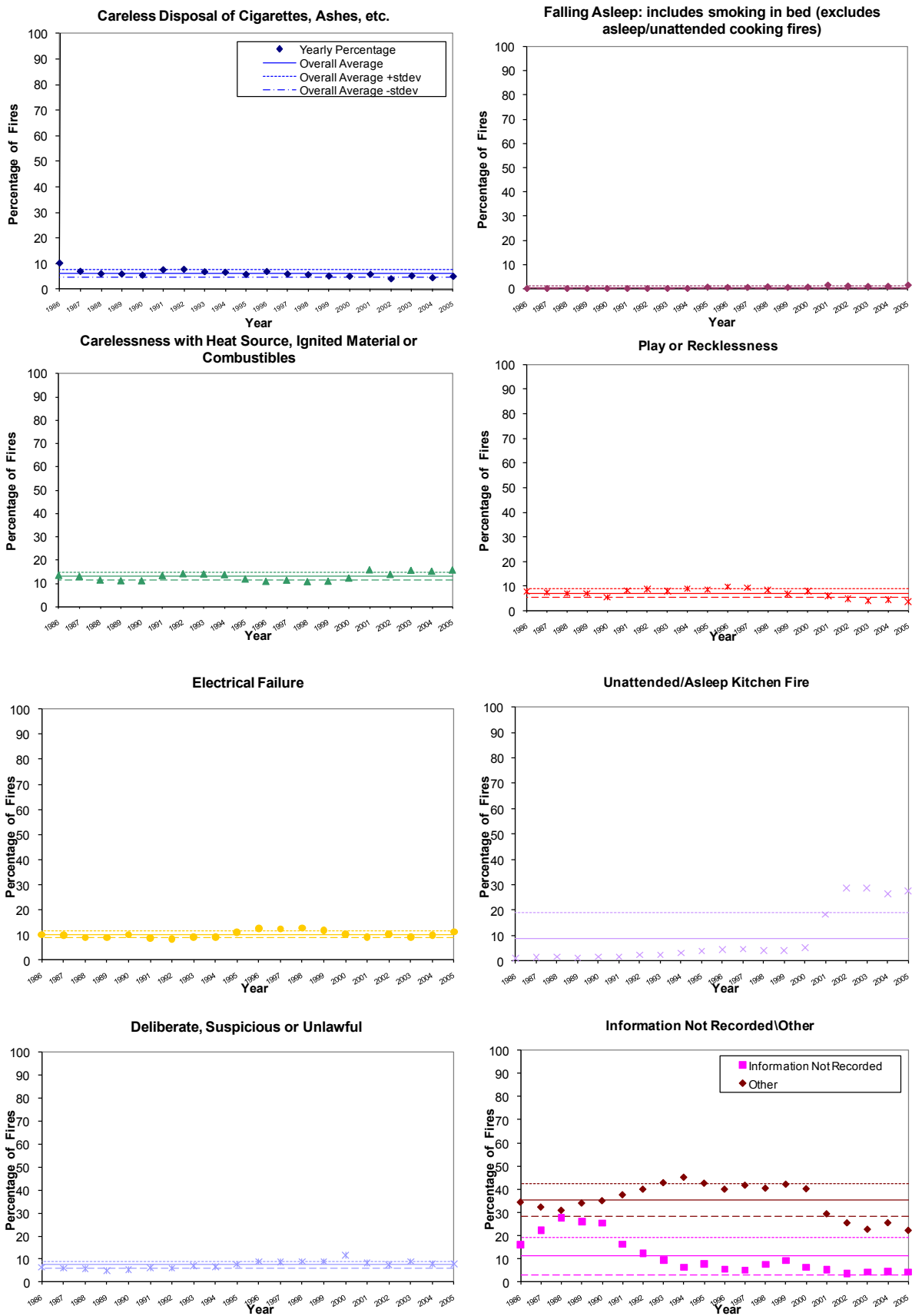


Figure 120: Yearly percentage of total residential structure fire incidents for each group of cause of ignition (1986 – 2005).

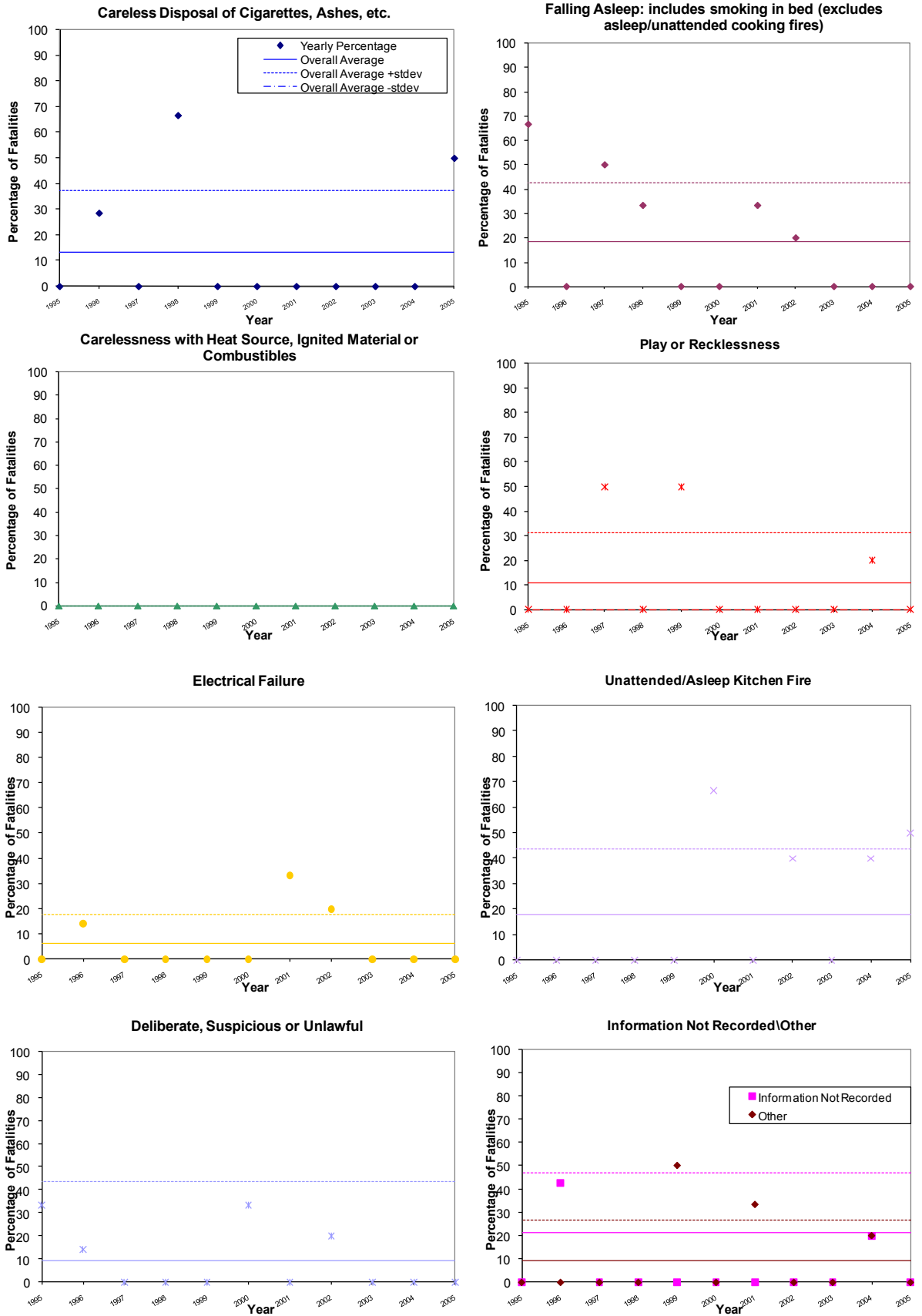


Figure 121: Yearly percentage of total apartment structure fire fatalities for each group of cause of ignition (1995 – 2005).

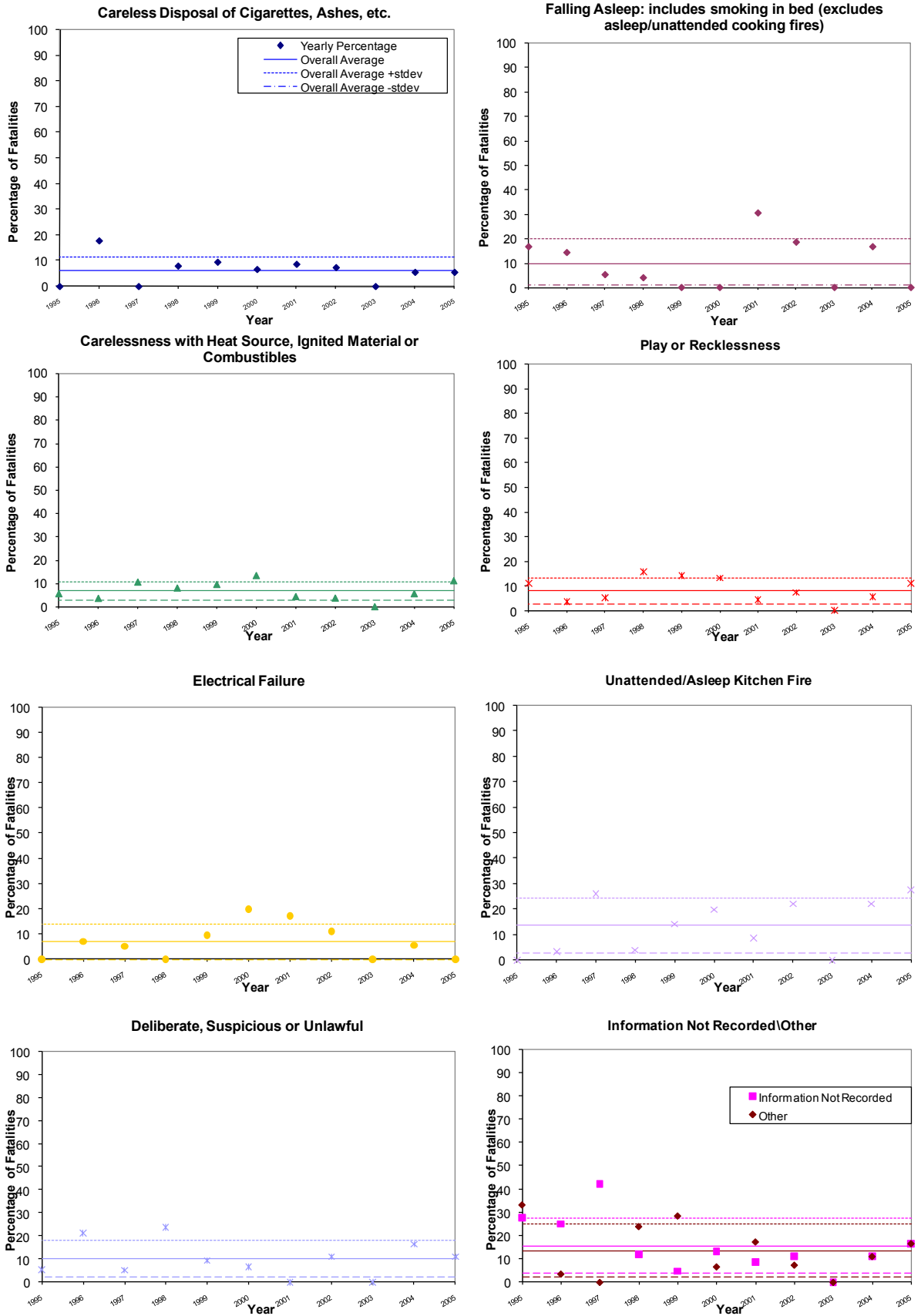


Figure 122: Yearly percentage of total residential structure fire fatalities for each group of cause of ignition (1995 – 2005).

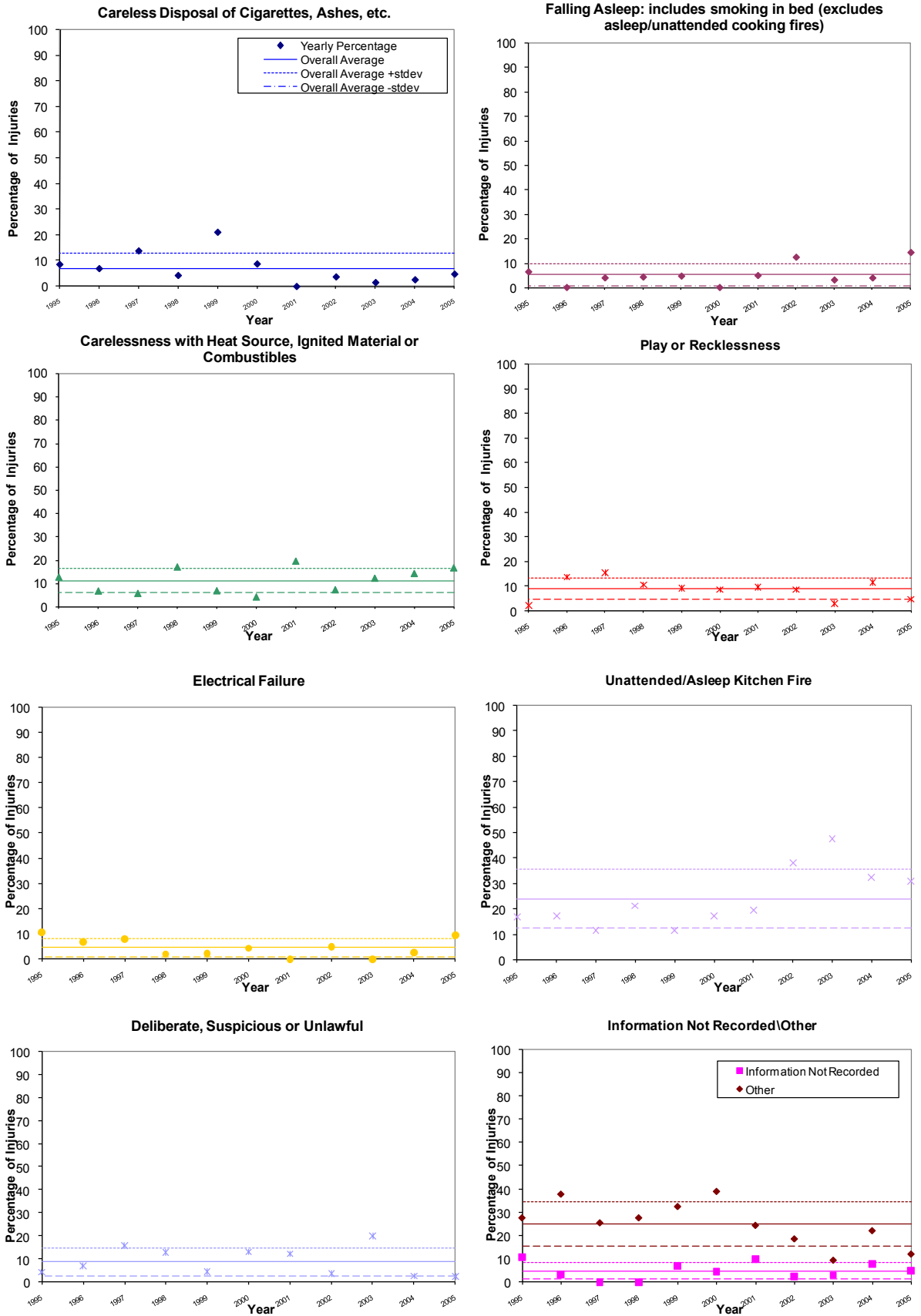


Figure 123: Yearly percentage of total apartment structure fire injuries for each group of cause of ignition (1995 – 2005).

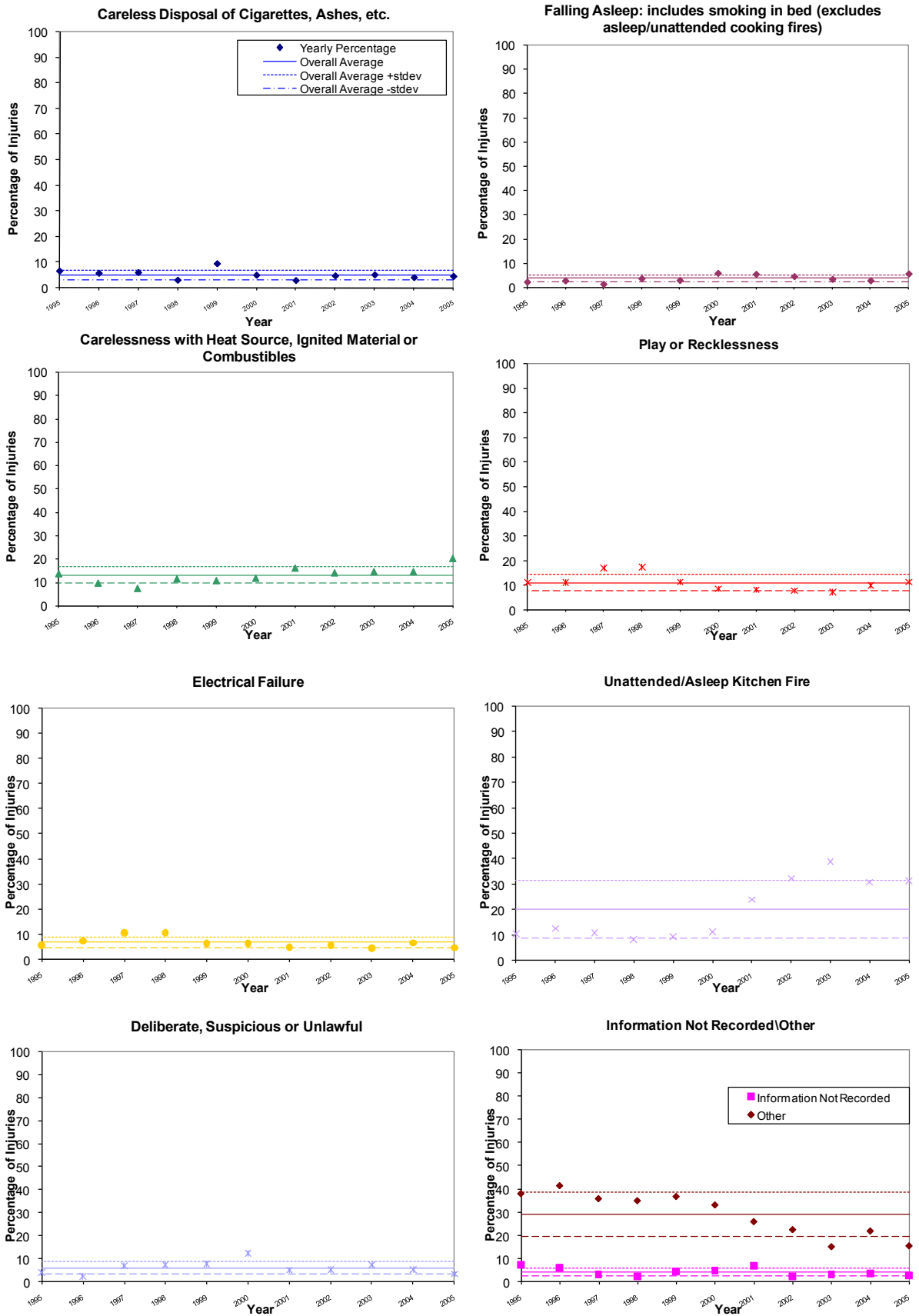


Figure 124: Yearly percentage of total residential structure fire injuries for each group of cause of ignition (1995 – 2005).

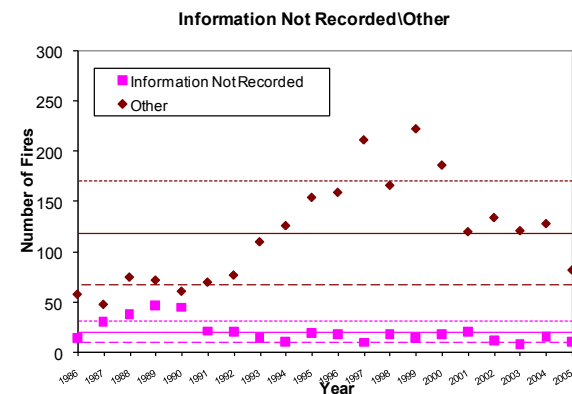
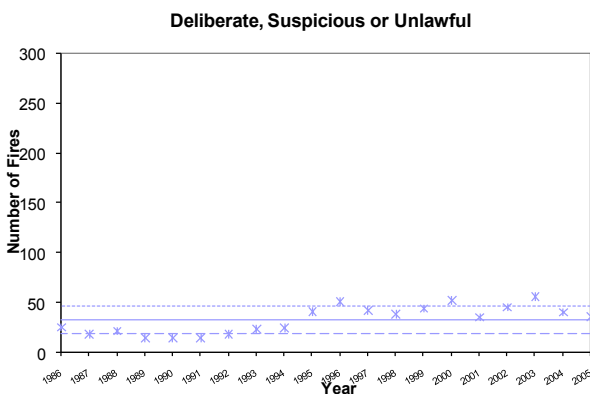
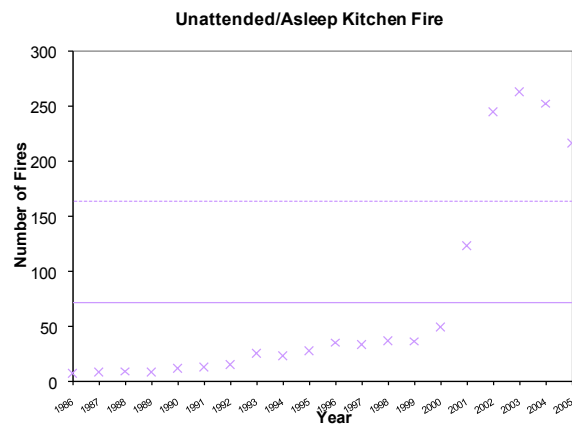
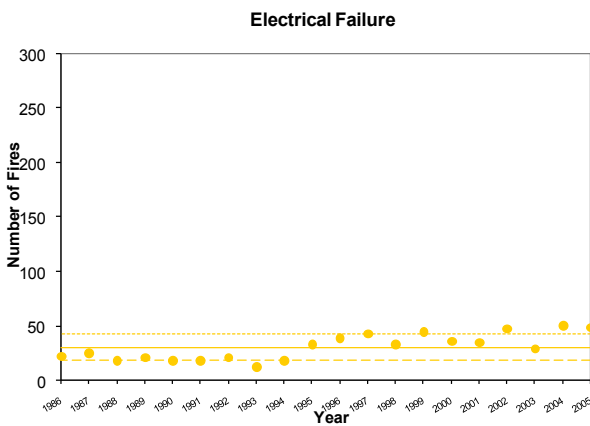
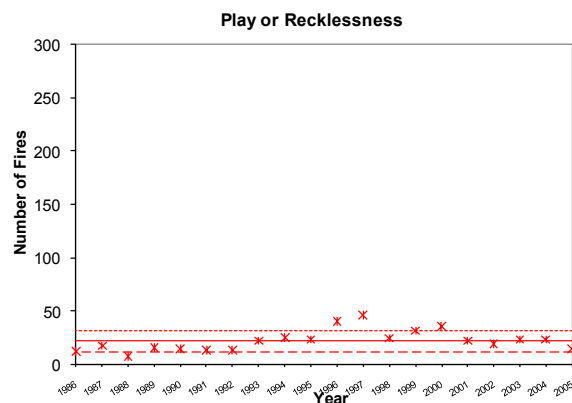
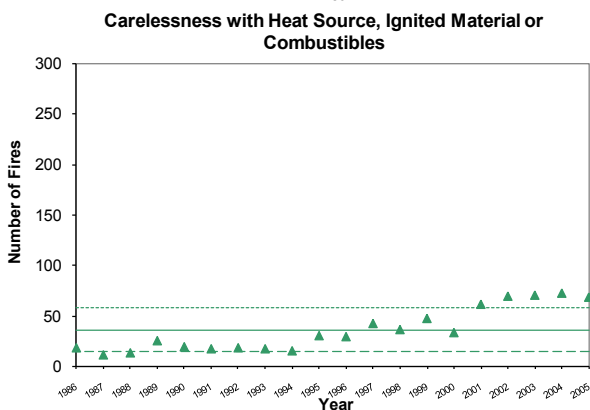
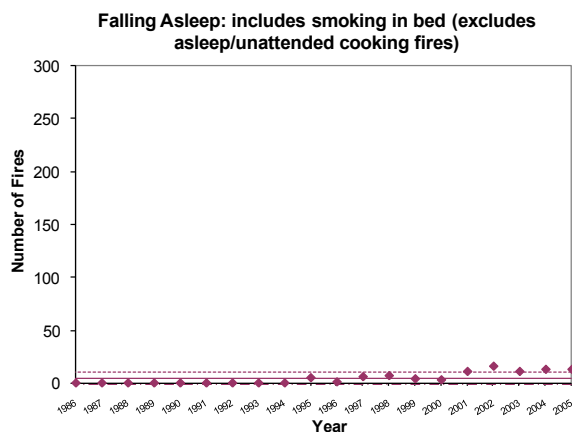
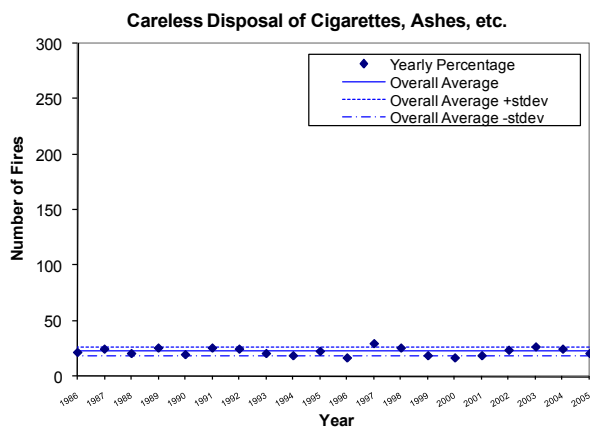


Figure 125: Number of fire incidents for each group of cause of ignition that occurred each year in apartments (1986 – 2005).

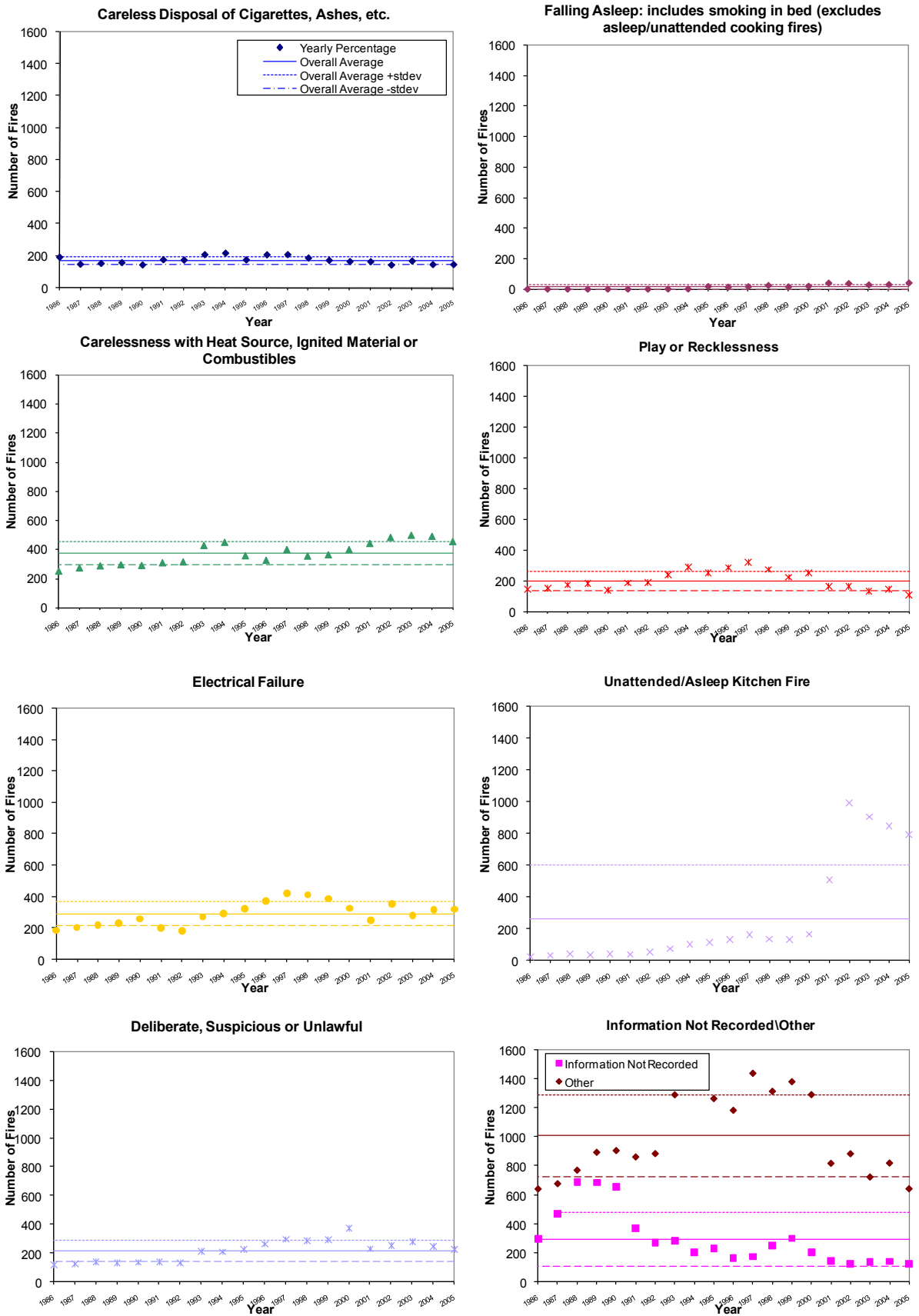


Figure 126: Number of fire incidents for each group of cause of ignition that occurred each year in all residential structures (1986 – 2005).

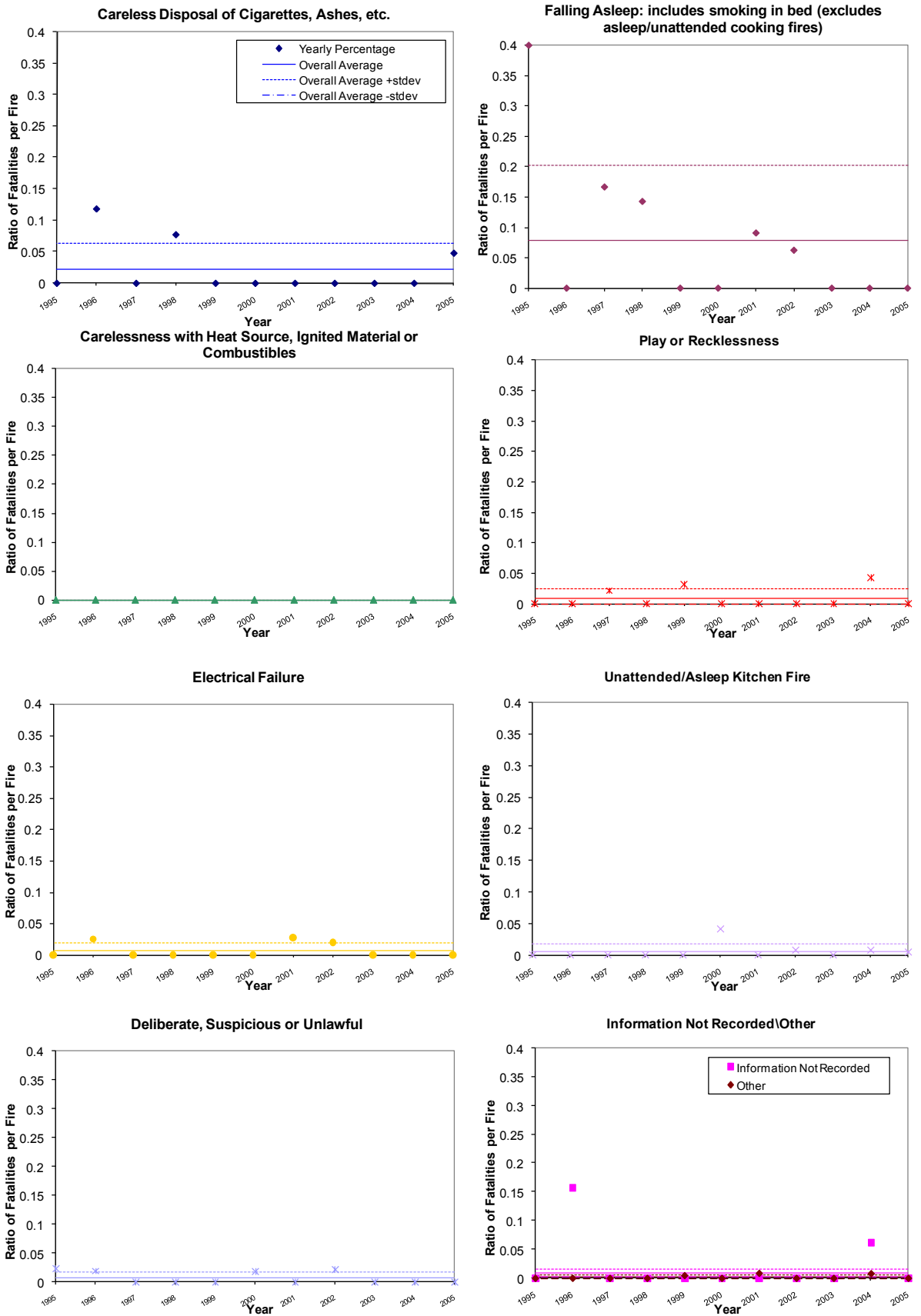


Figure 127: Ratio of fatalities to fires for each group of cause of ignition that occurred each year in apartments (1995 – 2005).

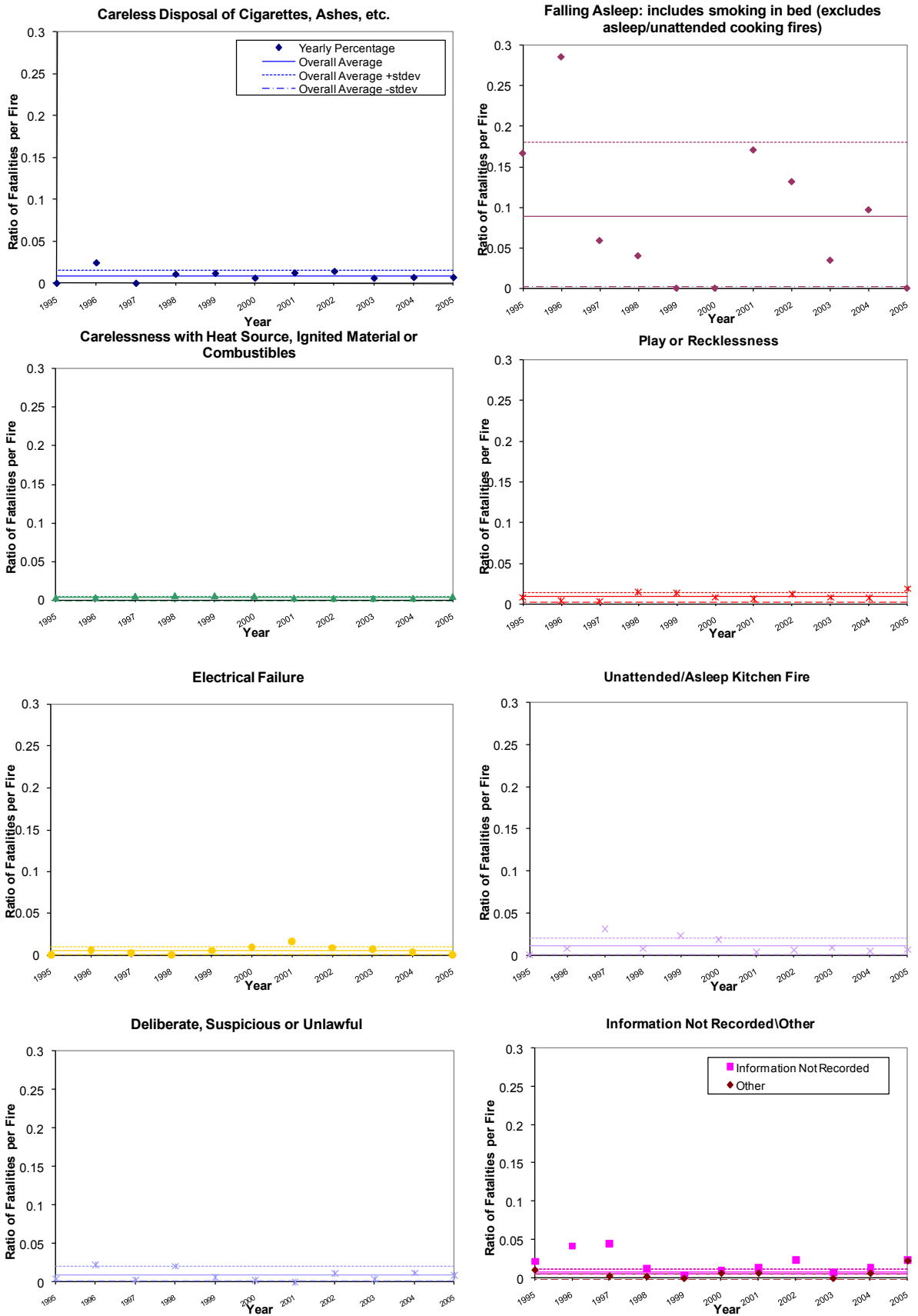


Figure 128: Ratio of fatalities to fires for each group of cause of ignition that occurred each year in all residential structures (1995 – 2005).

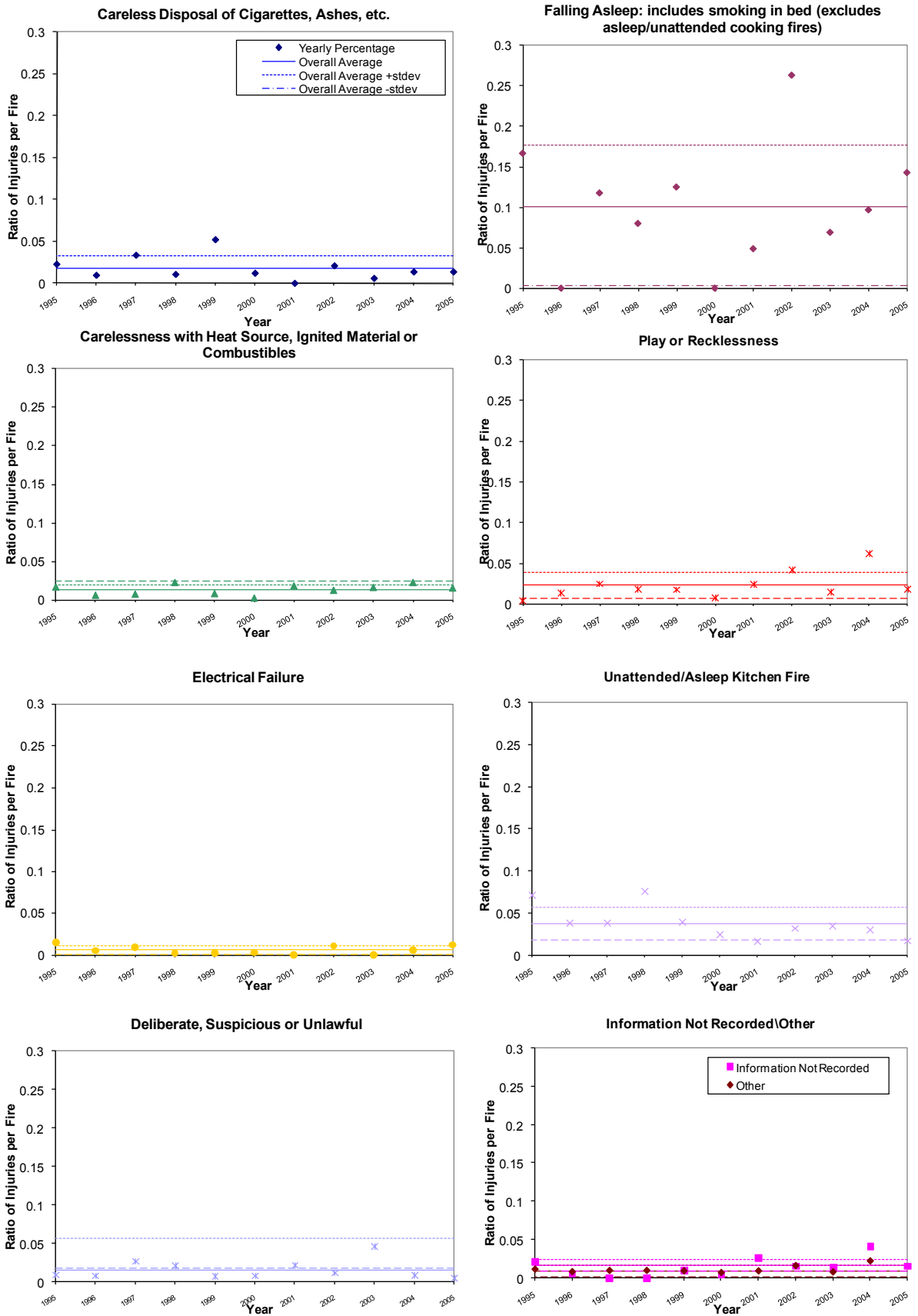


Figure 129: Ratio of injuries to fires for each group of cause of ignition that occurred each year in apartments (1995 – 2005).

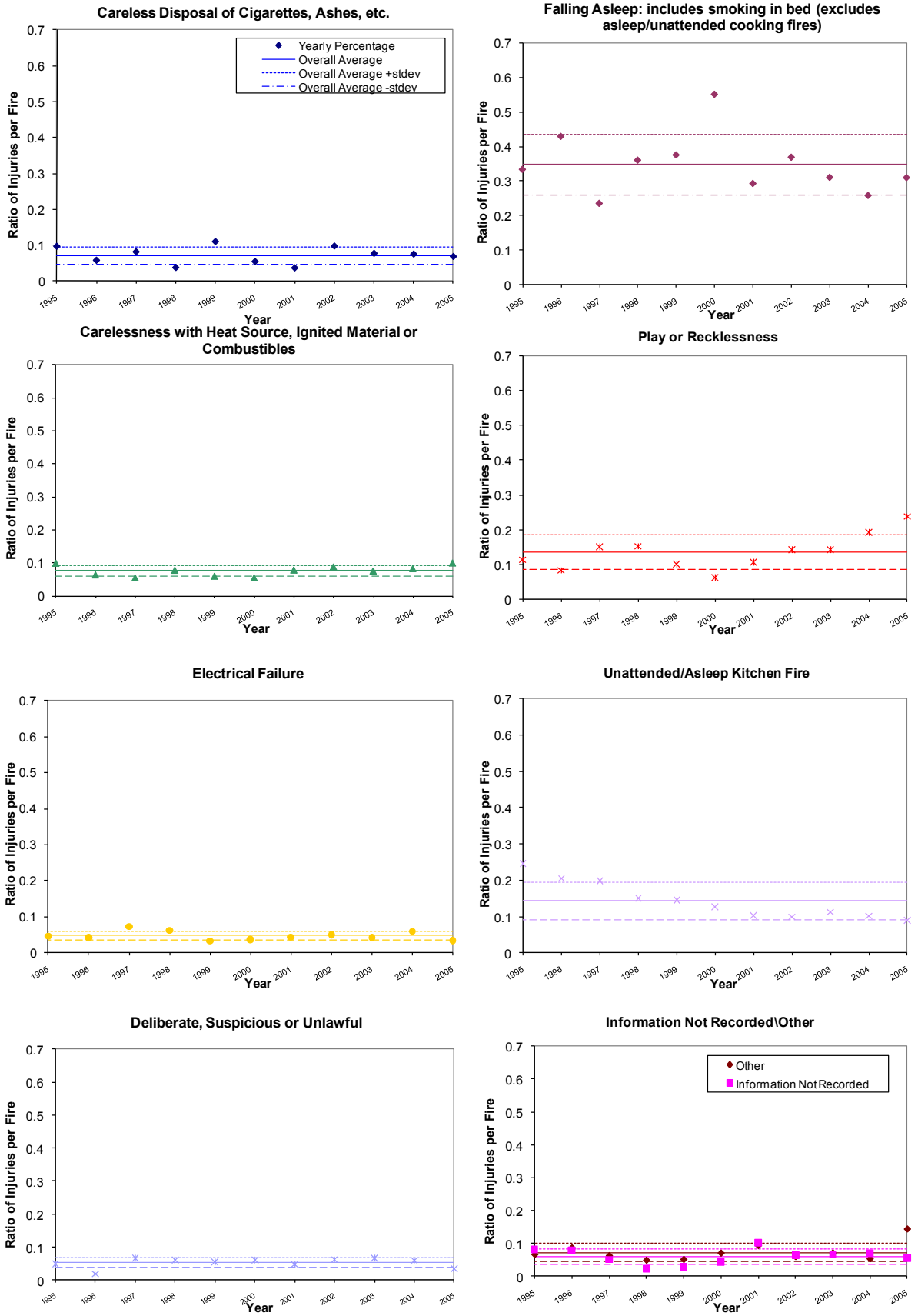


Figure 130: Ratio of injuries to fires for each group of cause of ignition that occurred each year in all residential structures (1995 – 2005).

5. SUMMARY & CONCLUSIONS

The results of this report are summarised in terms of the three original objectives (Section 1.2) of this investigation.

5.1 Available Sample Size

The appropriateness of the use of New Zealand residential fire statistics to estimate a selection of fire events for apartments was indicated by the sample sizes available in this analysis.

In summary, the sample sizes available for New Zealand fire incident statistics are small. For example, for the data sets considered here there was an average of approximately:

- 230 and 3500 fires/year in apartment and residential properties, respectively,
- 4 and 24 civilian fatalities/year in apartment and residential properties, respectively, and
- 55 and 270 civilian injuries/year in apartment and residential properties, respectively.

Furthermore, each category considered had up to 211 individual classes:

- Room of fire origin: 74 classes
- Equipment involved in ignition: 211 classes
- First material ignited: 80 classes
- Cause of fire: 67 classes

The situation was improved by using groups of related individual classes that included a group for “information not recorded” (to provide an indication of the detail recorded) and “other” (to collate all the classes with small individual contributions to the information):

- Room of fire origin: 7 groups
- Equipment involved in ignition: 9 groups
- First material ignited: 7 groups
- Cause of fire: 9 groups

The probabilities of the yearly numbers of fires, fatalities and injuries of the data sets used being representative (within $\pm 10\%$) of the reality of the situation in New Zealand (assuming a normal distribution) is summarised in Figure 131. The data sets used for all residential fire incidents has a good probability of being representative, whereas when considering the apartment fire incident data set there is a reasonable probability of the number of yearly fire incidents being representative, with more doubt for fatalities and injuries. This lower probability associated with the apartment data set is expected because of the small sample sizes for apartment fatalities and injuries.

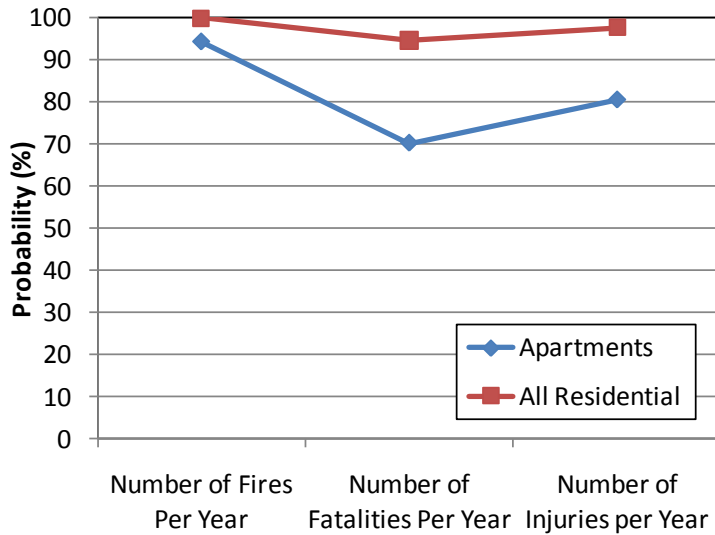


Figure 131: Probabilities of the data set for yearly averages being representative (within ±10%) of the situation in New Zealand (assuming a normal distribution).

The probabilities of the data sets used in this analysis in terms of the groupings listed above being representative (within ±10%) of the reality of the situation in New Zealand (assuming a normal distribution) is summarised for the apartment data set in Figure 132 – Figure 135 and Table 93 – Table 96, and the all residential data set, in Figure 136 – Figure 139 and Table 93 – Table 96. These results were calculated based on the averages and sample deviations of the percentages (rather than the numbers) of fires, fatalities and injuries for each group and the ratios of fatalities or injuries to local fires for each group. Values of zero represent situations where there were no fatalities or injuries for that group in the data sets used.

The assumption that the reality that these values are an estimate for is a normal distribution is only for calculation purposes. It is not expected that data would provide a normal distribution for statistics per year, since historical trends are expected to be influenced by changes in building code requirements, building practices and changes in occupant behaviour that are all changeable over time. However for short time periods, the assumption of a normal distribution may be reasonable if the results are used only as indicative.

Most of the yearly averages for the grouped categories are reasonable representations of the whole data set considered here. However the results are consistently lower for the category of equipment involved in ignition than for other categories. Also percentage of fatalities, percentages of injuries and ratios of fatalities per fire tended to have a lower probability result than the results for percentages of fires.

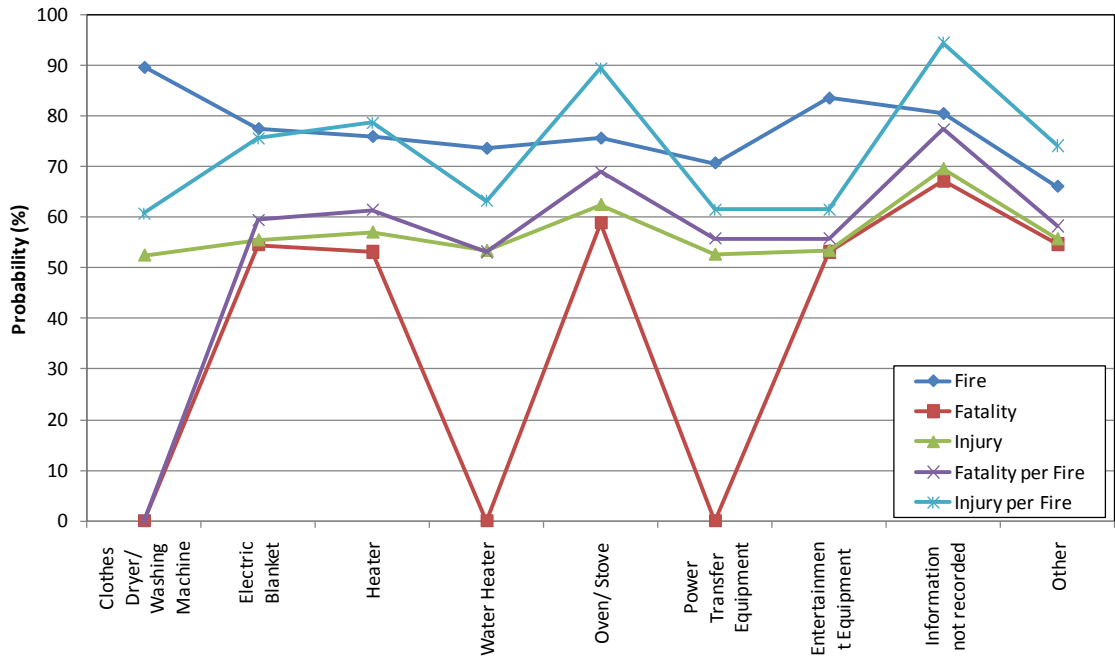


Figure 132: Probabilities of the data set for apartment room of origin being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

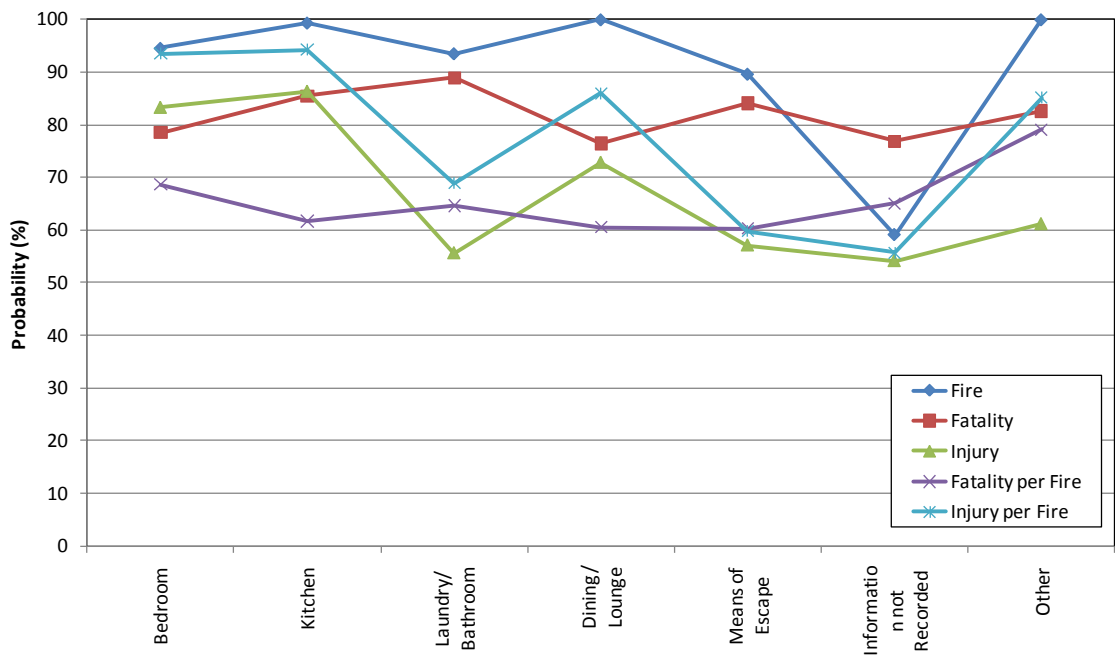


Figure 133: Probabilities of the data set for apartment equipment involved in ignition being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

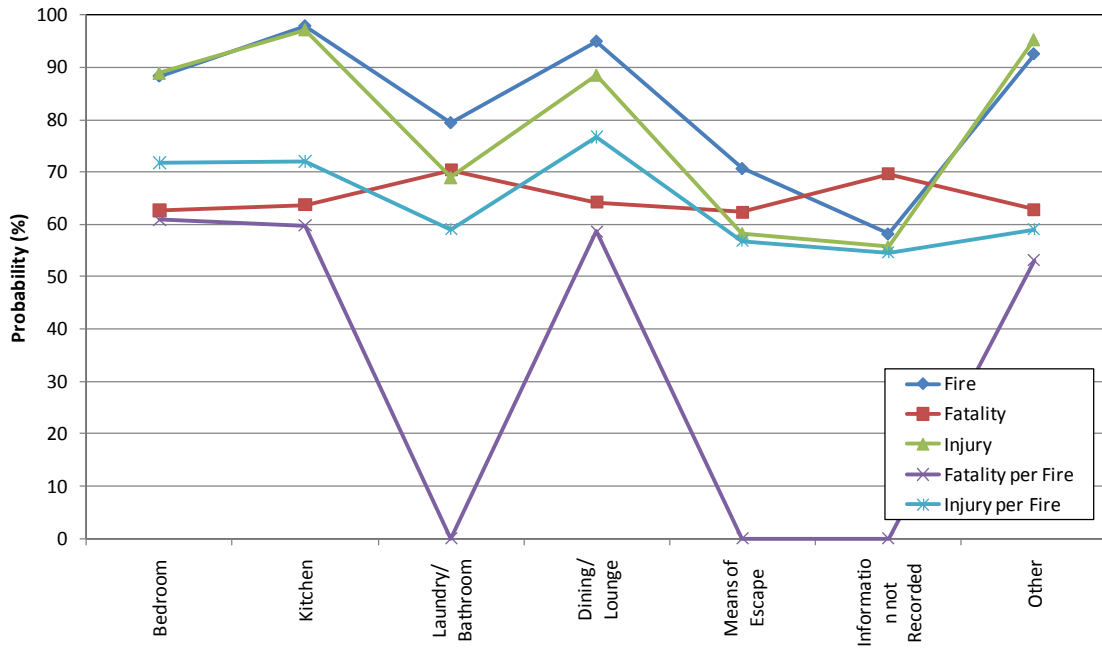


Figure 134: Probabilities of the data set for apartment material first ignited being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

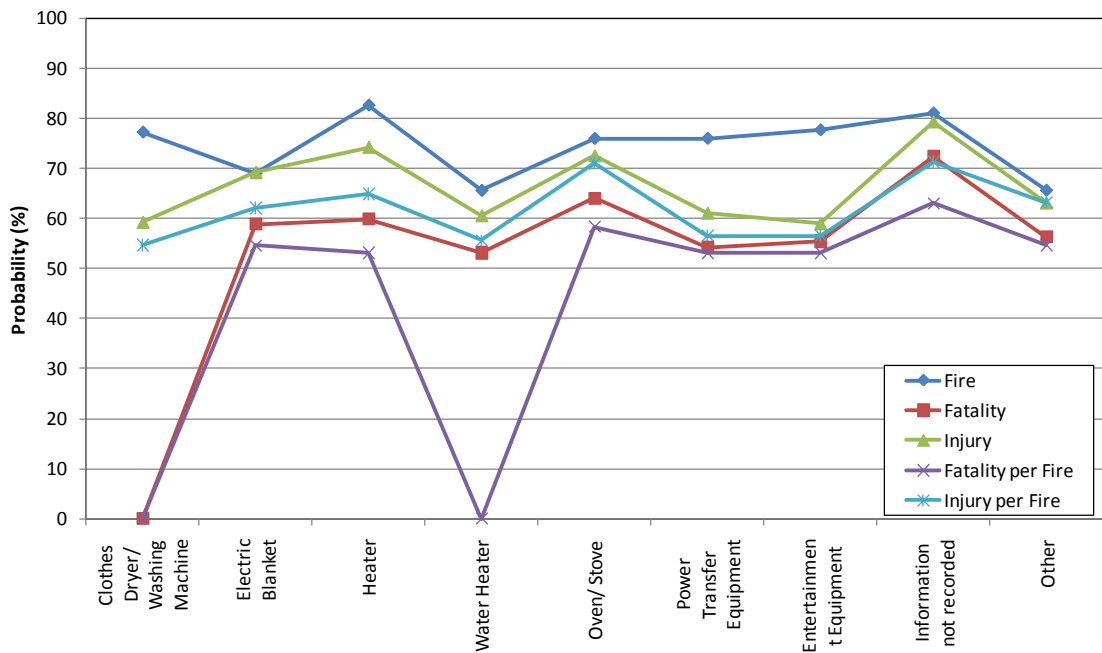


Figure 135: Probabilities of the data set for apartment cause of ignition being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

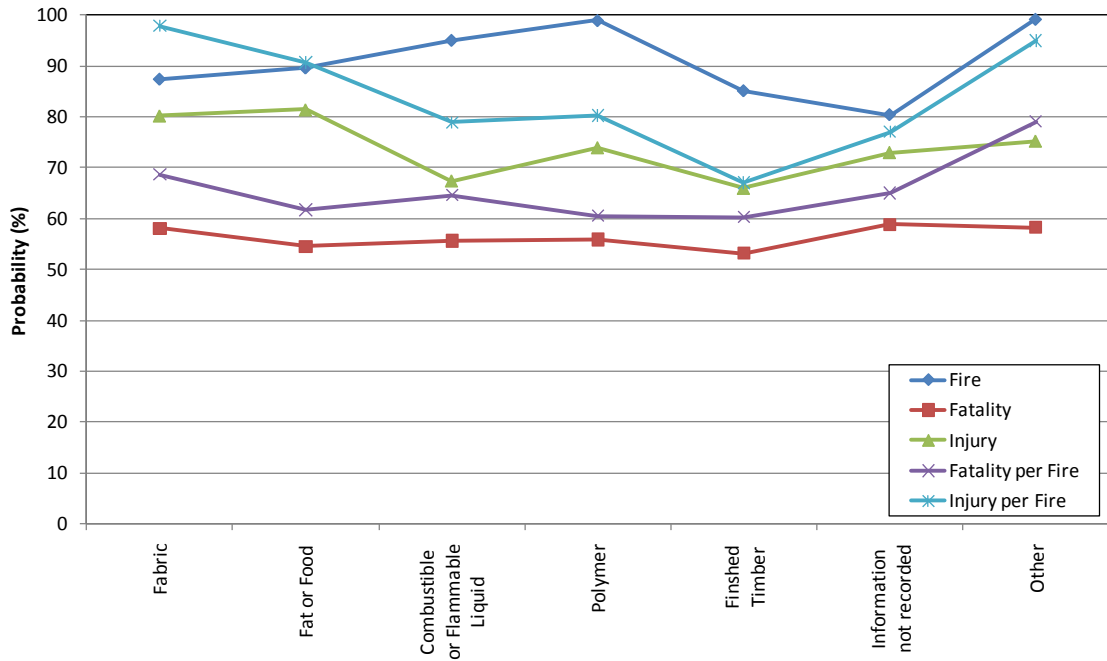


Figure 136: Probabilities of the data set for residential room of fire origin being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

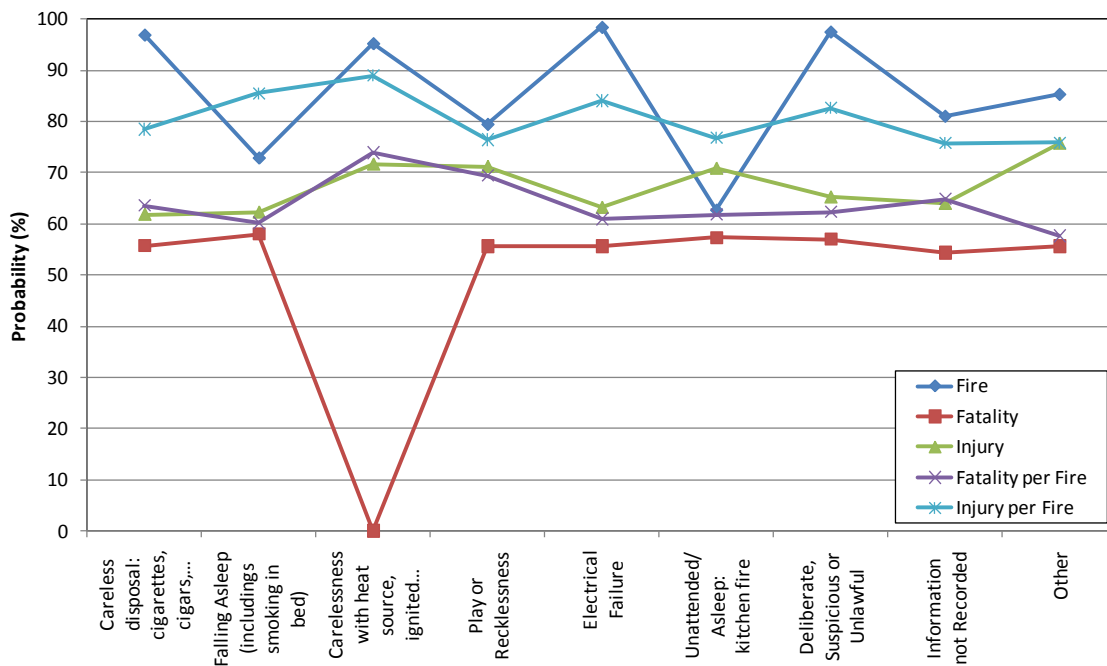


Figure 137: Probabilities of the data set for residential equipment involved in ignition being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

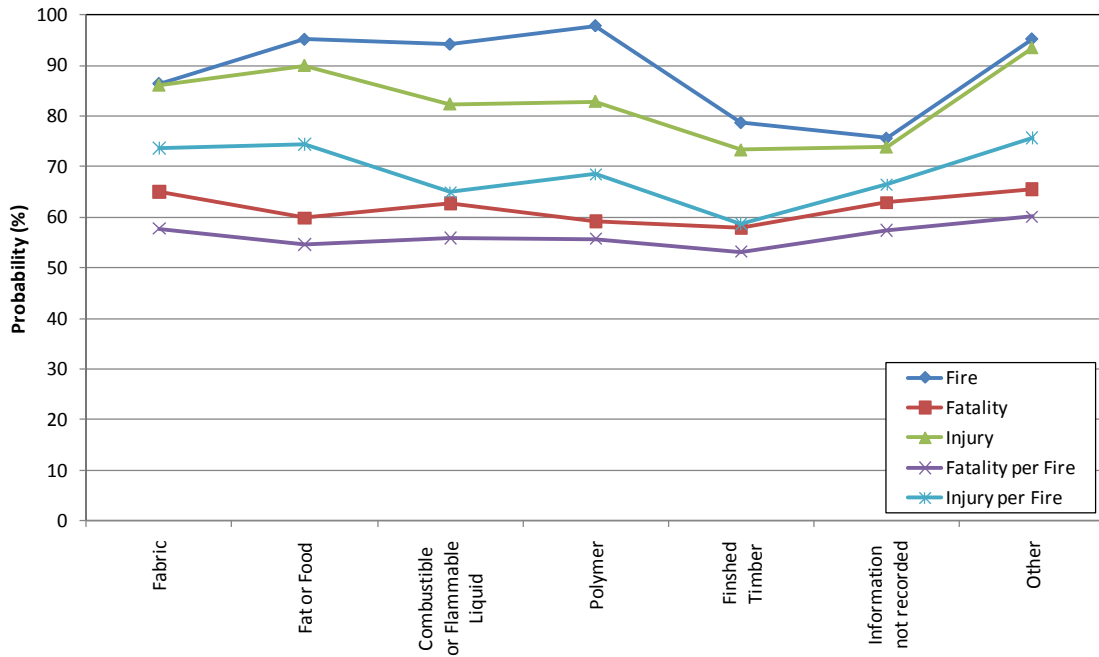


Figure 138: Probabilities of the data set for residential material first ignited being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

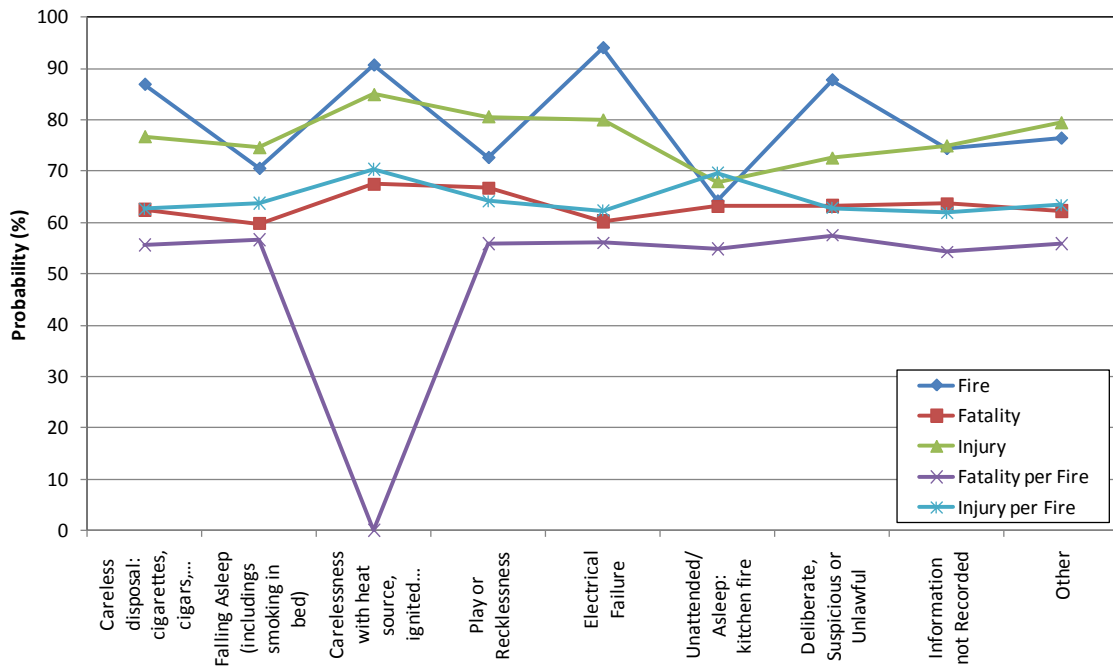


Figure 139: Probabilities of the data set for residential cause of ignition being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

In conclusion, the probabilities of the yearly data sets used in this analysis in terms of the groupings listed above being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution) is reasonable to low. This is attributed to the small sample sizes available and that the assumption of the yearly statistics not being accurately described by a normal distribution. Therefore the results based on these statistics are recommended to be use as a general indication only.

5.2 Correlation of Data Sets

The appropriateness of the use of New Zealand fire statistics for all residential structures to represent fire statistics for apartments was estimated here using linear correlations between the two data sets for the range of categories and groups within these.

The results of the linear correlations between apartment and all residential data sets are summarised for all entries of each category in Figure 140, Figure 141, and Figure 142 (and Table 91, adapted from Table 12, using one significant figure) and groups of each category in Figure 143 (and Table 92, adapted from Table 18 and Table 19, using one significant figure). Details of these results are included in Section 3 and Appendix D.

The summarised data for individual entries for each category (Figure 140, Figure 141, and Figure 142) has a wide variation in the linear correlations between apartment and all residential data sets. The category of equipment involved in ignition consistently has the lowest correlations, which is reasonable because of the data being spread over 211 entries and a large proportion being listed with no information recorded. The fatalities per fire and injuries per fire also have consistently low linear correlations across the categories considered, which is attributed to the data being spread across a large number of potential outcomes for consideration.

The summarised data for grouped entries for each category (Figure 143) has consistently good linear correlations between apartment and all residential data sets. This is attributed to the smaller number of potential outcomes for the grouped entries versus all the individual entries for each category. The number of fatalities and the number of fatalities to local fires are associated with the lowest linear correlations. This is attributed to the small sample size available for NZ fire fatalities. Use of these results are particularly cautioned, recommending use in terms of general indication of trends only.

In conclusion, based on the sample sizes available and the good linear correlations, as summarised in Figure 143, it is reasonable to estimate the general proportions of the grouped categories considered here for apartments based on the data set for all residential fire incidents. It is recommended that these results are used as a general indication, because of the low significance attributed to the small sample sizes available for both data sets, and especially the apartment fire incident data set. In addition, it is noted that information regarding fire incident fatalities must be applied with care, because of the extremely small sample size available for NZ.

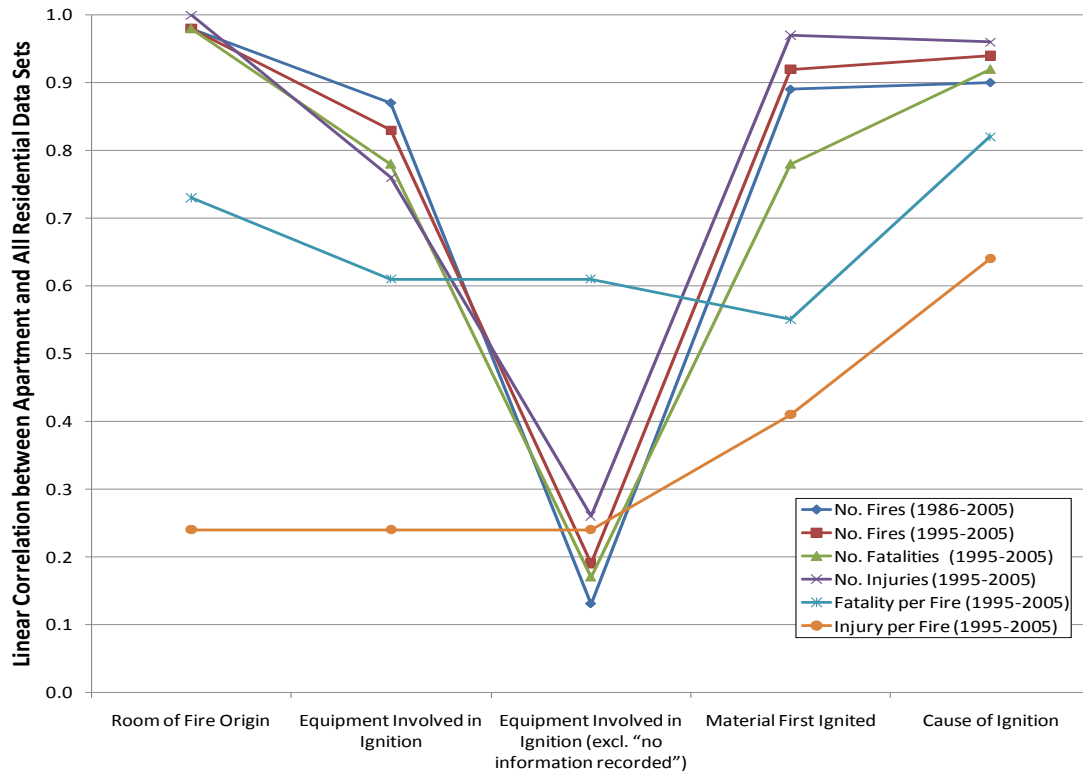


Figure 140: Summary of correlations between apartment and all residential data sets (both with and without structure damage) for cumulative totals and casualties per fire for all entries of each category.

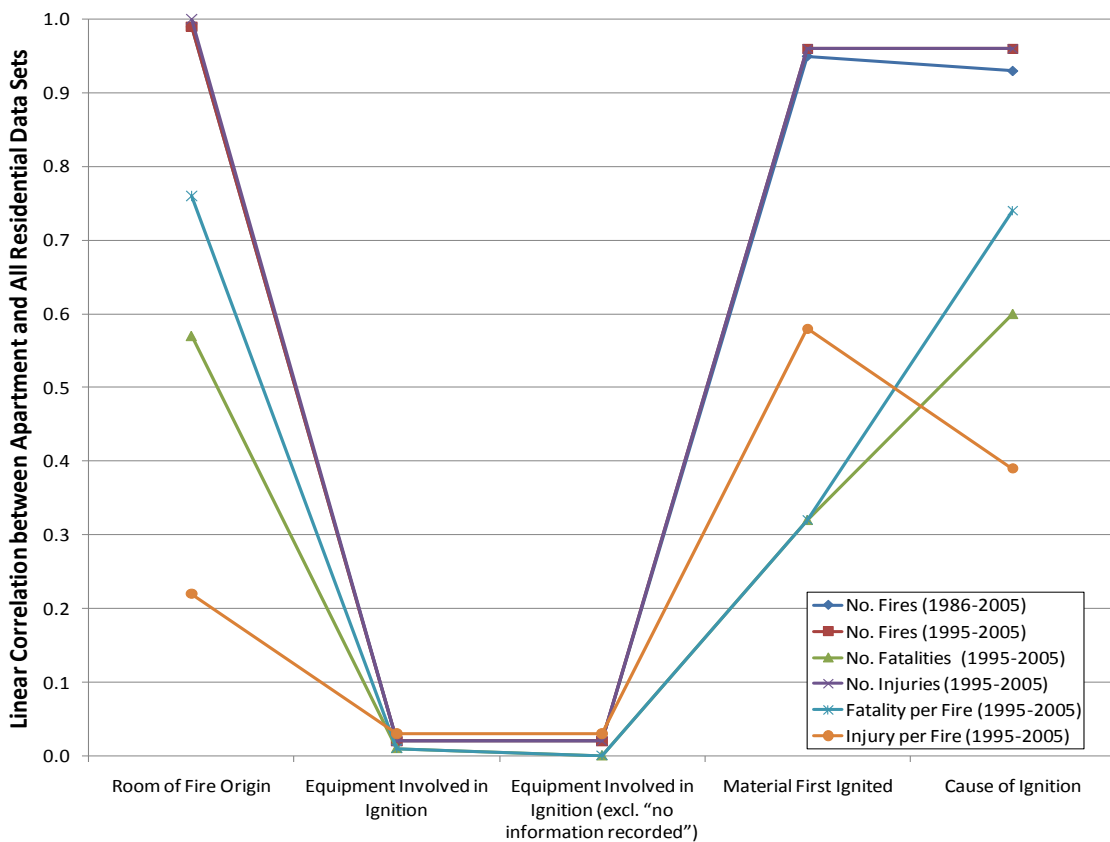


Figure 141: Summary of correlations between apartment and all residential data sets (with structure damage) for cumulative totals and casualties per fire for all entries of each category.

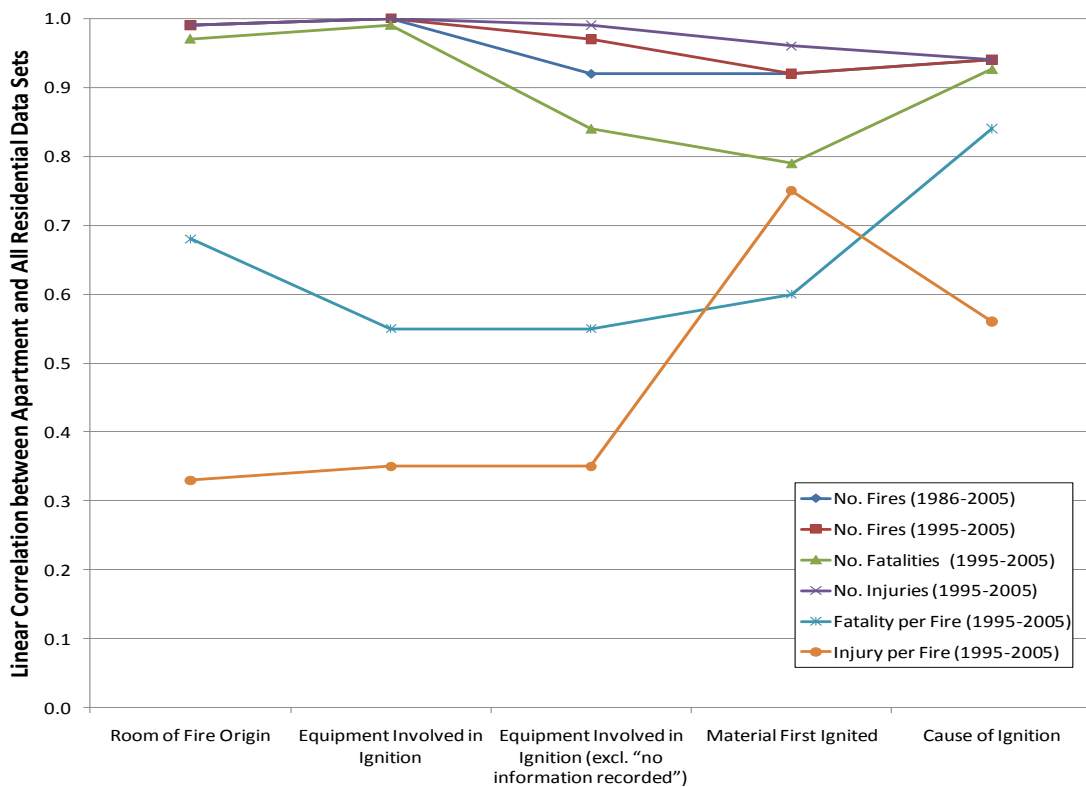


Figure 142: Summary of correlations between apartment and all residential data sets (without structure damage) for cumulative totals and casualties per fire for all entries of each category.

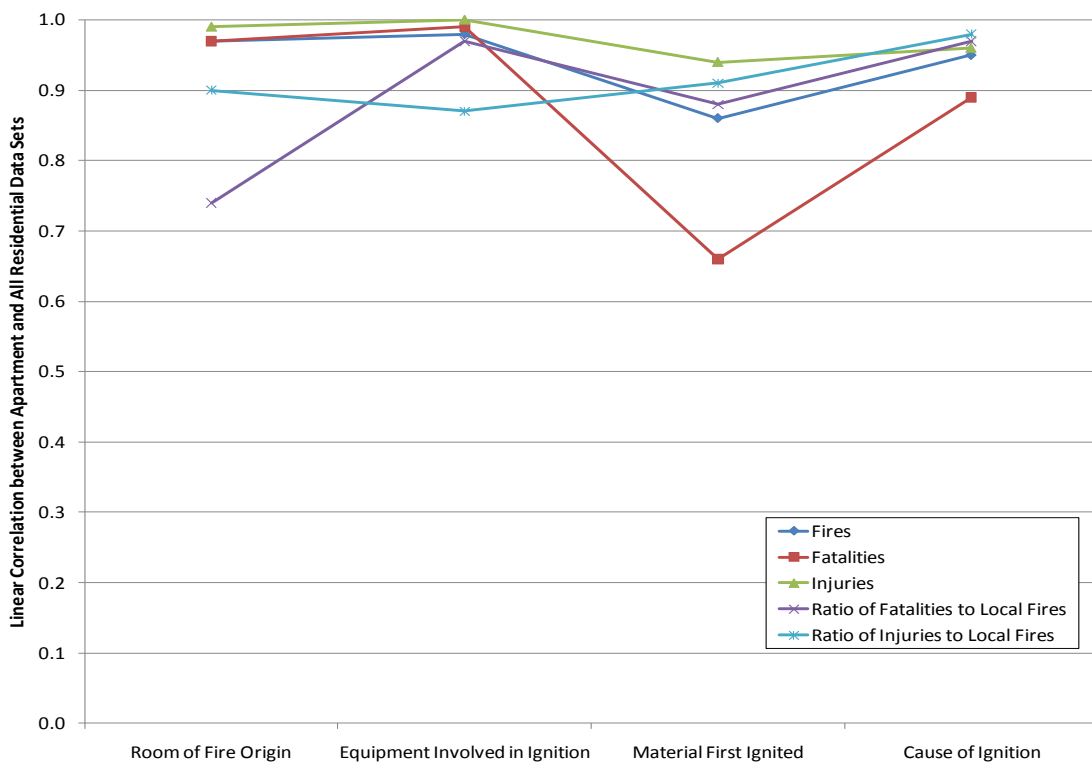


Figure 143: Summary of correlations between apartment and all residential data sets (without structure damage) for cumulative totals and casualties per fire for groups of each category.

5.3 Most Common & Most Costly

The most common and the most costly fire events that occur in New Zealand residential structures were identified for each of the categories and groups within these that were considered.

In summary, the results for the most common fire incidents were determined in terms of the percentage of fires for each group of each category. The results are summarised for grouped categories for all residential data sets in Figure 144 – Figure 147, and Table 97 – Table 100.

The results for the most costly fire incidents were determined in terms of ratios of fatalities or injuries to fires for each group. The results are summarised for grouped categories for all residential data sets in Figure 148 – Figure 151, and Table 97 – Table 100.

In conclusion, the results for most common and most costly fire incidents can be estimated for the grouped categories considered in this analysis. The results are recommended to be used only as indicative.

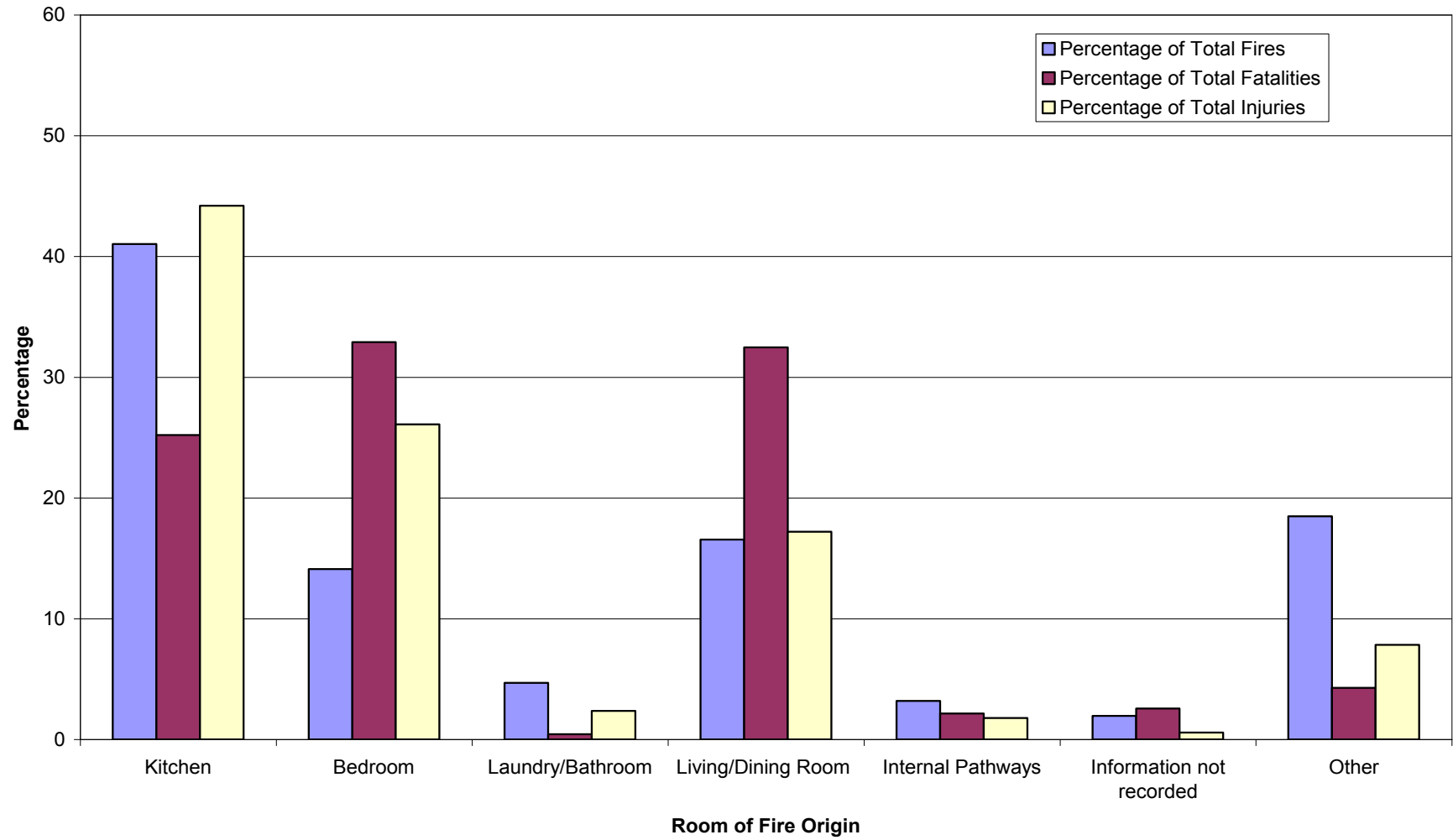


Figure 144: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of room of fire origin (1995-2005).

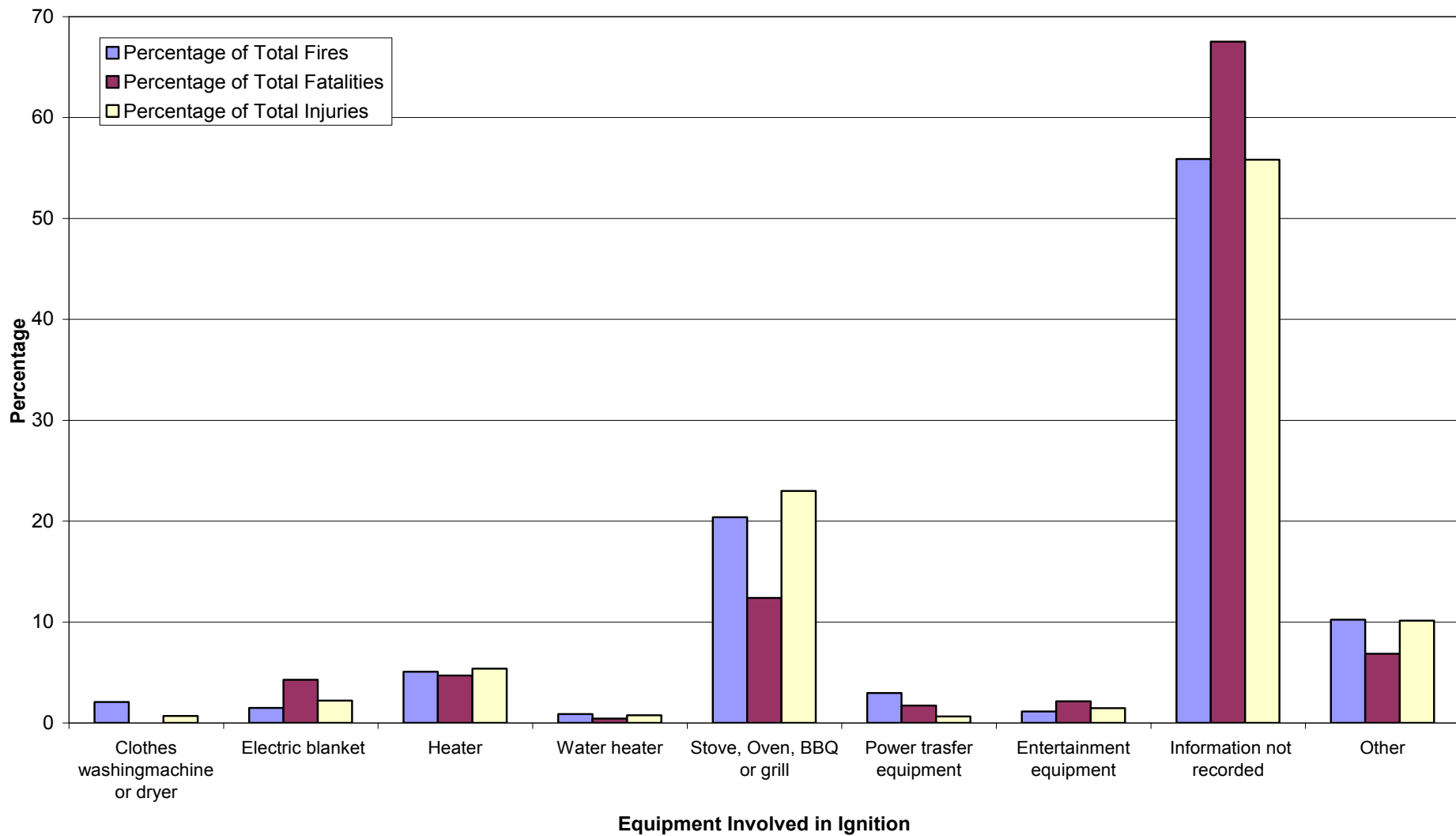


Figure 145: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of equipment involved in ignition (1995-2005).

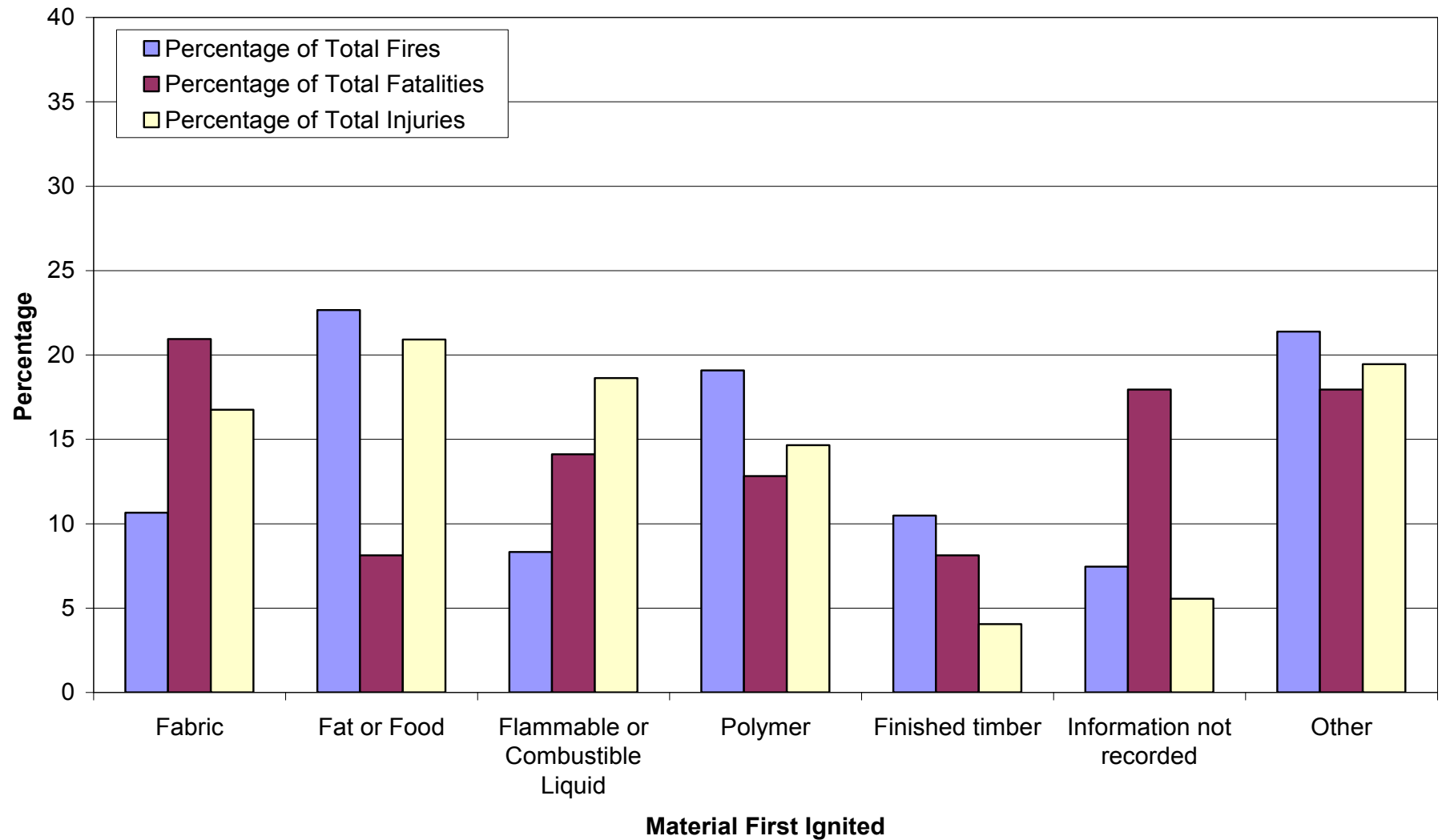


Figure 146: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of first material ignited (1995-2005).

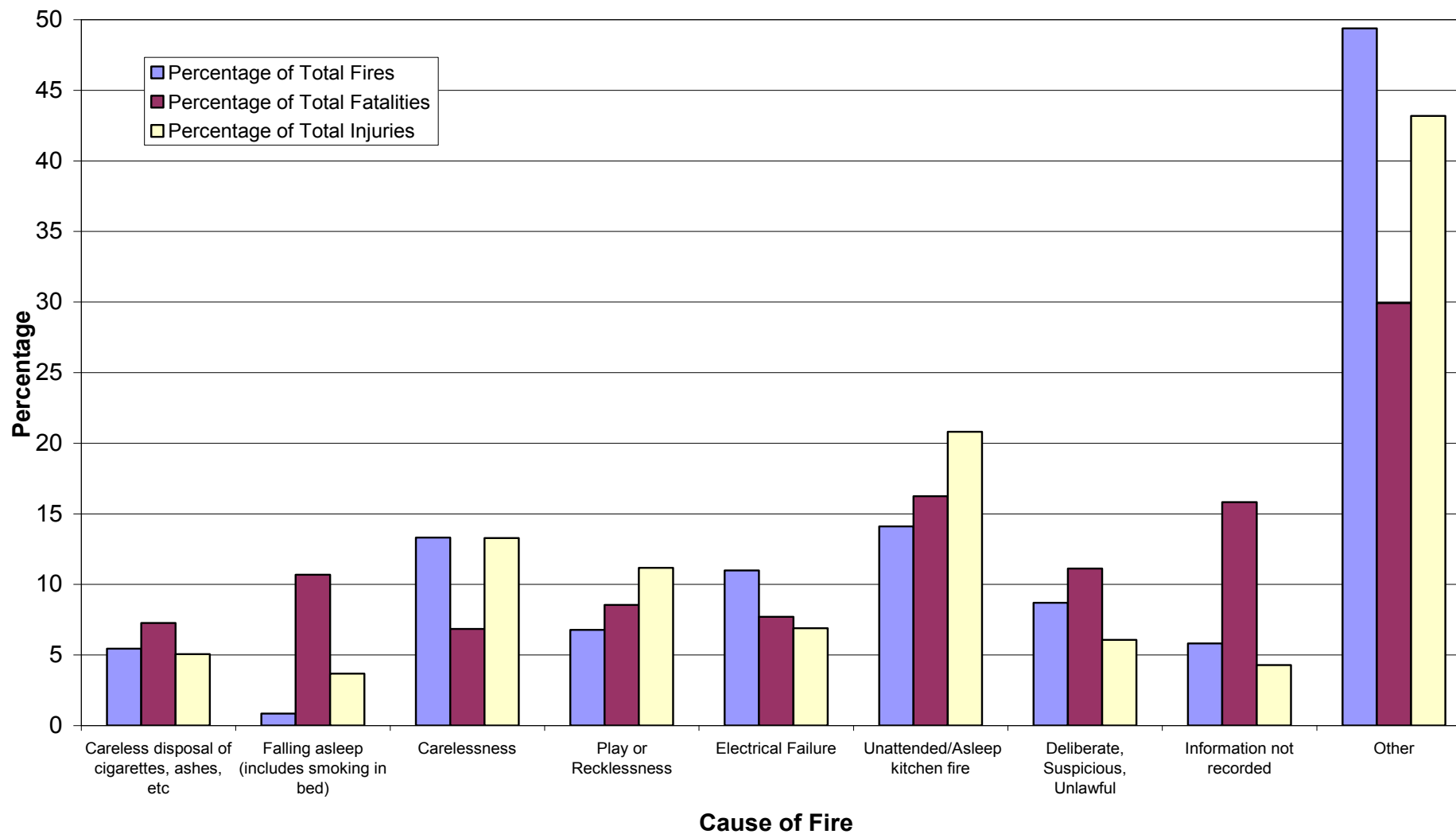


Figure 147: Percentage of totals for fires, fatalities and injuries that occurred in all residential structures as recorded for each group of cause of ignition (1995-2005).

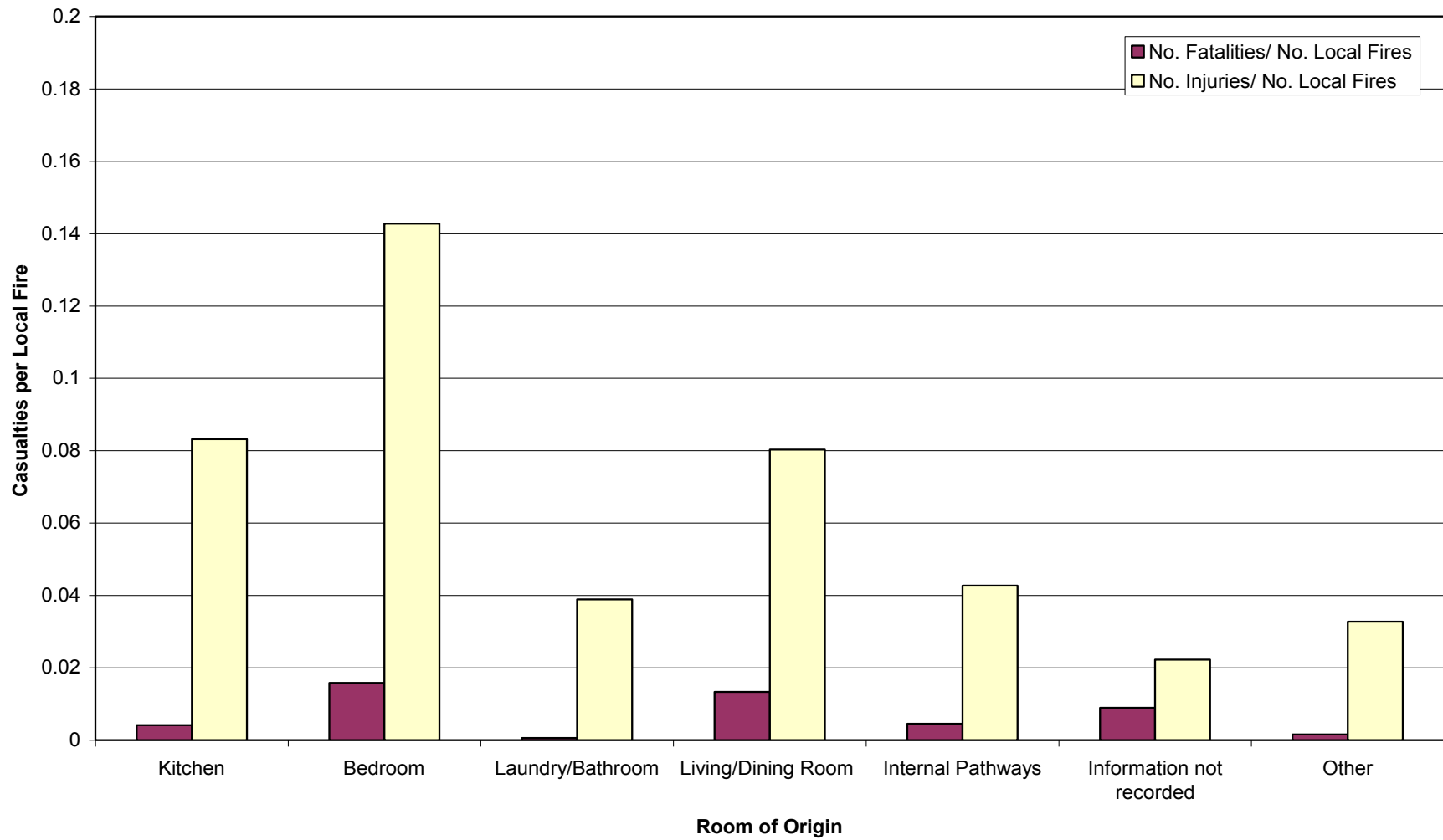


Figure 148: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of room of fire origin (1995-2005).

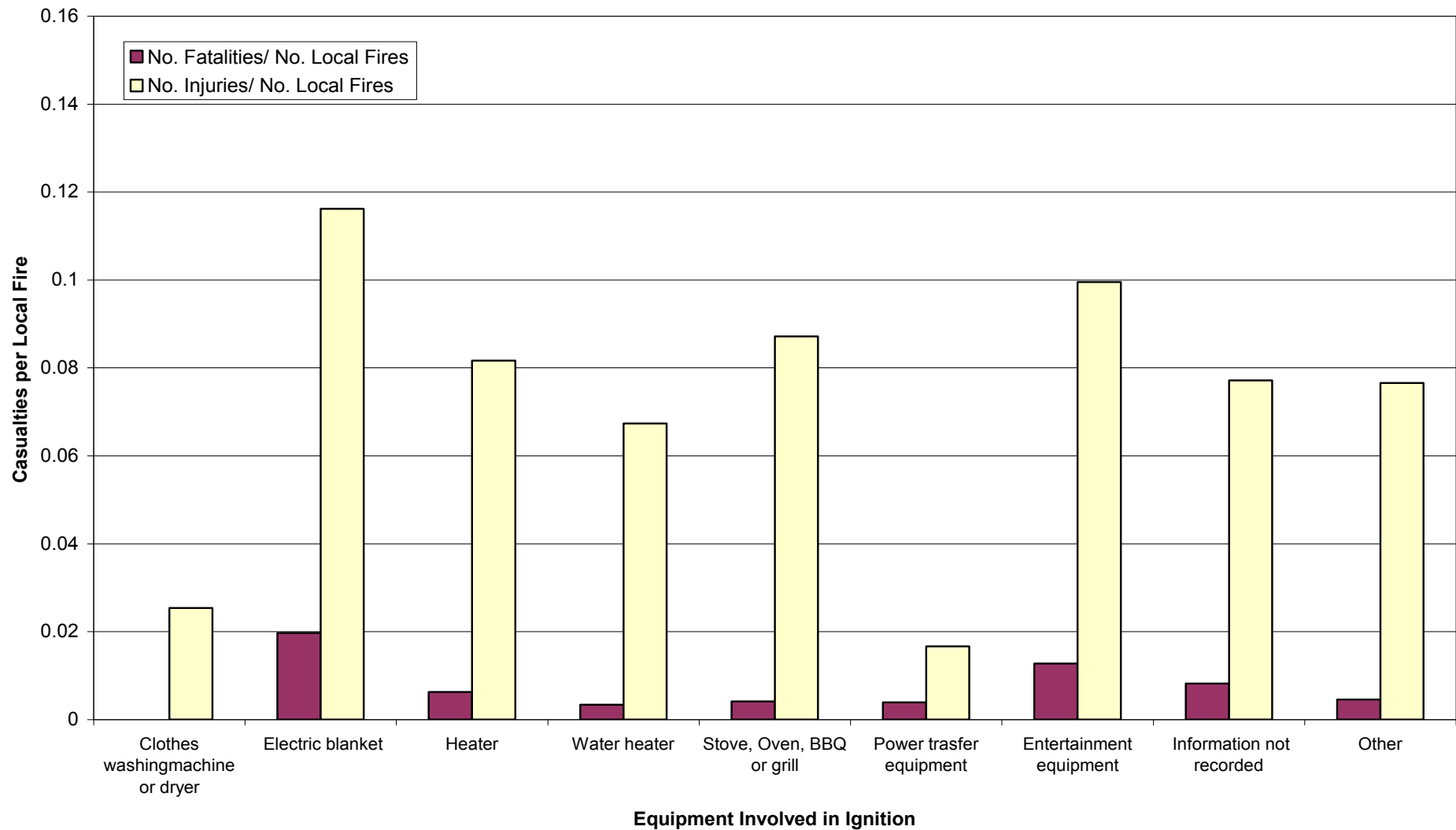


Figure 149: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of equipment involved in ignition (1995-2005).

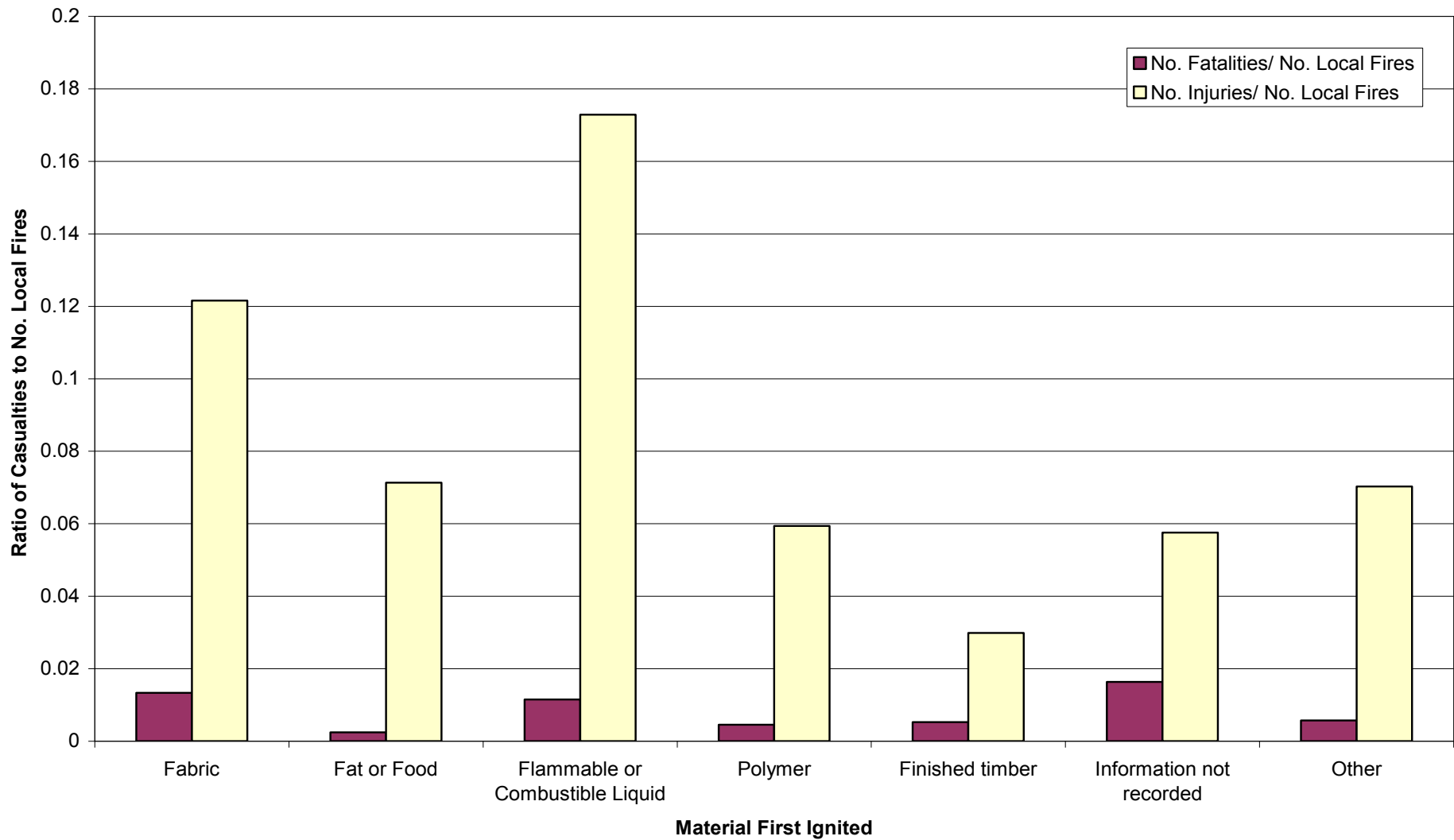


Figure 150: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of material first ignited (1995-2005).

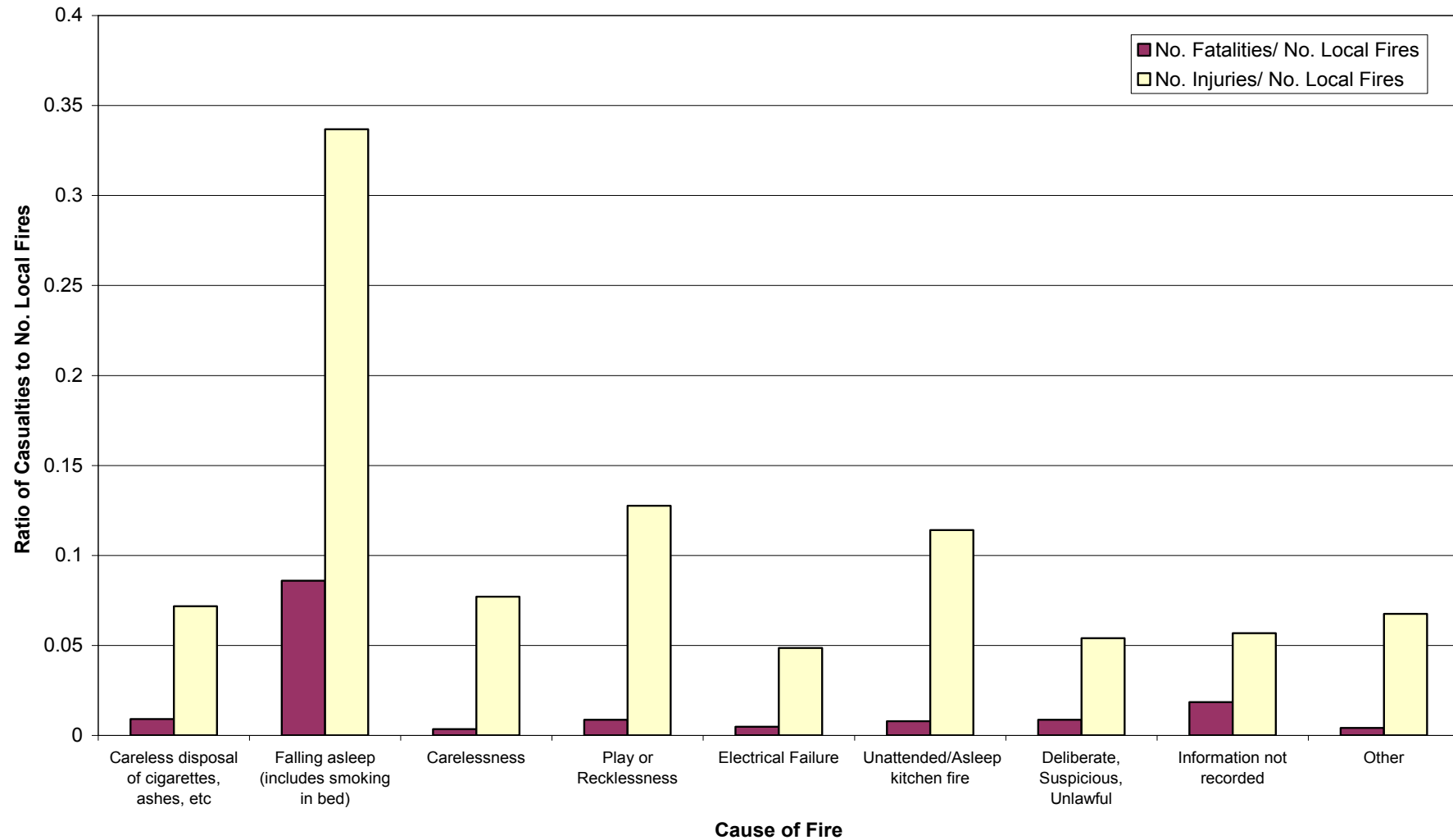


Figure 151: Ratios of numbers of fatalities and injuries to numbers of local fires that occurred in all residential structures as recorded for each group of cause of ignition (1995-2005).

6. REFERENCES

Challands N. (2007) *Personal Communication: Statistics from the NZFS Station Management System*. New Zealand Fire Service, Wellington.

Robbins AP & CA Wade. 2010. *Residential New Zealand Fire Statistics: Part 2 Two-Level Event Tree Analysis*. BRANZ Study Report No. 223. BRANZ Ltd, Porirua City, New Zealand.

APPENDIX A LISTING OF NZFS SMS CATEGORIES USED

No.	Room of fire origin	Cause of Ignition	First Material Ignited	Equipment Involved
1	Area under construction or major renovation	Accidentally turned on: not turned off	Acetylene	Amplifiers for sound and musical instruments
2	Balcony, Porch, Veranda	Animal	Adhesive, Resin, Tar	Arc welder
3	Bedroom, Sleeping area, Cell: 5 or more persons	Automatic control failure	Ammonia	Automatic garage door opener
4	Bedroom, Sleeping area, Cell: under 5 persons	Backfire	Anaesthetic gas	Barbecue grill: Electric
5	Boot, Load carrying area	Careless disposal: cigarettes, cigars, ashes, embers	Asphalt treated material	Barbecue grill: Gas fuelled
6	Ceiling and floor assembly	Carelessness with heat source - not classified above	Cardboard	Barbecue grill: Solid fuelled
7	Ceiling and roof assembly	Carelessness with material ignited - not classified above	CNG	Bathroom towel rail - wall mounted heater
8	Chimney	Collision, overturn, knockdown (includes vehicle)	Coal, Coke	Battery charger
9	Chute: Mail, Laundry (not Rubbish)	Combustible placed too close to heat source	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	Brazier
10	Conveyer	Construction deficiency	Combustible Metal e.g. Magnesium, Titanium, Zirconium	Bunsen burner
11	Crawl space, Basement	Controlled burn, land clearing fire	Cork	Calculator, Adding machine
12	Dining area, Cafeteria, Canteen, Served, Bar area	Deliberately lit fire - not classified above	Cotton, Canvas, Rayon (not oiled canvas)	Carpet shampoo machine
13	Duct: Air, Heating, Cable, Exhaust	Design deficiency	Cryogenic (- 200°C)	Central air conditioning
14	Electronic equipment area/room, computer area, control centre, telephone booth	Design, construction or installation fault - not classified above	Diesel	Chainsaw
15	Enclosure with pressurised air	Earthquake	Fabric, Fibre (finished)	Charcoal grill
16	Engine area, Running gear	Equipment not being operated properly	Fabric, Textiles, Wool, Hair - not classified above	Christmas tree wiring
17	Escalator	Equipment overloaded	Fat, Grease, Butter	Cigarette, Confectionery, Can dispensing vending machine
18	First aid, Surgery, Treatment room, Dialysis room	Equipment unattended	Flammable Combustible Liquid - not classified above	Clock, Clock radio
19	Fuel tank, Fuel line area	Equipment used for purpose not intended	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	Clothes dryer: Commercial

20	Garage, Carport, Vehicle storage, Storage Shed	Exposure fire	Food, Starch (not fat and grease)	Clothes dryer: Residential
21	Hallway, Passageway, Corridor, Walkway in mall	Extreme conditions - not classified above	Fur, Silk, Other Fabric (finished goods)	Clothes washing machine: Commercial
22	Heating equipment, Water heating	Failure to clean	Gorse, Scrub	Clothes washing machine: Residential
23	Incinerator room	Failure to use ordinary care	Grain, Natural fibres, Flax, Hessian, Kapok	Clothing iron
24	Kitchen, Cooking area	Falling asleep: other (includes smoking in bed)	Grass	Coffee maker, Cappuccino
25	Laboratory	Flammable liquid used: kindle fire, washing, cleaning, painting	Grease (non food)	Coffee urn, Fixed food warmer
26	Large assembly area: Auditorium, Place of worship, Theatre, Arena, Lecture hall etc	Flammable liquid/gas spilled or accidentally released	Gypsum board, Gib board, Elephant board	Computer disk drive or CPU
27	Large open room: Ballroom, Gymnasium, Roller rink, Bowling alley lane etc	Friction (sparks etc.)	Hay, Straw, Chaff	Computer keyboard
28	Laundry area, Wash house	Heat source too close to combustibles: fires near trees, welding/cutting, debris	Hexamine, Fire starters	Computer monitor
29	Lawn, Park, Sports field	High temperature	Human hair	Computer printer
30	Library, Art gallery, Exhibition space	High water, floods	Hydrogen	Cord on appliance
31	Lift, Dumbwaiter	High wind	Information not recorded	Cord on Portable lamp
32	Light well	Improper container	Leather	Cutting torch
33	Living area - not classified above	Improper fuelling techniques: vehicles, saws, petrol motors etc	Linoleum	Decoding receiver eg Sky, Saturn Cable
34	Lobby, Entrance way	Improper startup or shut down procedures	Logs	Dehumidifying air conditioning
35	Lounge, Common room, TV room, Sitting room, Music room	Improper storage procedures	LPG	Dishwashing machine: Commercial
36	Machinery room/area, Engine room, Refrigeration room, Pump room, Lift motor room	Inadequate control: open fires, camp fires, bonfires	Mulch, Clippings, Weeds, Cuttings, Compost	Dishwashing machine: Residential
37	Maintenance shop, Repair, Welding, Paint shop, Paint	Information not recorded	Multiple materials first ignited	Distilling chemical processing equipment

	spraying area			
38	Manufacturing, Process, Work room	Installed too close to combustibles	Natural gas	Distribution board circuit breaker
39	Multiple areas of origin	Lack of maintenance	Natural products - not classified above	Distribution board fuse type
40	Not Recorded	Lawful	Oil cloth	Drill
41	Office	Legality not known	Oily rags	Drycleaning machine
42	On or near railway track or embankment	Lightning	Paint, Varnish	Electric blanket
43	Open land, Scrub land, Farm land	Manual control failure	Paper e.g. Uncoated, untreated, ground up & recycled, used as insulation	Electric can opener
44	Operating control area: Cockpit, Cab of truck, Bridge on ship	Mechanical failure, malfunction - not classified above	Particle board, Hardboard, Pinex, Fibre board	Electric central heating unit
45	Operating theatre, Recovery room	No spark arrester: spark arrester, improperly installed	Peat	Electric convector - wall mounted heater
46	Outside area, multiple area - not classified above	Operating deficiency - not classified above	Perspex e.g. Plastic windows	Electric deep fat fryer
47	Passenger area (of transportation equipment)	Other electrical failure	Petrol	Electric fan wall mounted heater
48	Patio, Court, Terrace, Gazebo	Other installation deficiency	Plastics - not classified above	Electric fence unit
49	Photographic, Printing room	Part failure, leak or break	Plywood	Electric motor: Over 1 hp
50	Product storage, Tank, Bin, Agricultural storage, Hay barn, Hay stack	People impaired by drugs or alcohol	Polish, Paraffin wax	Electric motor: Up to 1 hp
51	Record storage/room, Vault	People otherwise impaired: unconscious, mental/physical impairment)	Polycarbonate e.g. Safety screens	Electric panel wall mounted heater
52	Recreational: Swimming pool, Health club, Massage parlour, Sauna	People playing with combustibles	Polystyrene e.g. Foam plastic, Cool store, Domestic insulation, Cladding	Electric radiant bar - wall mounted heater
53	Road, Street, Parking lot, Highway, Motorway	People playing with heat sources	Polyurethane e.g. Foam plastic, Fridge & domestic insulation	Electric water heater
54	Roof surface (exterior)	Pyrophoric	Polyurethane e.g. Furnishings, Upholstery, Mattresses	Elevator, Lift motor
55	Rubbish, Industrial waste, Waste container	Reckless (involving fire) - not classified above	Processed wood, Paper - not classified above	Exhaust system
56	Service or equipment area - not classified above	Reckless act (involving fire)	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	Extension cord properly used

57	Shipping area, Receiving area, Loading area, Packing area	Reckless with fireworks	Radioactive material	Extension cord used in place of permanent wiring
58	Showroom, Sales area	Rekindled from previous fire, Re-ignition	Rubber	Fax machine
59	Small assembly area: Classroom, Meeting room, Multi-purpose room	Short circuit, earth fault	Rubbish (material having no value in the same container or pile)	Fixed air conditioning
60	Stage area, Dressing room, Performance area	Solar, sun	Shavings, Sawdust, Chips	Fixed stationary heating unit - not classified above
61	Stairs (exterior): Fire escape, Ramp	Spontaneous ignition	Slash, Prunings (including felled bush)	Floor heating unit (electric thermo floor)
62	Stairs (interior)	Suspicious	Solid Chemical e.g. Explosives	Floor sanding machine
63	Storage and garage area - not classified above	Thawing	Soot, Creosote (in chimney flues)	Fluorescent light fixture
64	Supply room/area, Tool room, Maintenance supply room	Unable to classify	Tobacco	Fluorescent tube, Fluorescent bulb
65	Technical, Manufacturing area - not classified above	Unattended/Asleep: kitchen, cooking fire	Toi Toi	Food mixer, Beater
66	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	Unknown	Treated paper e.g. building paper, wax or tar paper, wallpaper	Food processor, Whizz
67	Transformer, Switch gear, Electrical control board	Unlawful	Trees: dead, rotten wood (not felled)	Freezer: Commercial
68	Unable to classify		Trees: live (not felled)	Freezer: Residential
69		Vacant structural area	Unable to classify	Fridge/freezer,
70		Vehicle area - not classified above	Unknown	Fridge: Residential
71		Ventilation shaft, Conduit shaft, Utility shaft	Vegetative litter, Dead leaves	Furnace
72		Wall assembly: Concealed wall space	Vinyl e.g. Floor coverings, Wallpaper (but NOT vinyl-coated)	Fuse
73		Wall surface (exterior)	Vinyl e.g. Plastic-coated fabrics, Upholstery fabrics (NOT floor covering)	Gas central heating unit
74		Wardrobe, Cupboard, Walk in pantry	Volatile, solid chemical - not classified above	Gas fuelled water heater
75			Waterproof canvas	Gas mantle
76			Wood pulp	General reffridgeration, Water cooling devices

77			Wood: felled but unsawn	Generator
78			Wood: Round, Posts, Poles, Piles (not logs)	Grinding equipment
79			Wood: sawn, finished timber	Hair dryer
80			Wool, Wool mixtures (finished goods)	Halogen bulb/light
81				Heater lamp (electric)
82				Incandescent heat lamp
83				Incandescent light bulb
84				Incandescent light fixture
85				Incinerator: Residential
86				Industrial control switch
87				Information not recorded
88				Inside light sign
89				Jug or kettle
90				Kiln
91				Knitting machine
92				Lamp holder
93				Lantern for recreational use
94				Lawnmower: electric
95				Lawnmower: petrol
96				LPG deep fat fryer
97				LPG wall mounted heater
98				Main switch
99				Mains gas deep fat fryer
100				Mains gas supply wall mounted heater
101				Meter
102				Meter mounting equipment
103				Microwave oven
104				Multi box plug
105				Night store heater (electric)
106				No Equipment Involved in Ignition
107				Oil lamp
108				Oil or diesel fuel central heating unit
109				Oil or diesel fuel water heater
110				Outside light sign
111				Oven (not for food)
112				Oven, Furnace, Kiln - not classified above
113				Oven: Electric (fixed or stationary)
114				Oven: Liquid fuelled (fixed or stationary)
115				Oven: LPG (fixed or stationary)

116				Oven: Mains gas (fixed or stationary)
117				Oven: Rotisserie (fixed or stationary)
118				Oven: Solid fuelled, coal, wood (fixed or stationary)
119				Paint spraying
120				Paint stripper (flame/gas powered)
121				Paint stripper (hot air)
122				Planing equipment
123				Plug (not a wall socket)
124				Plumbers torch
125				Portable air conditioning
126				Portable bread maker
127				Portable camp stove: Electric
128				Portable camp stove: Gas fuelled
129				Portable cassette, CD player, DVD player, Electronic games deck
130				Portable controlled heat appliance - not classified above
131				Portable cooking warming unit - not classified above
132				Portable crock pot: Electric
133				Portable electric convector heater
134				Portable electric deep fat fryer
135				Portable electric fan heater
136				Portable electric oil-filled column heater
137				Portable electric radiant bar heater
138				Portable electric space heater
139				Portable fan: Electric
140				Portable gas fuelled camping type heater
141				Portable heater - not classified above
142				Portable hot plate, electric frying pan
143				Portable kerosene or oil heater
144				Portable LPG heater
145				Portable mini oven: Electric
146				Portable toasted sandwich maker

147				Portable toaster: Electric
148				Portable toaster: Gas fuelled
149				Portable waffle iron (electric),
150				Power device - battery/batteries
151				Power device - not classified above
152				Power device - Portable gas cylinder
153				Power transfer equipment - not classified above
154				Power transfer: blocks
155				Power transfer: cable
156				Power transfer: wire rope
157				Printing press
158				Pump
159				Radio
160				Razor, Shaver
161				Record player
162				Recycling equipment
163				Saw
164				Skill saw
165				Soldering iron
166				Solenoid
167				Solid fuelled central heating unit
168				Solid fuelled water heater
169				Spa pool water heater (electric)
170				Spa pool water heater (gas fuelled)
171				Space heater (electric)
172				Specialised electronic equipment - not classified above
173				Stereo system, Home music centre
174				Stove: Electric cook, Range top
175				Stove: Gas cook, Range top
176				Stove: Liquid fuelled cook, Range top
177				Stove: LPG cook, Range top
178				Stove: Solid fuelled cook, Range top
179				Tape recorder
180				Telephone: Cellular
181				Telephone: Cordless
182				Telephone: Fixed wire

183				Television
184				Transformer: Circuit breakers associated with transformers
185				Transformer: Control type, Solenoid, Starter
186				Transformer: Distribution type
187				Transformer: Low voltage
188				Transformers & associated equipment - not classified above
189				Transmission equipment
190				Transmitter equipment
191				Unable to classify
192				UPS (Uninterruptible Power Supply) & similar equipment
193				Vacuum (built in) cleaner
194				Vacuum cleaner (dry)
195				Vacuum cleaner (wet + dry)
196				Vehicle electrical equipment
197				Vehicle engine
198				Vehicle fuel system
199				Vehicle part, Pump, Compressor - not classified above
200				Vending machine - not classified above
201				Video player
202				Wall type socket, Light switch, Wall switch
203				Wall type switch, Wall outlet, Wall powerpoint, Wall plug
204				Warming drawer
205				Washing machine - not classified above
206				Waste disposer
207				Water heater - not classified above
208				Waterbed heater pad
209				Weed burner
210				Welding torch
211				Working, Shaping, Machinery - not classified above

APPENDIX B DESCRIPTION OF GROUPED CLASSES USED

Table 8: Overall Headings used for Room of Fire Origin

Overall Headings Used	Associated NZFS Categories
Kitchen	Kitchen, Cooking area;
Bedroom	Bedroom, Sleeping area, Cell: 5 or more persons Bedroom, Sleeping area, Cell: under 5 persons;
Laundry/Bathroom	Laundry area, Wash house Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet
Lounge/Dining Room	Dining area, Cafeteria, Canteen, Served, Bar area Living area - not classified above Lounge, Common room, TV room, Sitting room, Music room;
Internal Pathways	Hallway, Passageway, Corridor, Walkway in mall Lobby, Entrance way Stairs (exterior): Fire escape, Ramp; Stairs (interior);
Information not Recorded	Not Recorded Unable to classify
Other	all other categories

Table 9: Overall Headings used for Equipment Involved in Ignition

Overall Headings Used	Associated NZFS Categories
Washing Machine or Clothes Dryer	Clothes dryer: Commercial Clothes dryer: Residential Clothes washing machine: Commercial Clothes washing machine: Residential
Electric Blanket	Electric blanket
Heater	Bathroom towel rail - wall mounted heater Electric central heating unit Electric convector - wall mounted heater Electric fan wall mounted heater Electric panel wall mounted heater

	<p>Electric radiant bar - wall mounted heater</p> <p>Fixed stationary heating unit - not classified above</p> <p>Floor heating unit (electric thermo floor)</p> <p>Gas central heating unit</p> <p>Heater lamp (electric)</p> <p>Incandescent heat lamp</p> <p>LPG wall mounted heater</p> <p>Mains gas supply wall mounted heater</p> <p>Night store heater (electric)</p> <p>Oil or diesel fuel central heating unit</p> <p>Portable controlled heat appliance - not classified above</p> <p>Portable electric convector heater</p> <p>Portable electric fan heater</p> <p>Portable electric oil-filled column heater</p> <p>Portable electric radiant bar heater</p> <p>Portable electric space heater</p> <p>Portable gas fuelled camping type heater</p> <p>Portable heater - not classified above</p> <p>Portable kerosene or oil heater</p> <p>Portable LPG heater</p> <p>Solid fuelled central heating unit</p> <p>Space heater (electric)</p>
Water Heater	<p>Electric water heater</p> <p>Gas fuelled water heater</p> <p>Oil or diesel fuel water heater</p> <p>Solid fuelled water heater</p> <p>Water heater - not classified above</p>
Stove or Oven	<p>Barbecue grill: Electric</p> <p>Barbecue grill: Gas fuelled</p> <p>Barbecue grill: Solid fuelled</p> <p>Charcoal grill</p> <p>Microwave oven</p> <p>Oven, Furnace, Kiln - not classified above</p> <p>Oven: Electric (fixed or stationary)</p> <p>Oven: Liquid fuelled (fixed or stationary)</p> <p>Oven: LPG (fixed or stationary)</p> <p>Oven: Mains gas (fixed or stationary)</p> <p>Oven: Rotisserie (fixed or stationary)</p> <p>Oven: Solid fuelled, coal, wood (fixed or stationary)</p>

	<p>Portable camp stove: Electric</p> <p>Portable camp stove: Gas fuelled</p> <p>Portable cooking warming unit - not classified above</p> <p>Portable mini oven: Electric</p> <p>Portable toaster: Electric</p> <p>Portable toaster: Gas fuelled</p> <p>Stove: Electric cook, Range top</p> <p>Stove: Gas cook, Range top</p> <p>Stove: Liquid fuelled cook, Range top</p> <p>Stove: LPG cook, Range top</p> <p>Stove: Solid fuelled cook, Range top</p> <p>Warming drawer</p>
Power Transfer and Associated Equipment	<p>Distribution board circuit breaker</p> <p>Distribution board fuse type</p> <p>Fuse; Incandescent light fixture</p> <p>Industrial control switch</p> <p>Main switch</p> <p>Meter</p> <p>Meter mounting equipment</p> <p>Power transfer equipment - not classified above</p> <p>Power transfer: blocks</p> <p>Power transfer: cable</p> <p>Power transfer: wire rope</p> <p>Transformer: Circuit breakers associated with transformers</p> <p>Transformer: Control type, Solenoid, Starter</p> <p>Transformer: Distribution type</p> <p>Transformer: Low voltage</p> <p>Transformers & associated equipment - not classified above</p> <p>Transmission equipment</p> <p>Wall type socket, Light switch, Wall switch</p> <p>Wall type switch, Wall outlet, Wall powerpoint, Wall plug;</p>
TV, Entertainment and Associated Equipment	<p>Clock, Clock radio</p> <p>Computer disk drive or CPU</p> <p>Computer keyboard</p> <p>Computer monitor</p> <p>Computer printer</p> <p>Decoding receiver eg Sky, Saturn Cable</p> <p>Portable cassette, CD player, DVD player, Electronic games deck</p>

	Radio Record player Tape recorder Television Video player;
Information not Recorded	Information not recorded Unable to classify

Table 10: Overall Headings used for First Material Ignited

Overall Headings Used	Associated NZFS Categories
Fabric	Cotton, Canvas, Rayon (not oiled canvas) Fabric, Fibre (finished) Fabric, Textiles, Wool, Hair - not classified above Fur, Silk, Other Fabric (finished goods) Wool, Wool mixtures (finished goods)
Fat or Food	Fat, Grease, Butter Food, Starch (not fat and grease)
Combustible or Flammable Liquid	Ammonia Combustible Liquid e.g. Linseed, Lubricant, Cooking oil Diesel Flammable Combustible Liquid - not classified above Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine Petrol
Polymer	Perspex e.g. Plastic windows Plastics - not classified above Polycarbonate e.g. Safety screens Polystyrene e.g. Foam plastic, Cool store, Domestic insulation, Cladding Polyurethane e.g. Foam plastic, Fridge & domestic insulation; Polyurethane e.g. Furnishings, Upholstery, Mattresses PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation Rubber Vinyl e.g. Floor coverings, Wallpaper (but NOT vinyl-coated) Vinyl e.g. Plastic-coated fabrics, Upholstery fabrics (NOT

	floor covering)
Finished Timber	Wood: sawn, finished timber
Information not Recorded	Information not recorded Unable to classify Unknown

Table 11: Overall Headings used for Reported Cause of Ignition

Overall Headings Used	Associated NZFS Categories
Careless disposal of cigarettes, ashes, etc	Careless disposal: cigarettes, cigars, ashes, embers
Falling asleep: includes smoking in bed	Falling asleep: other (includes smoking in bed)
Carelessness with heat source, ignited material or combustibles	Carelessness with heat source - not classified above Carelessness with material ignited - not classified above Combustible placed too close to heat source Heat source too close to combustibles: fires near trees, welding/cutting, debris Installed too close to combustibles
Play or Recklessness	People playing with combustibles People playing with heat sources Reckless (involving fire) - not classified above Reckless act (involving fire) Reckless with fireworks
Electrical Failure	No spark arrester: spark arrester, improperly installed Other electrical failure Short circuit, earth fault
Unattended/Asleep: kitchen fire	Unattended/Asleep: kitchen, cooking fire
Deliberate, Suspicious or Unlawful	Deliberately lit fire - not classified above Suspicious Unlawful
Information not Recorded	Information not recorded Unable to classify Unknown

APPENDIX C EXAMPLES OF EVENT-TREES

An example of a one-level event tree for fires that have occurred in apartments (1995 – 2005) is shown in Figure 152. An example of part of a two-level event tree for fires that have occurred in apartments (1995 – 2005) is shown in Figure 153.

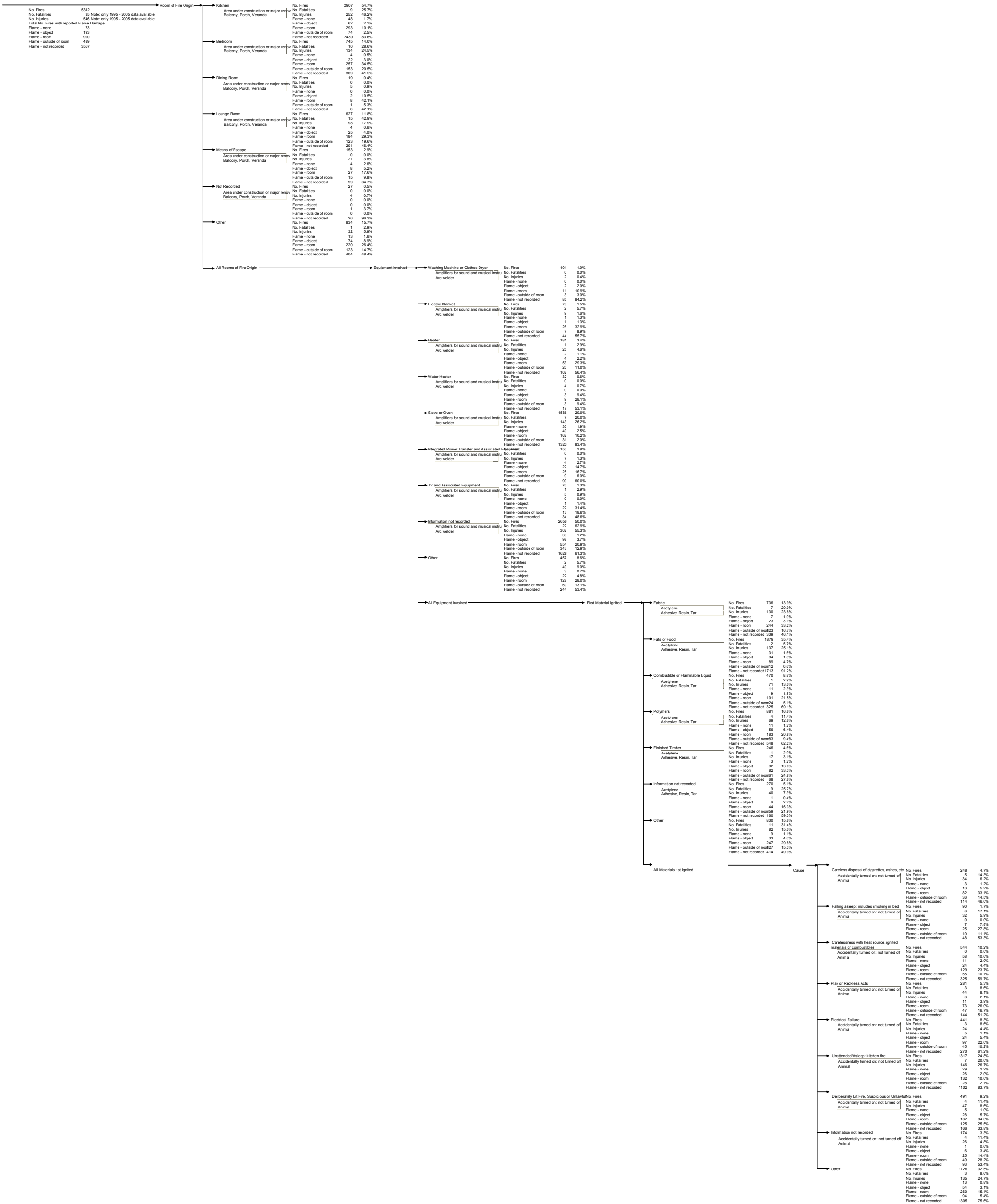


Figure 152: Example output for the one-level event tree for apartment data (1995-2005).

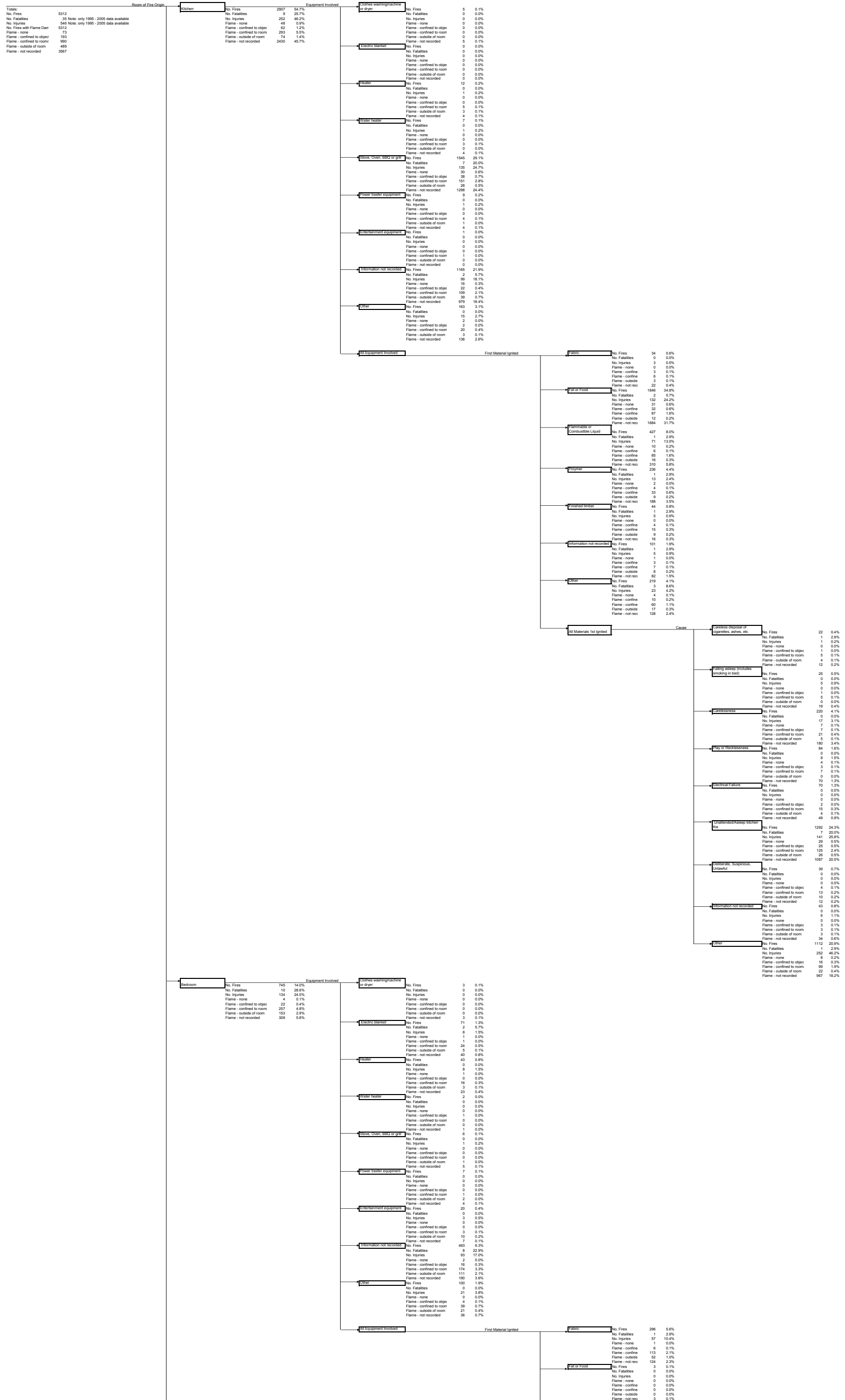


Figure 153: Example output of part of the two-level event tree for apartment data (1995-2005).

APPENDIX D SUMMARY OF CORRELATIONS

A summary of the linear correlations between various attributes for the entire set of NZFS categories is presented in Table 12 and Table 13.

A summary of the linear correlations between various attributes for the grouped categories is presented in Table 14, Table 15, Table 16, Table 17, Table 18 and Table 19.

Table 12: Summary of correlations for cumulative totals and casualties per fire between apartment and all residential data sets for 1-level event-tree

Categories	Building Types Compared	No. Fires ^a	No. Fires ^b	No. Fatalities ^b	No. Injuries ^b	Fatality per Fire ^b	Injury per Fire ^b
Room of Fire Origin	apt wd to res wd	0.99	0.99	0.97	0.99	0.68	0.33
	apt wod to res wod	0.99	0.99	0.57	1.00	0.76	0.22
	apt to res	0.98	0.98	0.98	1.00	0.73	0.24
Equipment Involved in Ignition	apt wd to res wd	1.00	1.00	0.99	1.00	0.55	0.35
	apt wod to res wod	0.02	0.02	0.01	0.02	0.01	0.03
	apt to res	0.87	0.83	0.78	0.76	0.61	0.24
Equipment Involved in Ignition (excl. "no information recorded")	apt wd to res wd	0.92	0.97	0.84	0.99	0.55	0.35
	apt wod to res wod	0.02	0.02	-	0.02	-	0.03
	apt to res	0.13	0.19	0.17	0.26	0.61	0.24
Material First Ignited	apt wd to res wd	0.92	0.92	0.79	0.96	0.60	0.75
	apt wod to res wod	0.95	0.96	0.32	0.96	0.32	0.58
	apt to res	0.89	0.92	0.78	0.97	0.55	0.41
Cause of Ignition	apt wd to res wd	0.94	0.94	0.926	0.94	0.84	0.56
	apt wod to res wod	0.93	0.96	0.60	0.96	0.74	0.39
	apt to res	0.90	0.94	0.92	0.96	0.82	0.64

Notes:

^a Number of fires considered is for years 1986 to 2005.

^b Number of casualties considered is for years 1995 to 2005.

Table 13: Summary of correlations for years 1995 – 2005.

		apt wd	apt wod	res wd	res wod	apt	res
Room of Origin	fires to fatalities	0.92	0.10	0.96	0.76	0.69	0.82
	fires to injuries	0.99	0.99	0.96	0.98	0.96	0.98
Equipment Involved in Ignition	fires to fatalities	0.99	0.87	1.00	0.96	0.98	0.98
	fires to injuries	1.00	0.99	0.99	0.96	1.00	0.97
Equipment Involved in Ignition (excl. "no information recorded")	fires to fatalities	0.81	-	0.87	0.96	0.89	0.95
	fires to injuries	0.96	0.97	0.92	0.96	0.98	0.95
Material First Ignited	fires to fatalities	0.61	0.02	0.77	0.47	0.35	0.66
	fires to injuries	0.88	0.92	0.87	0.87	0.86	0.83
Cause of Ignition	fires to fatalities	0.74	0.00	0.74	0.20	0.64	0.74
	fires to injuries	0.901	0.96	0.81	0.95	0.96	0.93

Table 14: Summary of linear correlations between various parameters for groups of categories for apartments only 1995 – 2005.

		Fires	Fatalities	Injuries
Room of Origin	Fatalities	0.47	-	-
	Injuries	0.93	0.71	-
	FD Confined to Room/Firecell	0.84	0.67	0.86
	FD Beyond Room/Firecell	0.31	0.77	0.51
Equipment Involved in Ignition	Fatalities	0.96	-	-
	Injuries	0.99	0.98	-
	FD Confined to Room/Firecell	0.96	0.99	0.99
	FD Beyond Room/Firecell	0.88	0.96	0.92
Material First Ignited	Fatalities	-0.08	-	-
	Injuries	0.83	0.06	-
	FD Confined to Room/Firecell	0.34	0.42	0.46
	FD Beyond Room/Firecell	-0.24	0.68	-0.05
Cause of Ignition	Fatalities	0.79	-	-
	Injuries	0.97	0.78	-
	FD Confined to Room/Firecell	0.95	0.73	0.87
	FD Beyond Room/Firecell	0.76	0.60	0.64

Table 15: Summary of correlations between various parameters for groups of categories for apartments 1986 – 2005.

		Fires
Room of Fire Origin	FD Confined to Room/Firecell	0.75
	FD Beyond Room/Firecell	0.33
Equipment Involved in Ignition	FD Confined to Room/Firecell	0.96
	FD Beyond Room/Firecell	0.93
Material First Ignited	FD Confined to Room/Firecell	0.43
	FD Beyond Room/Firecell	-0.02
Cause of Ignition	FD Confined to Room/Firecell	0.96
	FD Beyond Room/Firecell	0.83

Table 16: Summary of linear correlations between various parameters for groups of categories for all residential structures 1995 – 2005.

		Fires	Fatalities	Injuries
Room of Fire Origin	Fatalities	0.57	-	-
	Injuries	0.91	0.78	-
	FD Confined to Room/Firecell	0.81	0.54	0.66
	FD Beyond Room/Firecell	0.57	0.69	0.54
Equipment Involved in Ignition	Fatalities	0.98		
	Injuries	1.00	0.97	
	FD Confined to Room/Firecell	0.98	0.99	0.97
	FD Beyond Room/Firecell	0.96	0.99	0.94
Material First Ignited	Fatalities	-0.29		
	Injuries	0.60	0.12	
	FD Confined to Room/Firecell	0.49	0.01	0.10
	FD Beyond Room/Firecell	0.13	0.40	-0.25
Cause of Ignition	Fatalities	0.85		
	Injuries	0.96	0.85	
	FD Confined to Room/Firecell	0.98	0.76	0.92
	FD Beyond Room/Firecell	0.88	0.76	0.75

Table 17: Summary of linear correlations between various parameters for groups of categories for all residential structures 1986 – 2005.

		Fires
Room of Fire	FD Confined to	0.77

Origin	Room/Firecell	
	FD Beyond Room/Firecell	0.61
Equipment Involved in Ignition	FD Confined to Room/Firecell	0.99
	FD Beyond Room/Firecell	0.98
Material First Ignited	FD Confined to Room/Firecell	0.68
	FD Beyond Room/Firecell	0.55
Cause of Ignition	FD Confined to Room/Firecell	0.98
	FD Beyond Room/Firecell	0.94

Table 18: Summary of linear correlations between various ratios of parameters for groups of categories (1995 – 2005).

			Apartments Only	All Residential Structures	
			Ratio of Injuries to Local Fires	Ratio of Fatalities to Local Fires	Ratio of Injuries to Local Fires
Room of Fire Origin	Apartments Only	Ratio of Fatalities to Local Fires	0.60	0.74	0.65
		Ratio of Injuries to Local Fires	-	0.62	0.90
	All Residential Structures	Ratio of Fatalities to Local Fires	-	-	0.60
Equipment Involved in Ignition	Apartments Only	Ratio of Fatalities to Local Fires	0.47	0.97	0.82
		Ratio of Injuries to Local Fires	-	0.49	0.87
	All Residential Structures	Ratio of Fatalities to Local Fires	-	-	0.83
Material First Ignited	Apartments Only	Ratio of Fatalities to Local Fires	0.18	0.88	0.08
		Ratio of Injuries to Local Fires	-	0.47	0.91
	All Residential Structures	Ratio of Fatalities to Local Fires	-	-	0.31
Cause of Ignition	Apartments Only	Ratio of Fatalities to Local Fires	0.91	0.97	0.87
		Ratio of Injuries to Local Fires	-	0.95	0.98
	All Residential Structures	Ratio of Fatalities to Local Fires	-	-	0.92

Table 19: Summary of linear correlations between apartments and all residential structures for 1995 – 2005 or 1986 -2005 for groups of categories.

		APT 95 - 05	APT 95 - 05	APT 86 - 05	RES 95 - 05
		APT 86 - 05	RES 95 - 05	RES 86 - 05	RES 86 - 05
Room of Fire Origin	Fires	1.00	0.97	0.95	0.99
	Fatalities	-	0.97	0.97	-
	Injuries	-	0.99	0.99	-
Equipment Involved in Ignition	Fires	0.99	0.98	0.98	0.99
	Fatalities	-	0.99	0.99	-
	Injuries	-	1.00	1.00	-
Material First Ignited	Fires	0.98	0.86	0.77	0.91
	Fatalities	-	0.66	0.66	-
	Injuries	-	0.94	0.94	-
Cause of Ignition	Fires	0.99	0.95	0.96	0.99
	Fatalities	-	0.89	0.89	-
	Injuries	-	0.96	0.96	-

APPENDIX E SUMMARY OF TOTAL SAMPLE POPULATIONS

Description of Population	Apartments with structure damage	Apartments without structure damage	All residential with structure damage	All residential without structure damage	Apartments	All Residential
Sample Size of Total Fire Events (1986 – 2005)	3223	4045	32296	24906	7268	57202
Sample Size of Total Fire Events (1995 – 2005)	1813	499	15327	19213	2312	34540
Sample Size of Total Civilian Fatalities (1995 – 2005)	34	1	225	9	35	234
Sample Size of Total Civilian Injuries (1995 – 2005)	300	246	1568	1100	546	2668
Flame Damage – none (1986 – 2005)	162	7	1247	42	169	1289
Flame Damage - confined to object (1986 – 2005)	409	6	3869	43	415	3912
Flame Damage - confined to room/firecell (1986 – 2005)	1714	14	14292	102	1728	14394
Flame Damage - outside of room (1986 – 2005)	738	3	10535	42	741	10577
Flame Damage - not recorded (1986 – 2005)	200	4015	2353	24677	4215	27030

APPENDIX F ROOM OF FIRE ORIGIN – DATA ANALYSIS OF ALL CLASSES

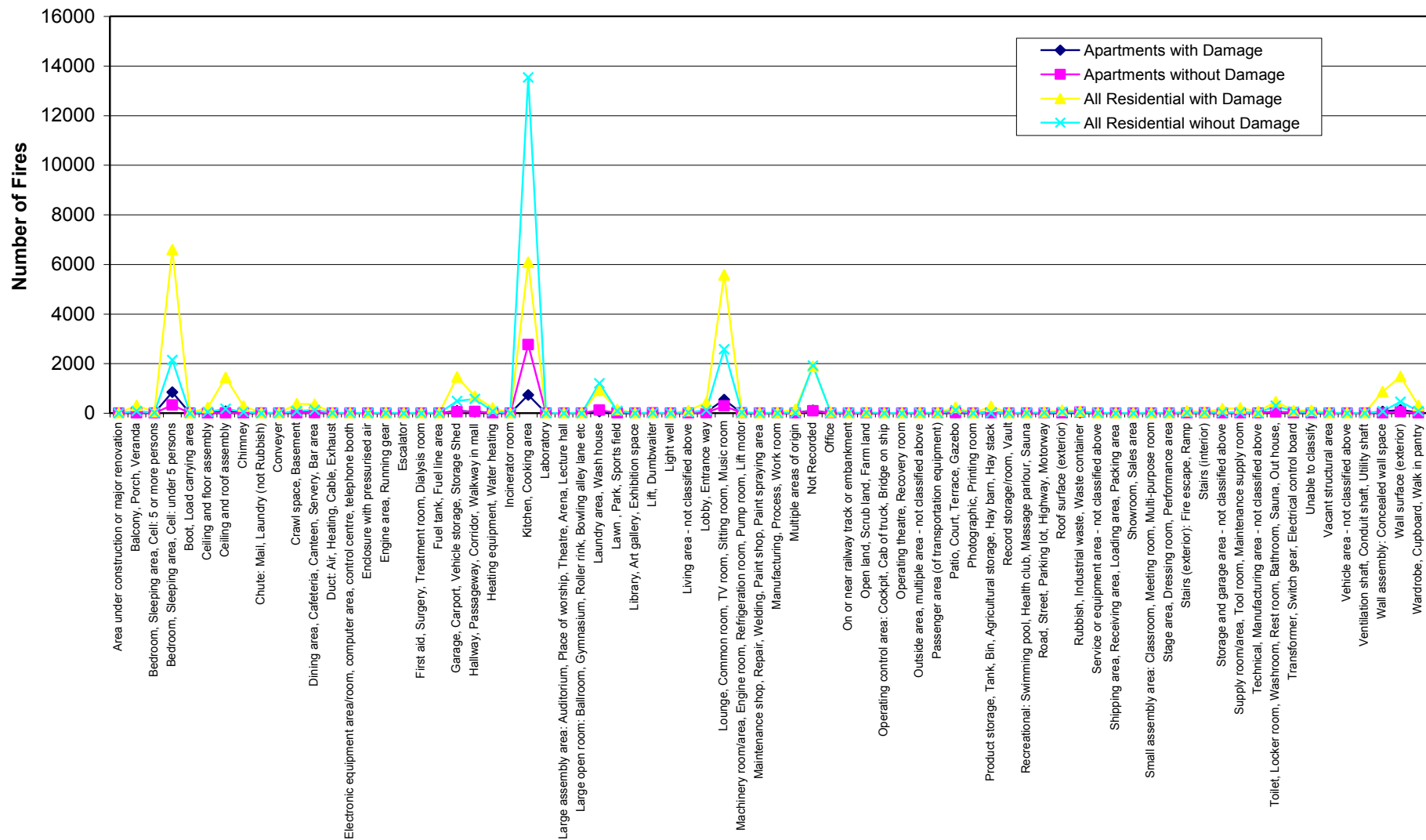


Figure 154: Number of fires in residential structures, with and without damage, according to the room of fire origin (1986-2005).

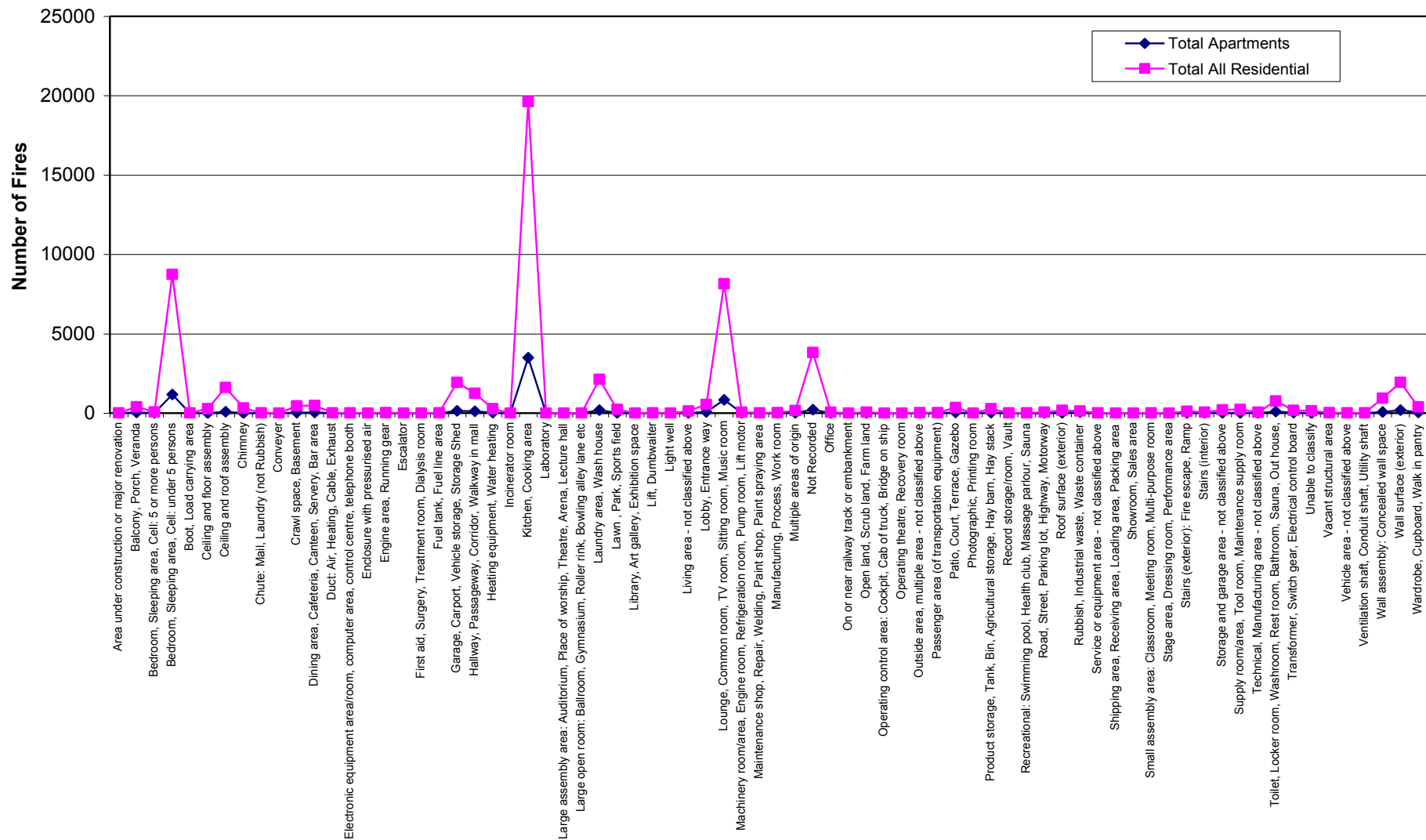


Figure 155: Number of fires in all apartments and all residential structures according to the room of fire origin (1986-2005).

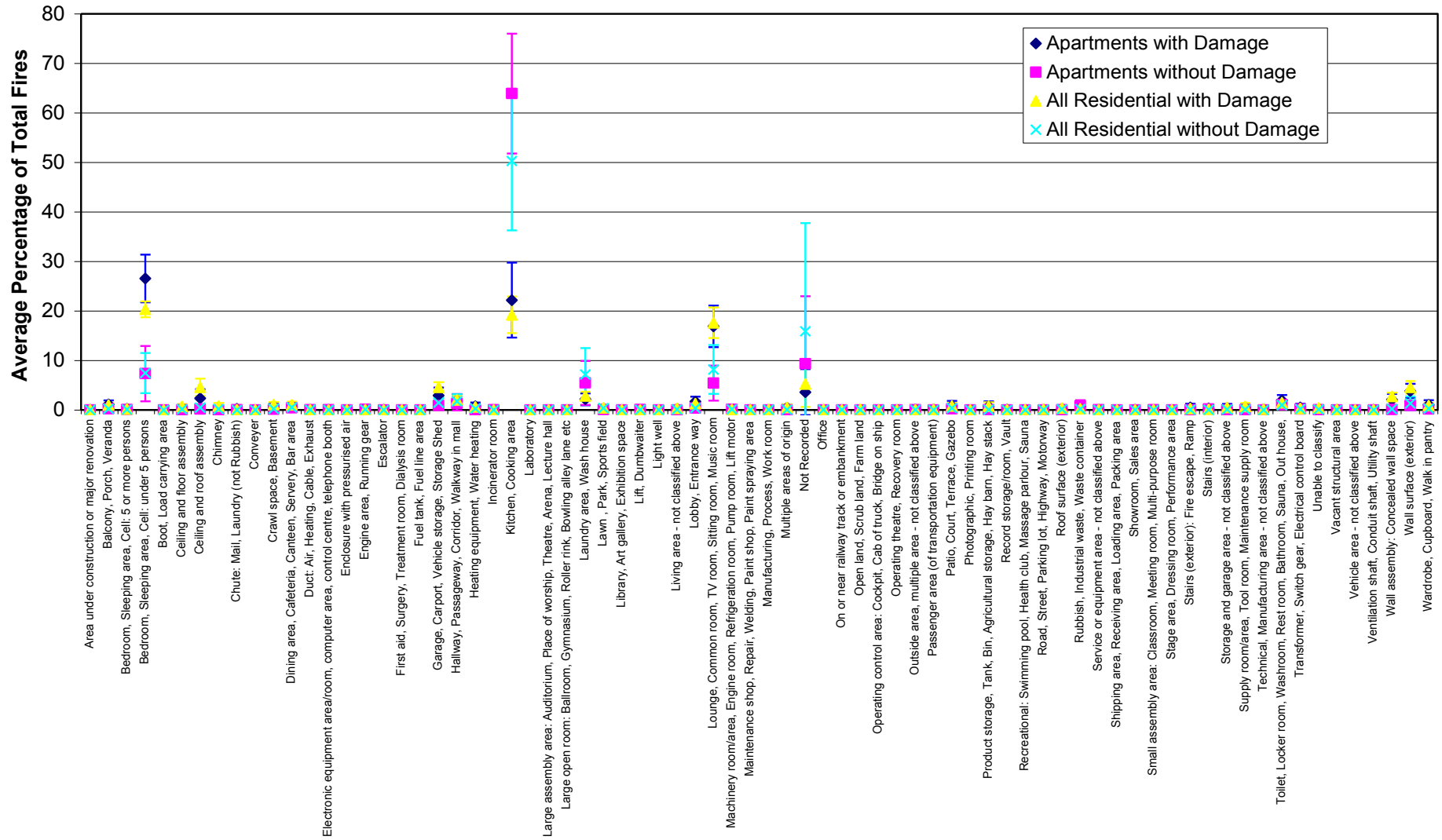


Figure 156: Average percentage of fires in residential structures according to the room of fire origin (1986-2005).

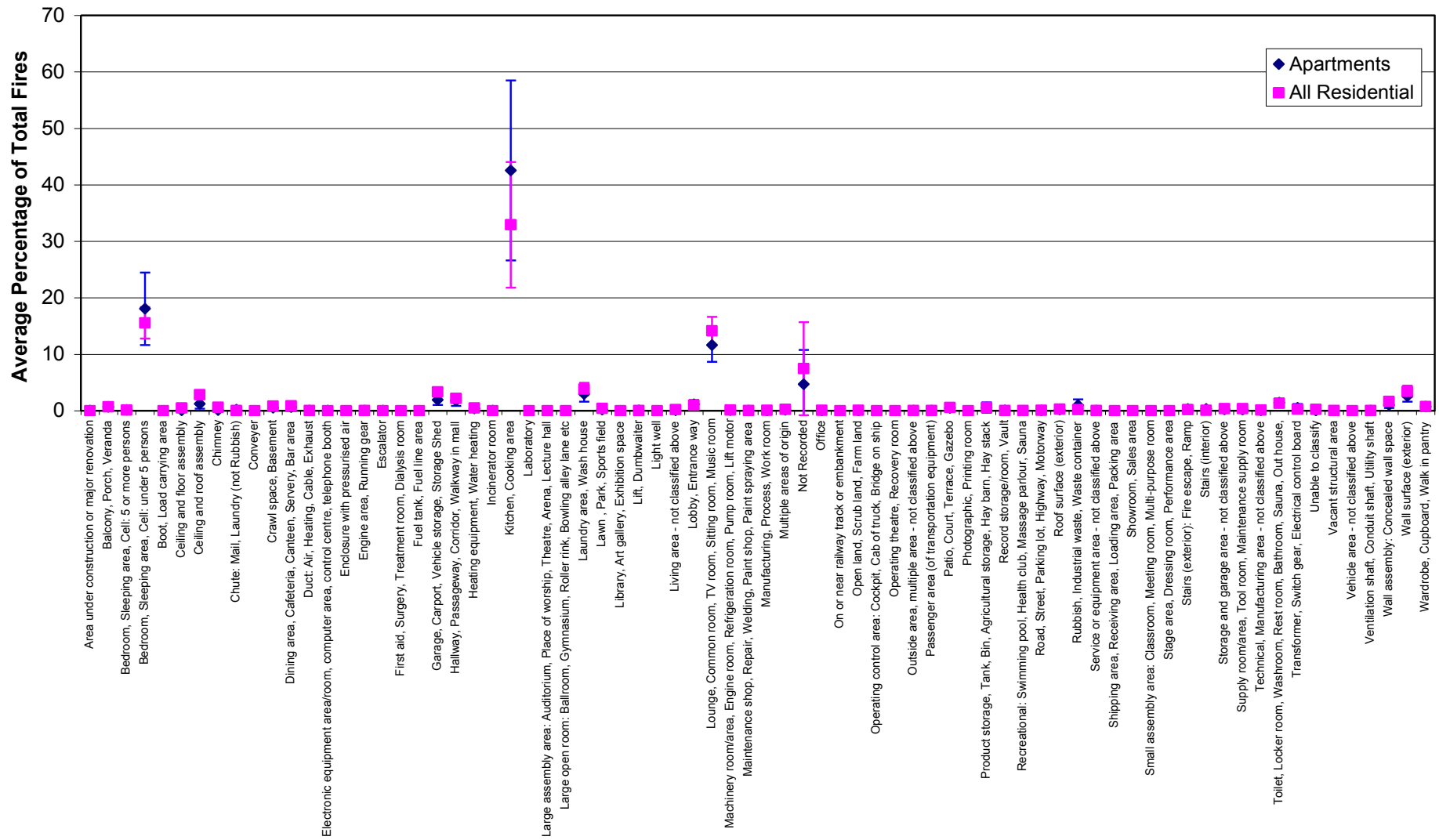


Figure 157: Average percentage of the total number fires per year and one standard deviation for each room of fire origin (1986 – 2005).

Table 20: Ranking of the most common room of fire origin by percentage of total fires (using NZFS categories from 1986 – 2005).

Apartments with damage		Apartments without damage		All residential with damage		All residential without damage	
Room of Fire Origin	% Total Fires	Room of Fire Origin	% Total Fires	Room of Fire Origin	% Total Fires	Room of Fire Origin	% Total Fires
Bedroom, Sleeping area, Cell: under 5 persons	26.3	Kitchen, Cooking area	68.3	Bedroom, Sleeping area, Cell: under 5 persons	20.4	Kitchen, Cooking area	54.4
Kitchen, Cooking area	22.7	Bedroom, Sleeping area, Cell: under 5 persons	8.0	Kitchen, Cooking area	18.8	Lounge, Common room, TV room, Sitting room, Music room	10.3
Lounge, Common room, TV room, Sitting room, Music room	16.9	Lounge, Common room, TV room, Sitting room, Music room	7.2	Lounge, Common room, TV room, Sitting room, Music room	17.3	Bedroom, Sleeping area, Cell: under 5 persons	8.6
Wall surface (exterior)	4.0	Laundry area, Wash house	3.0	Not Recorded	5.9	Not Recorded	7.7
Not Recorded	3.6	Not Recorded	2.4	Wall surface (exterior)	4.6	Laundry area, Wash house	4.8
Garage, Carport, Vehicle storage, Storage Shed	2.9	Hallway, Passageway, Corridor, Walkway in mall	1.6	Garage, Carport, Vehicle storage, Storage Shed	4.5	Hallway, Passageway, Corridor, Walkway in mall	2.3
Ceiling and roof assembly	2.5	Wall surface (exterior)	1.5	Ceiling and roof assembly	4.5	Garage, Carport, Vehicle storage, Storage Shed	2.0
Laundry area, Wash house	2.1	Garage, Carport, Vehicle storage, Storage Shed	1.3	Laundry area, Wash house	2.8	Wall surface (exterior)	1.9
Wall assembly: Concealed wall space	2.0	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	1.2	Wall assembly: Concealed wall space	2.7	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	1.2
Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	1.8	Rubbish, Industrial waste, Waste container	1.0	Hallway, Passageway, Corridor, Walkway in mall	2.1	Ceiling and roof assembly	0.7

Table 21: Ranking of the most common room of fire origin by percentage of fires per year (using NZFS from 1986 – 2005).

Apartments		All residential	
Room of Fire Origin	% Total Fires	Room of Fire Origin	% Total Fires
Kitchen, Cooking area	48.1	Kitchen, Cooking area	34.3
Bedroom, Sleeping area, Cell: under 5 persons	16.1	Bedroom, Sleeping area, Cell: under 5 persons	15.3
Lounge, Common room, TV room, Sitting room, Music room	11.5	Lounge, Common room, TV room, Sitting room, Music room	14.2
Not Recorded	3.0	Not Recorded	6.7
Wall surface (exterior)	2.6	Laundry area, Wash house	3.7
Laundry area, Wash house	2.6	Garage, Carport, Vehicle storage, Storage Shed	3.4
Garage, Carport, Vehicle storage, Storage Shed	2.0	Wall surface (exterior)	3.4
Hallway, Passageway, Corridor, Walkway in mall	1.7	Ceiling and roof assembly	2.8
Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	1.5	Hallway, Passageway, Corridor, Walkway in mall	2.2
Ceiling and roof assembly	1.2	Wall assembly: Concealed wall space	1.6

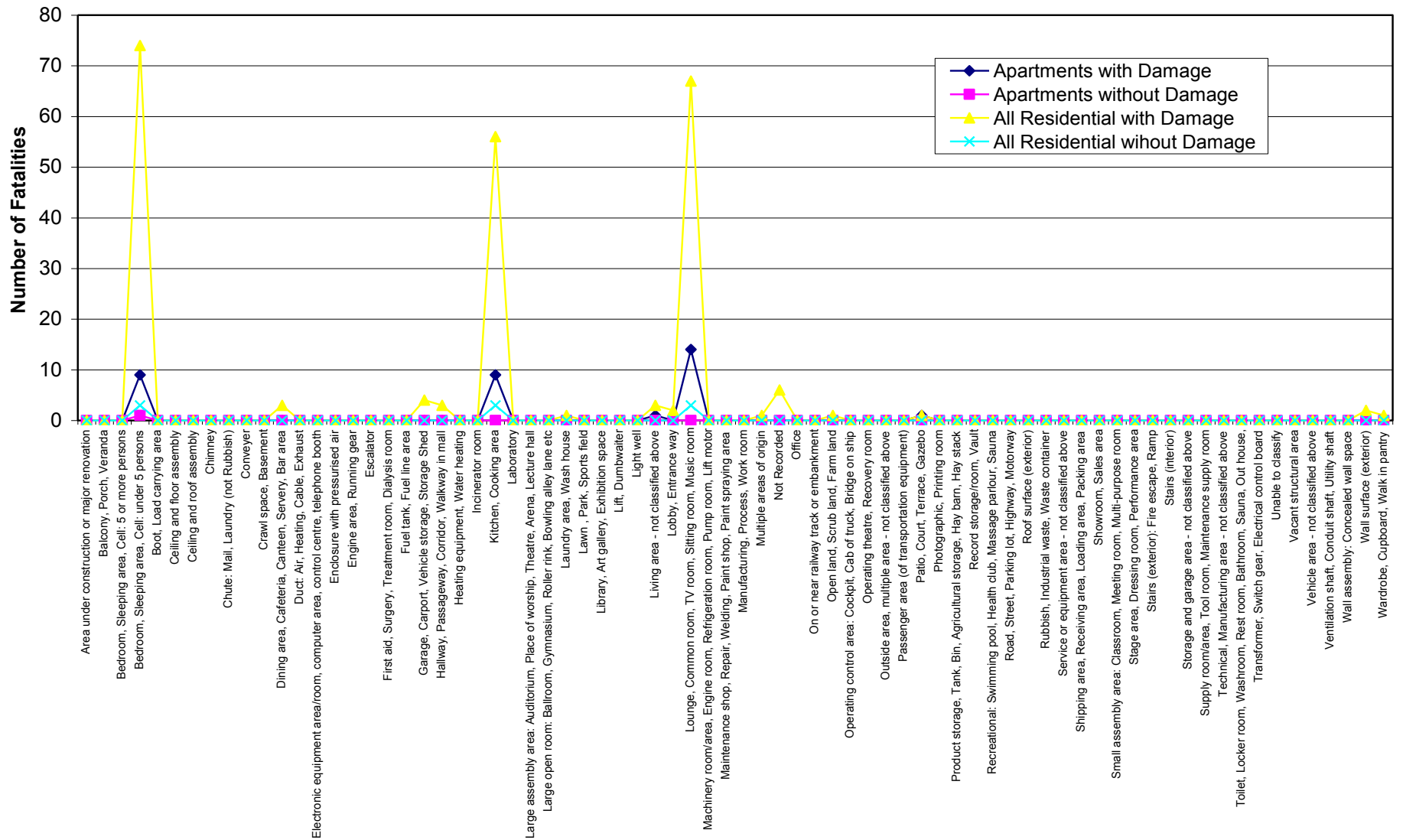


Figure 158: Number of fatalities from residential property fires, with and without damage, according to the room of fire origin (1995-2005).

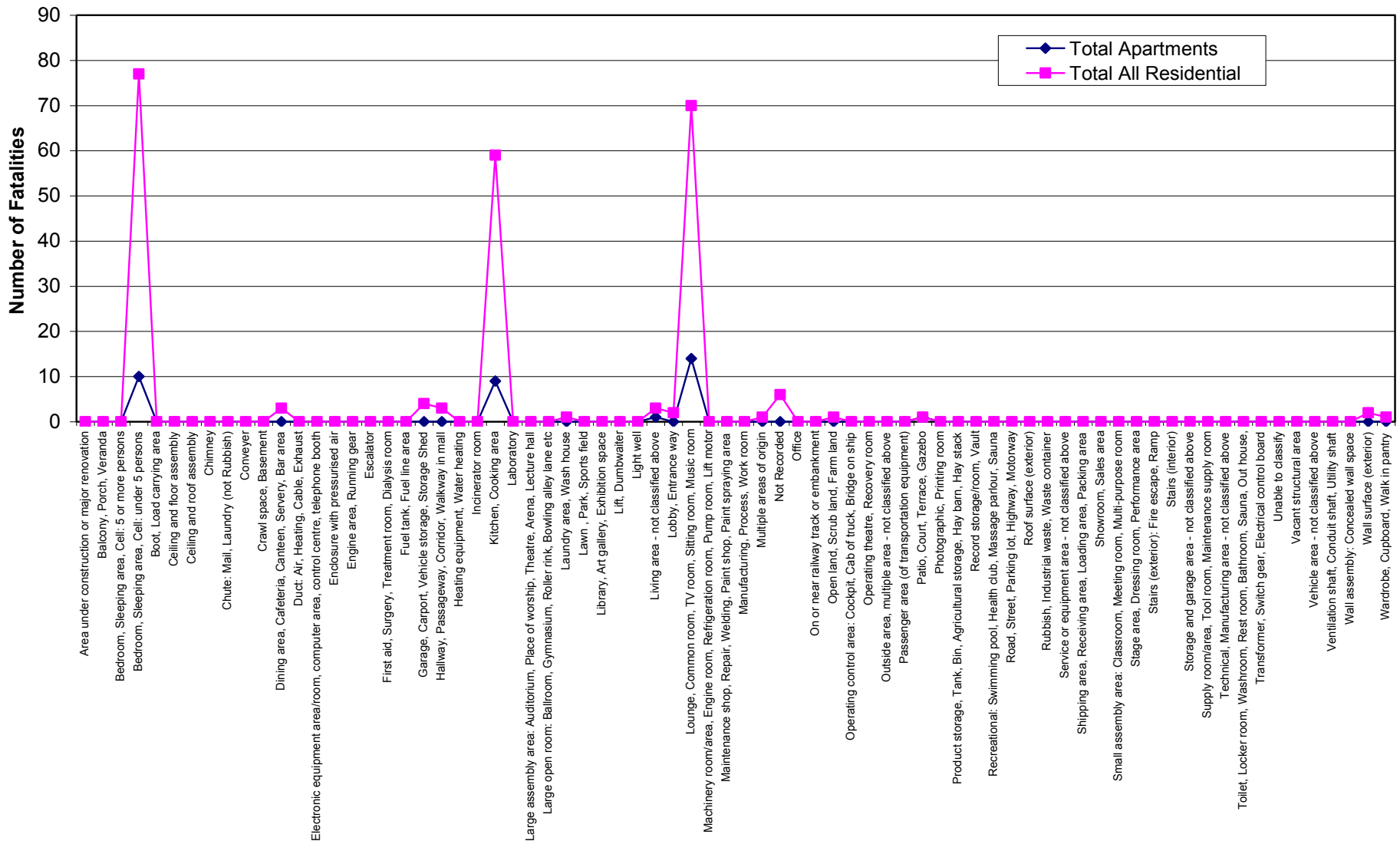


Figure 159: Number of fatalities from all apartments and all residential property fires according to the room of fire origin (1995-2005).

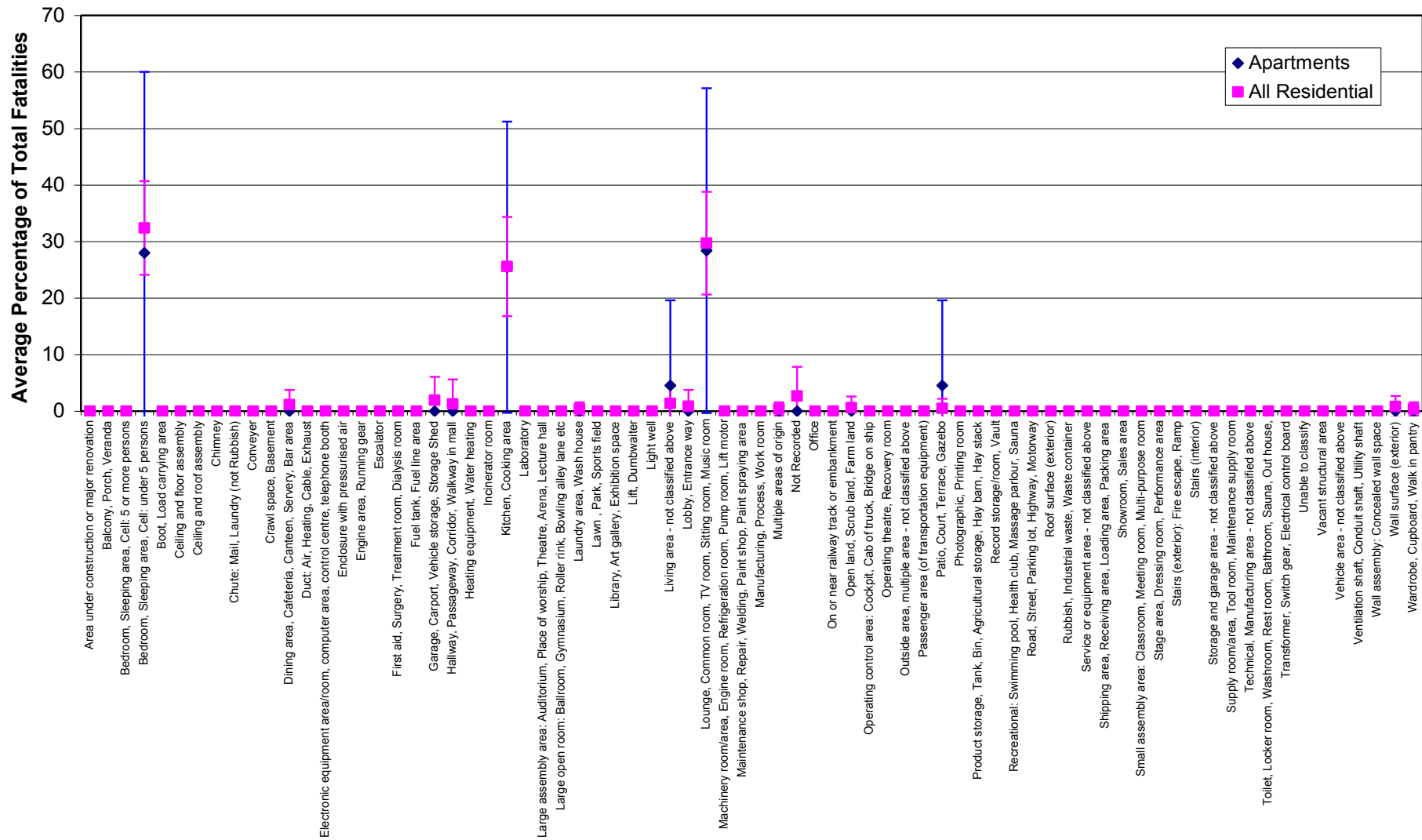


Figure 160: Average percentage of the total number fatalities per year for each room of fire origin and one standard deviation (1995 – 2005).

Table 22: Ranking of the most common room of fire origin by percentage of total civilian fatalities (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Room of Fire Origin	% Total Fatalities	Room of Fire Origin	% Total Fatalities	Room of Fire Origin	% Total Fatalities	Room of Fire Origin	% Total Fatalities
Lounge, Common room, TV room, Sitting room, Music room	41.2	Bedroom, Sleeping area, Cell: under 5 persons	100.0	Bedroom, Sleeping area, Cell: under 5 persons	32.9	Bedroom, Sleeping area, Cell: under 5 persons	33.3
Bedroom, Sleeping area, Cell: under 5 persons	26.5			Lounge, Common room, TV room, Sitting room, Music room	29.8	Kitchen, Cooking area	33.3
Kitchen, Cooking area	26.5			Kitchen, Cooking area	24.9	Lounge, Common room, TV room, Sitting room, Music room	33.3
Living area - not classified above	2.9			Not Recorded	2.7		
Patio, Court, Terrace, Gazebo	2.9			Garage, Carport, Vehicle storage, Storage Shed	1.8		
				Dining area, Cafeteria, Canteen, Servery, Bar area	1.3		
				Hallway, Passageway, Corridor, Walkway in mall	1.3		
				Living area - not classified above	1.3		
				Lobby, Entrance way	0.9		
				Wall surface (exterior)	0.9		

Table 23: Ranking of the most common room of fire origin by percentage of civilian fatalities per year (1995 – 2005).

Apartments		All Residential	
Room of Fire Origin	% Total Fatalities	Room of Fire Origin	% Total Fatalities
Lounge, Common room, TV room, Sitting room, Music room	40.0	Bedroom, Sleeping area, Cell: under 5 persons	32.9
Bedroom, Sleeping area, Cell: under 5 persons	28.6	Lounge, Common room, TV room, Sitting room, Music room	29.9
Kitchen, Cooking area	25.7	Kitchen, Cooking area	25.2
Living area - not classified above	2.9	Not Recorded	2.6
Patio, Court, Terrace, Gazebo	2.9	Garage, Carport, Vehicle storage, Storage Shed	1.7
Area under construction or major renovation	0.0	Dining area, Cafeteria, Canteen, Served, Bar area	1.3
Balcony, Porch, Veranda	0.0	Hallway, Passageway, Corridor, Walkway in mall	1.3
Bedroom, Sleeping area, Cell: 5 or more persons	0.0	Living area - not classified above	1.3
Boot, Load carrying area	0.0	Lobby, Entrance way	0.9
Ceiling and floor assembly	0.0	Wall surface (exterior)	0.9

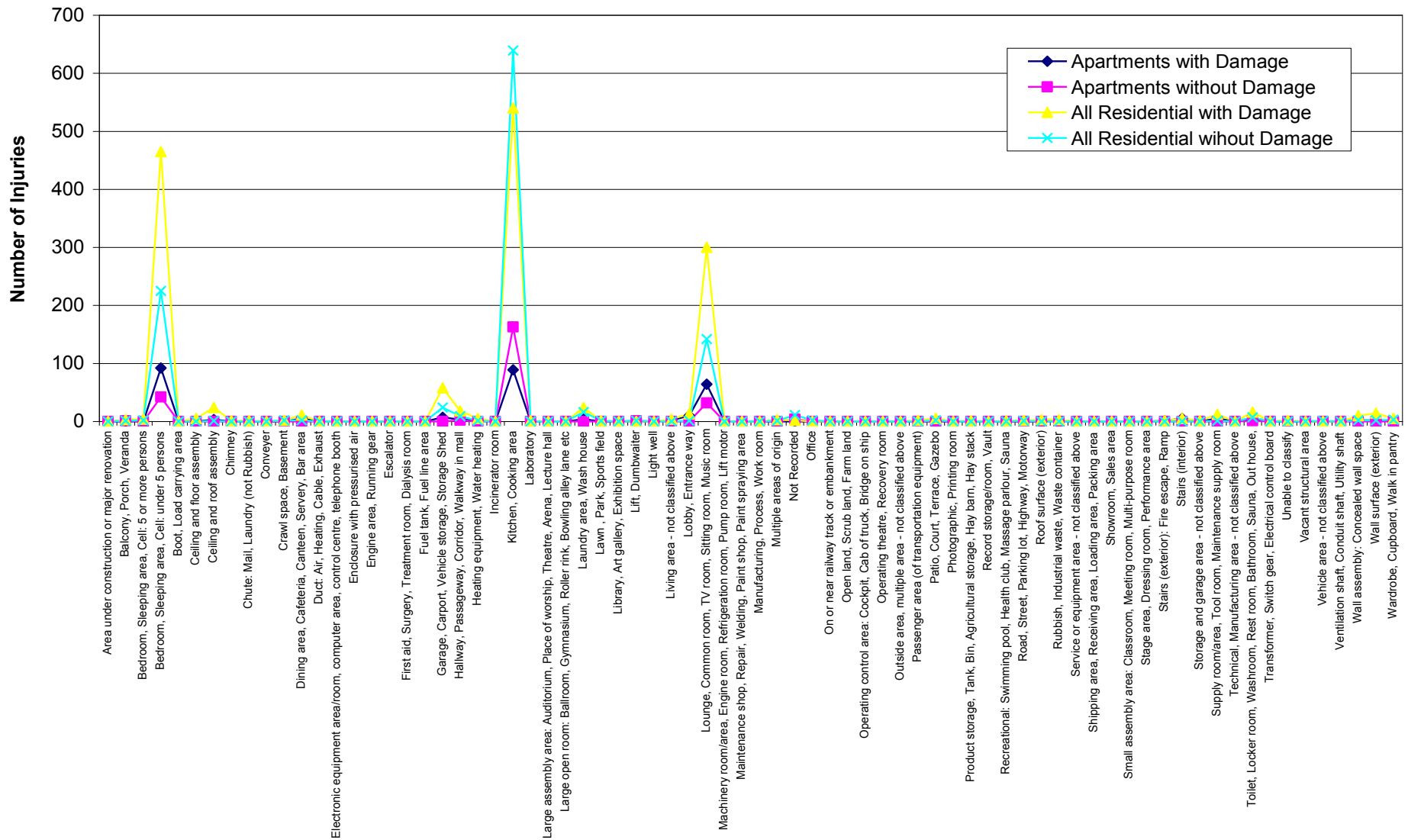


Figure 161: Number of injuries from apartment and all residential fires, with and without damage, according to the room of fire origin (1995-2005).

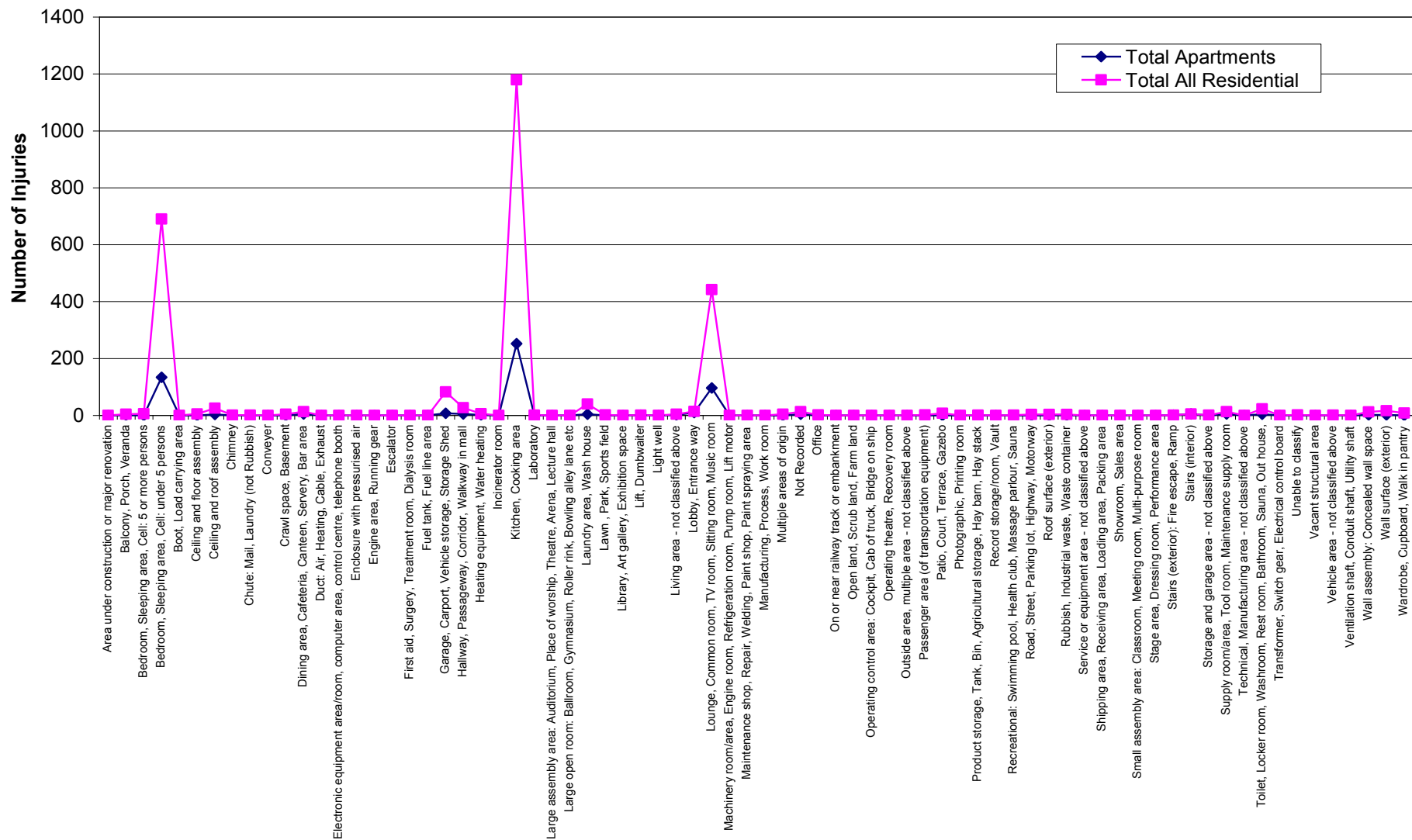


Figure 162: Number of injuries from all apartment and all residential fires according to the room of fire origin (1995-2005).

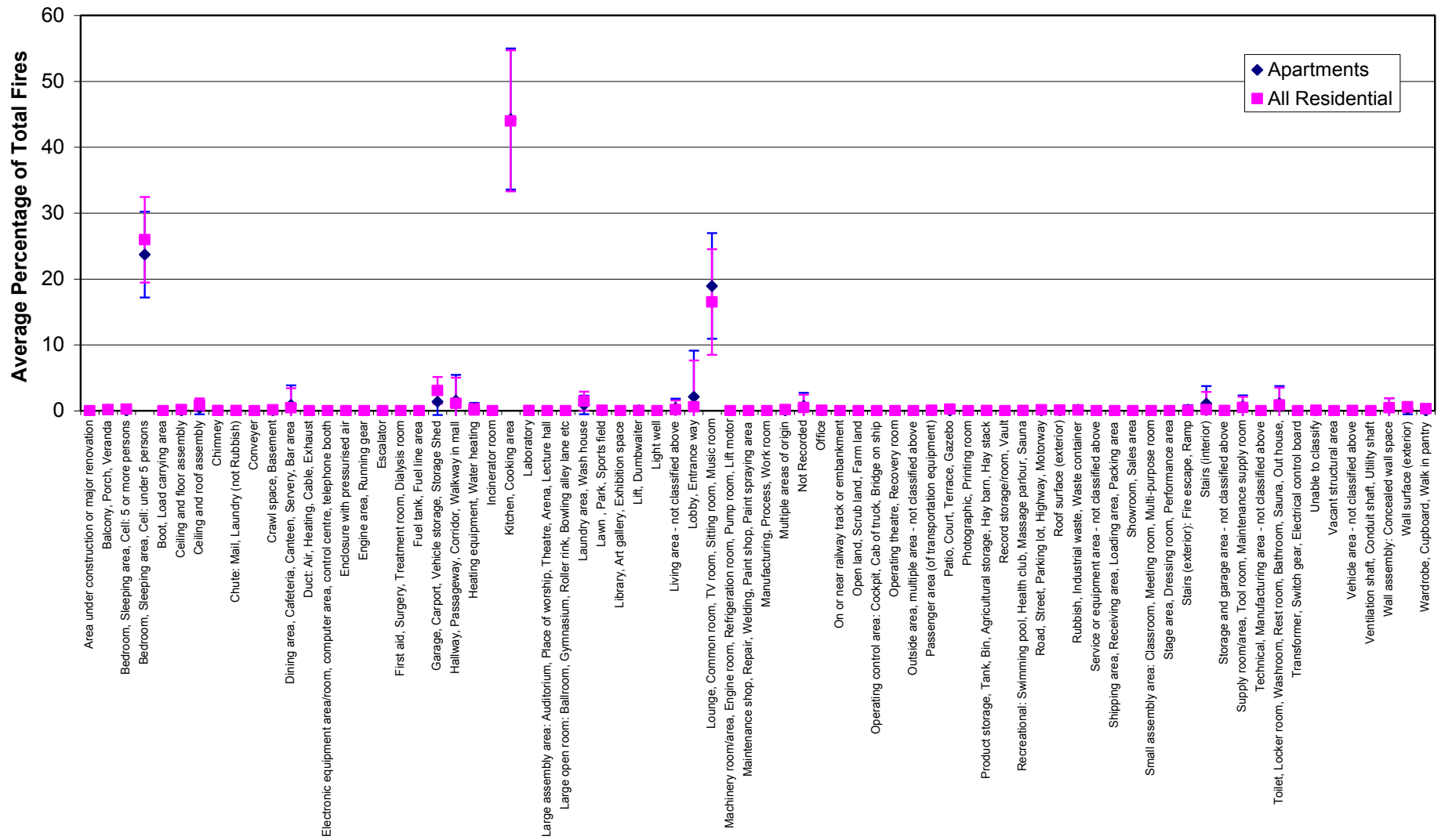


Figure 163: Average percentage of the total number of injuries per year and one standard deviation for each room of fire origin (1995 – 2005).

Table 24: Ranking of the most common room of fire origin by percentage of total civilian injuries (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Room of Fire Origin	% Total Injuries	Room of Fire Origin	% Total Injuries	Room of Fire Origin	% Total Injuries	Room of Fire Origin	% Total Injuries
Bedroom, Sleeping area, Cell: under 5 persons	30.7	Kitchen, Cooking area	66.3	Kitchen, Cooking area	34.4	Kitchen, Cooking area	58.1
Kitchen, Cooking area	29.7	Bedroom, Sleeping area, Cell: under 5 persons	17.1	Bedroom, Sleeping area, Cell: under 5 persons	29.7	Bedroom, Sleeping area, Cell: under 5 persons	20.5
Lounge, Common room, TV room, Sitting room, Music room	21.3	Lounge, Common room, TV room, Sitting room, Music room	13.0	Lounge, Common room, TV room, Sitting room, Music room	19.1	Lounge, Common room, TV room, Sitting room, Music room	12.9
Lobby, Entrance way	3.3	Not Recorded	1.6	Garage, Carport, Vehicle storage, Storage Shed	3.7	Garage, Carport, Vehicle storage, Storage Shed	2.2
Garage, Carport, Vehicle storage, Storage Shed	2.3	Hallway, Passageway, Corridor, Walkway in mall	0.8	Ceiling and roof assembly	1.5	Laundry area, Wash house	1.5
Dining area, Cafeteria, Canteen, Servery, Bar area	1.7	Balcony, Porch, Veranda	0.4	Laundry area, Wash house	1.5	Not Recorded	1.0
Stairs (interior)	1.7	Lift, Dumbwaiter	0.4	Hallway, Passageway, Corridor, Walkway in mall	1.1	Hallway, Passageway, Corridor, Walkway in mall	0.8
Supply room/area, Tool room, Maintenance supply room	1.7	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	0.4	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	1.0	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	0.6
Laundry area, Wash house	1.3			Wall surface (exterior)	0.9	Wardrobe, Cupboard, Walk in pantry	0.3
Ceiling and roof assembly	1.0			Lobby, Entrance way	0.8	Bedroom, Sleeping area, Cell: 5 or more persons	0.2

Table 25: Ranking of the most common room of fire origin by percentage of total civilian injuries (1995 – 2005).

Apartments		All Residential	
Room of Fire Origin	% Total Injuries	Room of Fire Origin	% Total Injuries
Kitchen, Cooking area	46.2	Kitchen, Cooking area	44.2
Bedroom, Sleeping area, Cell: under 5 persons	24.5	Bedroom, Sleeping area, Cell: under 5 persons	25.9
Lounge, Common room, TV room, Sitting room, Music room	17.6	Lounge, Common room, TV room, Sitting room, Music room	16.6
Lobby, Entrance way	1.8	Garage, Carport, Vehicle storage, Storage Shed	3.1
Garage, Carport, Vehicle storage, Storage Shed	1.3	Laundry area, Wash house	1.5
Dining area, Cafeteria, Canteen, Servery, Bar area	0.9	Hallway, Passageway, Corridor, Walkway in mall	1.0
Hallway, Passageway, Corridor, Walkway in mall	0.9	Ceiling and roof assembly	0.9
Stairs (interior)	0.9	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	0.9
Supply room/area, Tool room, Maintenance supply room	0.9	Wall surface (exterior)	0.6
Laundry area, Wash house	0.7	Lobby, Entrance way	0.5

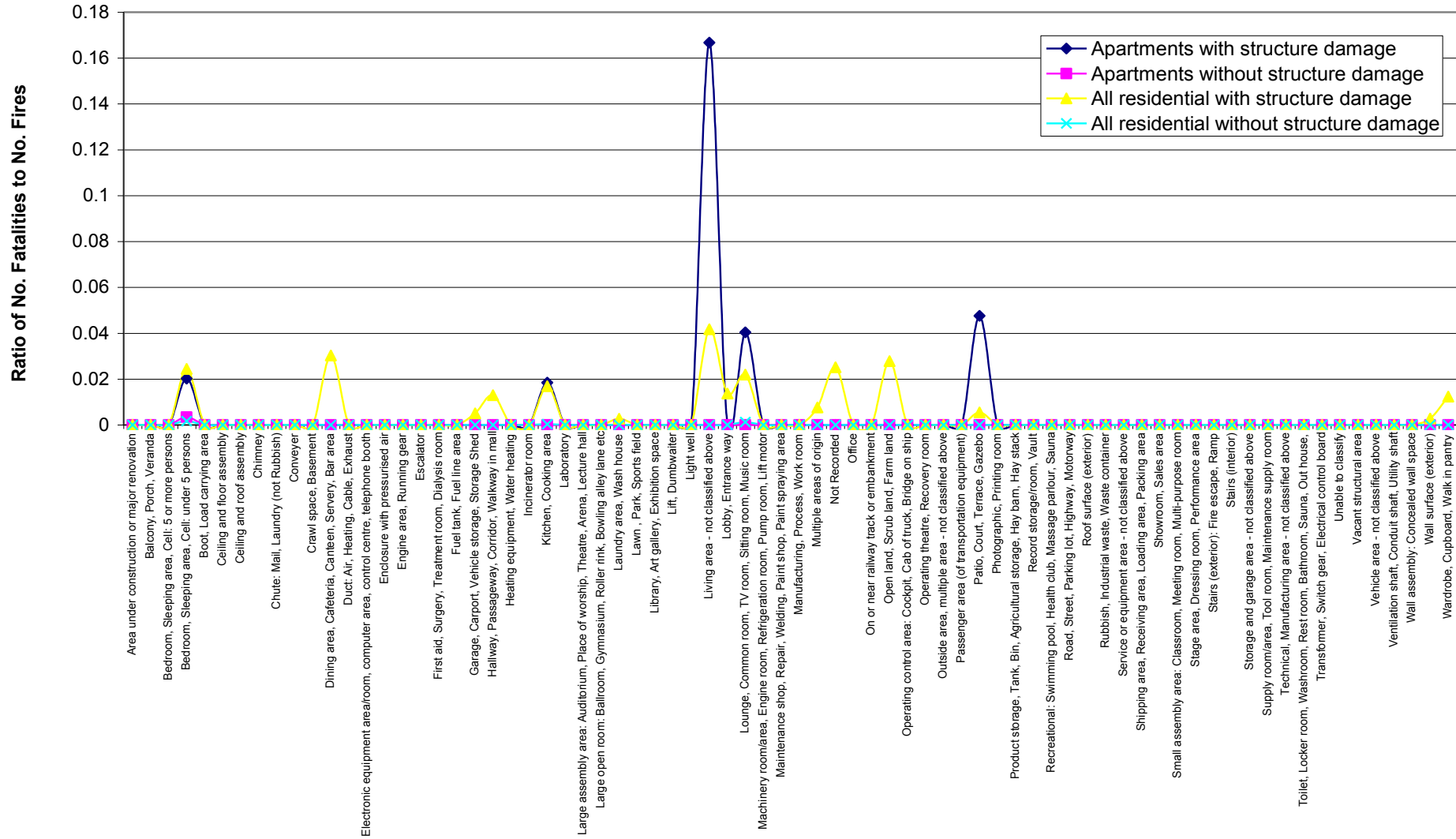


Figure 164: Ratio of numbers of fatalities to numbers of fires recorded according to room of fire origin (1995-2005).

Table 26: Highest ratios of numbers of civilian fatalities to numbers of fires for each room of fire origin (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Room of Fire Origin	Ratio of Fatalities to Fires	Room of Fire Origin	Ratio of Fatalities to Fires	Room of Fire Origin	Ratio of Fatalities to Fires	Room of Fire Origin	Ratio of Fatalities to Fires
Living area - not classified above	0.1429	Bedroom, Sleeping area, Cell: under 5 persons	0.0031	Living area - not classified above	0.0288	Bedroom, Sleeping area, Cell: under 5 persons	0.0014
Patio, Court, Terrace, Gazebo	0.0400			Open land, Scrub land, Farm land	0.0270	Lounge, Common room, TV room, Sitting room, Music room	0.0012
Lounge, Common room, TV room, Sitting room, Music room	0.0257			Lounge, Common room, TV room, Sitting room, Music room	0.0120	Kitchen, Cooking area	0.0002
Kitchen, Cooking area	0.0123			Bedroom, Sleeping area, Cell: under 5 persons	0.0112	Area under construction or major renovation	0.0000
Bedroom, Sleeping area, Cell: under 5 persons	0.0106			Kitchen, Cooking area	0.0092		
				Dining area, Cafeteria, Canteen, Served area	0.0084		
				Multiple areas of origin	0.0065		
				Lobby, Entrance way	0.0047		
				Hallway, Passageway, Corridor, Walkway in mall	0.0044		
				Patio, Court, Terrace, Gazebo	0.0043		

Table 27: Highest average ratios of numbers of civilian fatalities to numbers of fires each year for each room of fire origin (1995 – 2005).

Apartments		All Residential	
Room of Fire Origin	Ratio of Fatalities to Fires	Room of Fire Origin	Ratio of Fatalities to Fires
Living area - not classified above	0.1250	Living area - not classified above	0.0234
Patio, Court, Terrace, Gazebo	0.0244	Open land, Scrub land, Farm land	0.0185
Lounge, Common room, TV room, Sitting room, Music room	0.0167	Bedroom, Sleeping area, Cell: under 5 persons	0.0088
Bedroom, Sleeping area, Cell: under 5 persons	0.0085	Lounge, Common room, TV room, Sitting room, Music room	0.0086
Kitchen, Cooking area	0.0026	Dining area, Cafeteria, Canteen, Servery, Bar area	0.0061
		Multiple areas of origin	0.0060
		Lobby, Entrance way	0.0037
		Kitchen, Cooking area	0.0030
		Patio, Court, Terrace, Gazebo	0.0028
		Wardrobe, Cupboard, Walk in pantry	0.0025

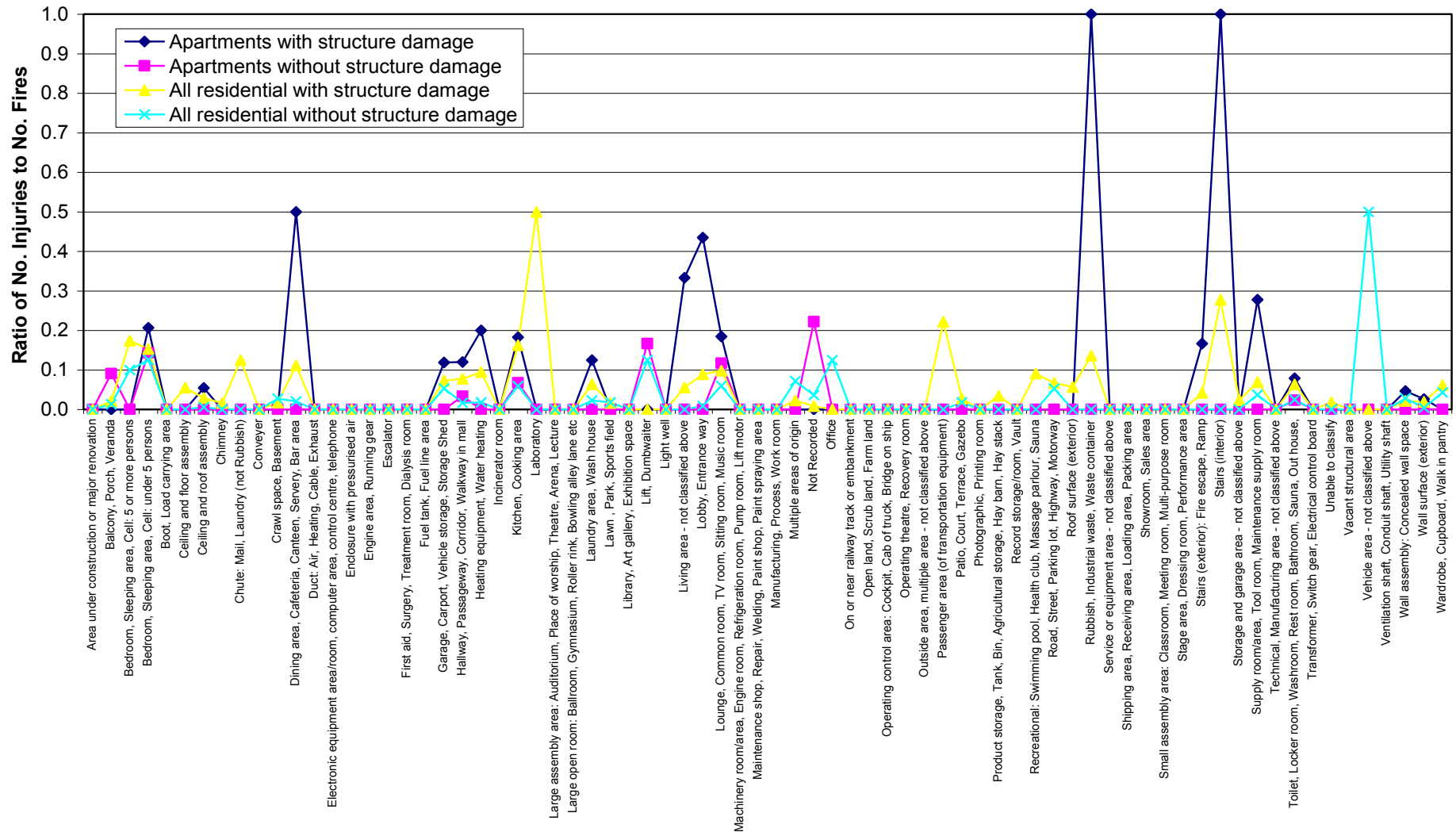


Figure 165: Ratio of numbers of injuries to numbers of fires recorded according to room of fire origin (1995-2005).

Table 28: Highest average ratios of numbers of civilian injuries to numbers of fires for each room of fire origin (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Room of Fire Origin	Ratio of Injuries to Fires	Room of Fire Origin	Ratio of Injuries to Fires	Room of Fire Origin	Ratio of Injuries to Fires	Room of Fire Origin	Ratio of Injuries to Fires
Stairs (interior)	0.4545	Lift, Dumbwaiter	0.1667	Laboratory	0.3333	Vehicle area - not classified above	0.5000
Living area - not classified above	0.2857	Bedroom, Sleeping area, Cell: under 5 persons	0.1292	Stairs (interior)	0.1250	Office	0.1176
Supply room/area, Tool room, Maintenance supply room	0.2778	Lounge, Common room, TV room, Sitting room, Music room	0.1100	Recreational: Swimming pool, Health club, Massage parlour, Sauna	0.0909	Lift, Dumbwaiter	0.1111
Dining area, Cafeteria, Canteen, Servery, Bar area	0.2083	Balcony, Porch, Veranda	0.0833	Kitchen, Cooking area	0.0888	Bedroom, Sleeping area, Cell: under 5 persons	0.1048
Lobby, Entrance way	0.2000	Kitchen, Cooking area	0.0590	Passenger area (of transportation equipment)	0.0741	Bedroom, Sleeping area, Cell: 5 or more persons	0.0870
Kitchen, Cooking area	0.1214	Not Recorded	0.0408	Bedroom, Sleeping area, Cell: 5 or more persons	0.0727	Multiple areas of origin	0.0714
Lounge, Common room, TV room, Sitting room, Music room	0.1174	Hallway, Passageway, Corridor, Walkway in mall	0.0303	Chute: Mail, Laundry (not Rubbish)	0.0714	Lounge, Common room, TV room, Sitting room, Music room	0.0552
Bedroom, Sleeping area, Cell: under 5 persons	0.1086	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	0.0213	Bedroom, Sleeping area, Cell: under 5 persons	0.0705	Garage, Carport, Vehicle storage, Storage Shed	0.0492
Heating equipment, Water heating	0.0909	Area under construction or major renovation	0.0000	Supply room/area, Tool room, Maintenance supply room	0.0577	Road, Street, Parking lot, Highway, Motorway	0.0476
Garage, Carport, Vehicle storage, Storage Shed	0.0745	Bedroom, Sleeping area, Cell: 5 or more persons	0.0000	Road, Street, Parking lot, Highway, Motorway	0.0556	Kitchen, Cooking area	0.0472

Table 29: Highest average ratios of numbers of civilian injuries to numbers of fires each year for each room of fire origin (1995 – 2005).

Apartments		All Residential	
Room of Fire Origin	Ratio of Injuries to Fires	Room of Fire Origin	Ratio of Injuries to Fires
Living area - not classified above	0.2500	Laboratory	0.3333
Stairs (interior)	0.2273	Vehicle area - not classified above	0.1111
Supply room/area, Tool room, Maintenance supply room	0.2273	Stairs (interior)	0.0862
Lobby, Entrance way	0.1408	Bedroom, Sleeping area, Cell: under 5 persons	0.0789
Dining area, Cafeteria, Canteen, Servery, Bar area	0.1250	Bedroom, Sleeping area, Cell: 5 or more persons	0.0769
Lounge, Common room, TV room, Sitting room, Music room	0.1148	Lift, Dumbwaiter	0.0769
Bedroom, Sleeping area, Cell: under 5 persons	0.1143	Passenger area (of transportation equipment)	0.0645
Lift, Dumbwaiter	0.1111	Kitchen, Cooking area	0.0601
Heating equipment, Water heating	0.0833	Chute: Mail, Laundry (not Rubbish)	0.0556
Kitchen, Cooking area	0.0721	Recreational: Swimming pool, Health club, Massage parlour, Sauna	0.0556

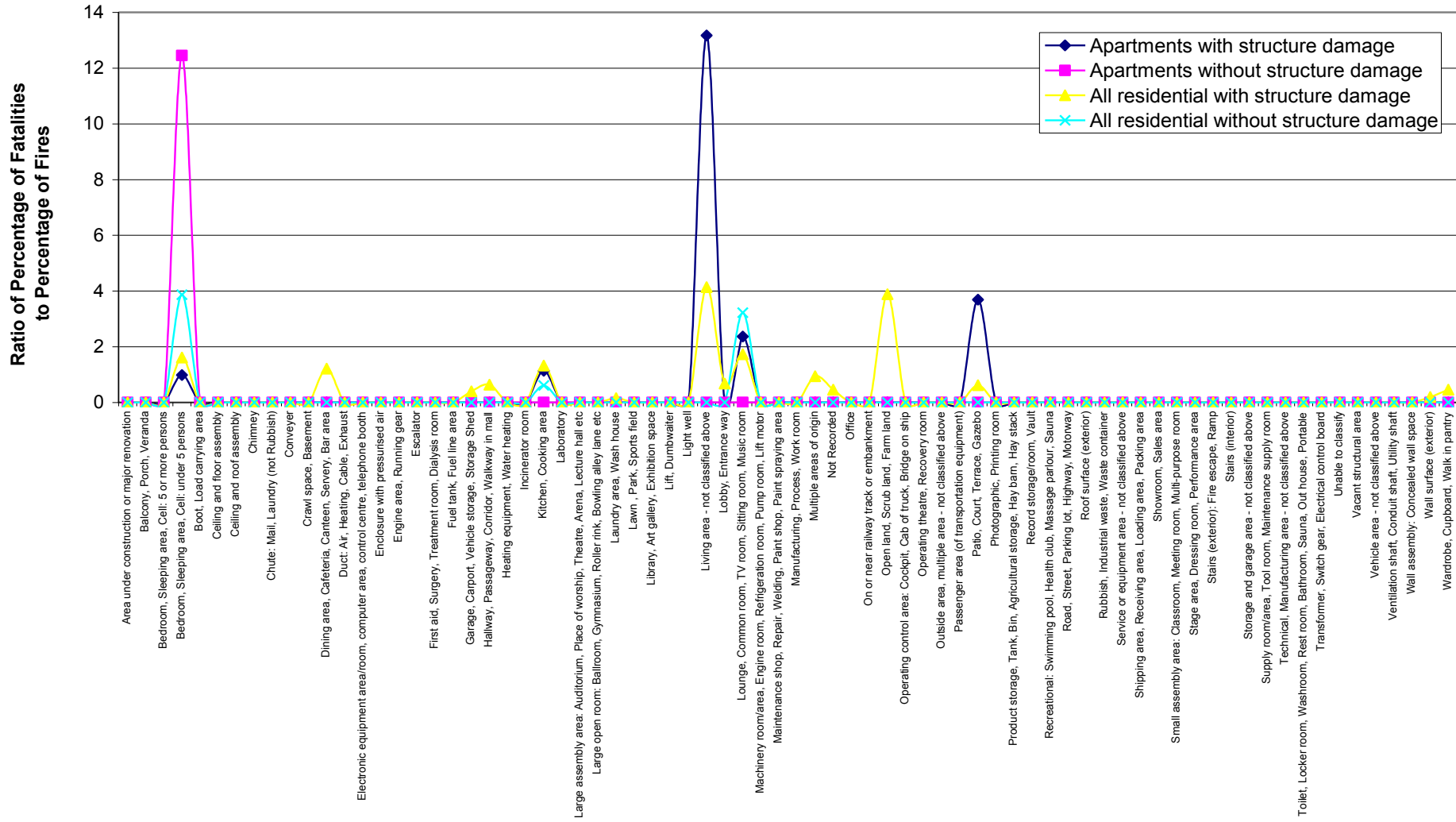


Figure 166: Ratio of percentage of total fatalities to percentage of total fires recorded according to room of fire origin (1995-2005).

Table 30: Highest average ratio of percentage of civilian fatalities to percentage of fires for each room of fire origin (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Room of Fire Origin	Ratio of %Fatalities to %Fires	Room of Fire Origin	Ratio of %Fatalities to %Fires	Room of Fire Origin	Ratio of %Fatalities to %Fires	Room of Fire Origin	Ratio of %Fatalities to %Fires
Living area - not classified above	13.54	Bedroom, Sleeping area, Cell: under 5 persons	12.45	Living area - not classified above	4.14	Bedroom, Sleeping area, Cell: under 5 persons	3.87
Patio, Court, Terrace, Gazebo	3.79			Open land, Scrub land, Farm land	3.88	Lounge, Common room, TV room, Sitting room, Music room	3.23
Lounge, Common room, TV room, Sitting room, Music room	2.44			Lounge, Common room, TV room, Sitting room, Music room	1.73	Kitchen, Cooking area	0.61
Kitchen, Cooking area	1.16			Bedroom, Sleeping area, Cell: under 5 persons	1.61		
Bedroom, Sleeping area, Cell: under 5 persons	1.01			Kitchen, Cooking area	1.32		
				Dining area, Cafeteria, Canteen, Served, Bar area	1.21		
				Multiple areas of origin	0.94		
				Lobby, Entrance way	0.68		
				Hallway, Passageway, Corridor, Walkway in mall	0.64		
				Patio, Court, Terrace, Gazebo	0.62		

Table 31: Highest average ratio of percentage of civilian fatalities to percentage of fires for each room of fire origin (1995 – 2005).

Apartments		All Residential	
Room of Fire Origin	Ratio of %Fatalities to %Fires	Room of Fire Origin	Ratio of %Fatalities to %Fires
Living area - not classified above	25.96	Living area - not classified above	5.73
Patio, Court, Terrace, Gazebo	5.06	Open land, Scrub land, Farm land	4.53
Lounge, Common room, TV room, Sitting room, Music room	3.48	Bedroom, Sleeping area, Cell: under 5 persons	2.15
Bedroom, Sleeping area, Cell: under 5 persons	1.77	Lounge, Common room, TV room, Sitting room, Music room	2.10
Kitchen, Cooking area	0.53	Dining area, Cafeteria, Canteen, Servery, Bar area	1.49
Area under construction or major renovation	0.00	Multiple areas of origin	1.46
Balcony, Porch, Veranda	0.00	Lobby, Entrance way	0.90
Bedroom, Sleeping area, Cell: 5 or more persons	0.00	Kitchen, Cooking area	0.73
Boot, Load carrying area	0.00	Patio, Court, Terrace, Gazebo	0.69
Ceiling and floor assembly	0.00	Wardrobe, Cupboard, Walk in pantry	0.62

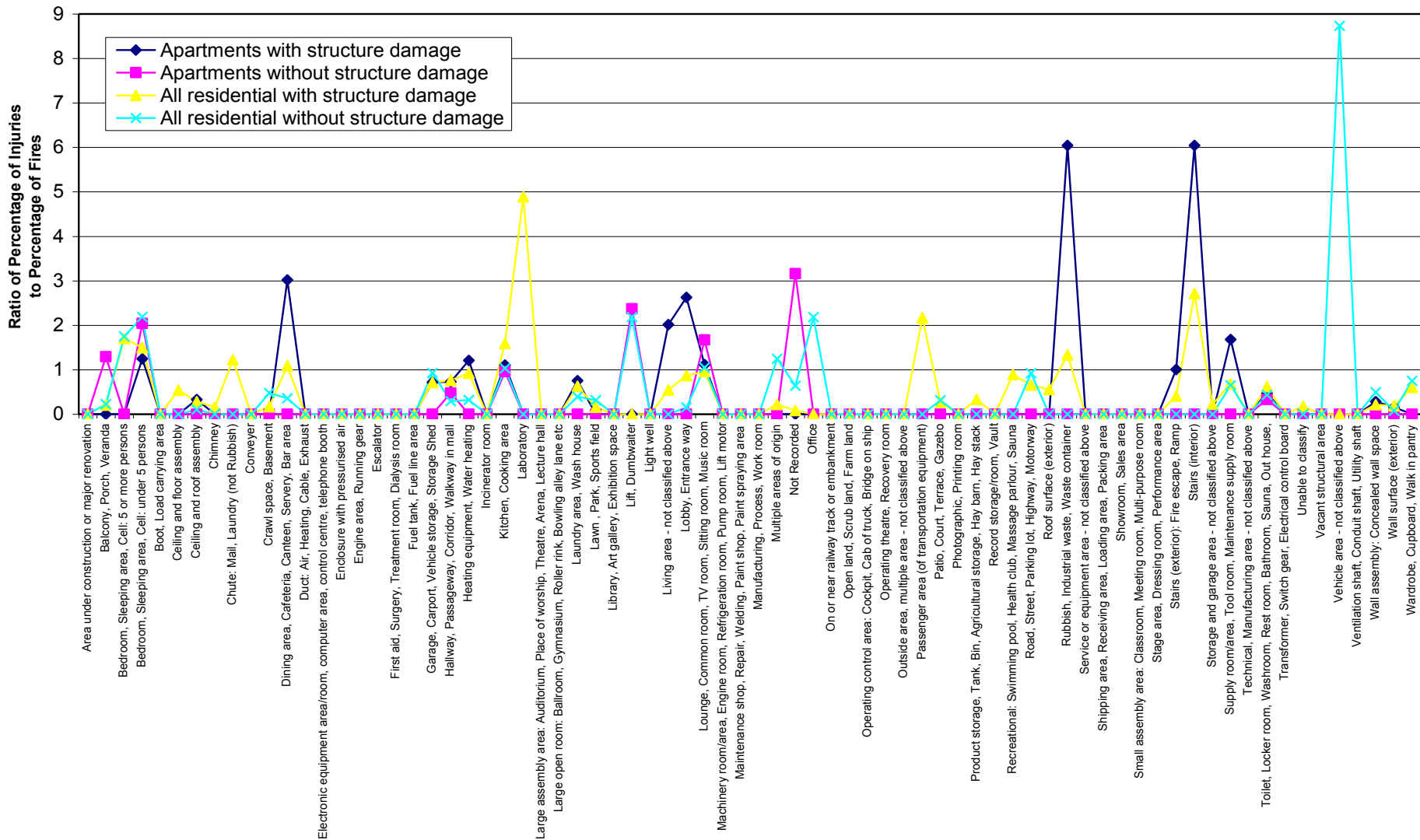


Figure 167: Ratio of percentage of total injuries to percentage of total fires recorded according to room of fire origin (1995-2005).

Table 32: Highest average ratio of percentage of civilian injuries to percentage of fires for each room of fire origin (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Room of Fire Origin	Ratio of %Injuries to %Fires	Room of Fire Origin	Ratio of %Injuries to %Fires	Room of Fire Origin	Ratio of %Injuries to %Fires	Room of Fire Origin	Ratio of %Injuries to %Fires
Stairs (interior)	4.88	Lift, Dumbwaiter	2.74	Laboratory	6.87	Vehicle area - not classified above	11.32
Living area - not classified above	3.07	Bedroom, Sleeping area, Cell: under 5 persons	2.12	Stairs (interior)	2.57	Office	2.66
Supply room/area, Tool room, Maintenance supply room	2.98	Lounge, Common room, TV room, Sitting room, Music room	1.81	Recreational: Swimming pool, Health club, Massage parlour, Sauna	1.87	Lift, Dumbwaiter	2.52
Dining area, Cafeteria, Canteen, Servery, Bar area	2.24	Balcony, Porch, Veranda	1.37	Kitchen, Cooking area	1.83	Bedroom, Sleeping area, Cell: under 5 persons	2.37
Lobby, Entrance way	2.15	Kitchen, Cooking area	0.97	Passenger area (of transportation equipment)	1.53	Bedroom, Sleeping area, Cell: 5 or more persons	1.97
Kitchen, Cooking area	1.30	Not Recorded	0.67	Bedroom, Sleeping area, Cell: 5 or more persons	1.50	Multiple areas of origin	1.62
Lounge, Common room, TV room, Sitting room, Music room	1.26	Hallway, Passageway, Corridor, Walkway in mall	0.50	Chute: Mail, Laundry (not Rubbish)	1.47	Lounge, Common room, TV room, Sitting room, Music room	1.25
Bedroom, Sleeping area, Cell: under 5 persons	1.17	Toilet, Locker room, Washroom, Rest room, Bathroom, Sauna, Out house, Portable toilet	0.35	Bedroom, Sleeping area, Cell: under 5 persons	1.45	Garage, Carport, Vehicle storage, Storage Shed	1.11
Heating equipment, Water heating	0.98			Supply room/area, Tool room, Maintenance supply room	1.19	Road, Street, Parking lot, Highway, Motorway	1.08
Garage, Carport, Vehicle storage, Storage Shed	0.80			Road, Street, Parking lot, Highway, Motorway	1.14	Kitchen, Cooking area	1.07

Table 33: Highest average ratio of percentage of civilian injuries to percentage of fires for each room of fire origin (1995 – 2005).

Apartments		All Residential	
Room of Fire Origin	Ratio of %Injuries to %Fires	Room of Fire Origin	Ratio of %Injuries to %Fires
Living area - not classified above	3.33	Laboratory	7.15
Stairs (interior)	3.03	Vehicle area - not classified above	2.38
Supply room/area, Tool room, Maintenance supply room	3.03	Stairs (interior)	1.85
Lobby, Entrance way	1.87	Bedroom, Sleeping area, Cell: under 5 persons	1.69
Dining area, Cafeteria, Canteen, Servery, Bar area	1.66	Bedroom, Sleeping area, Cell: 5 or more persons	1.65
Lounge, Common room, TV room, Sitting room, Music room	1.53	Lift, Dumbwaiter	1.65
Bedroom, Sleeping area, Cell: under 5 persons	1.52	Passenger area (of transportation equipment)	1.38
Lift, Dumbwaiter	1.48	Kitchen, Cooking area	1.29
Heating equipment, Water heating	1.11	Chute: Mail, Laundry (not Rubbish)	1.19
Kitchen, Cooking area	0.96	Recreational: Swimming pool, Health club, Massage parlour, Sauna	1.19

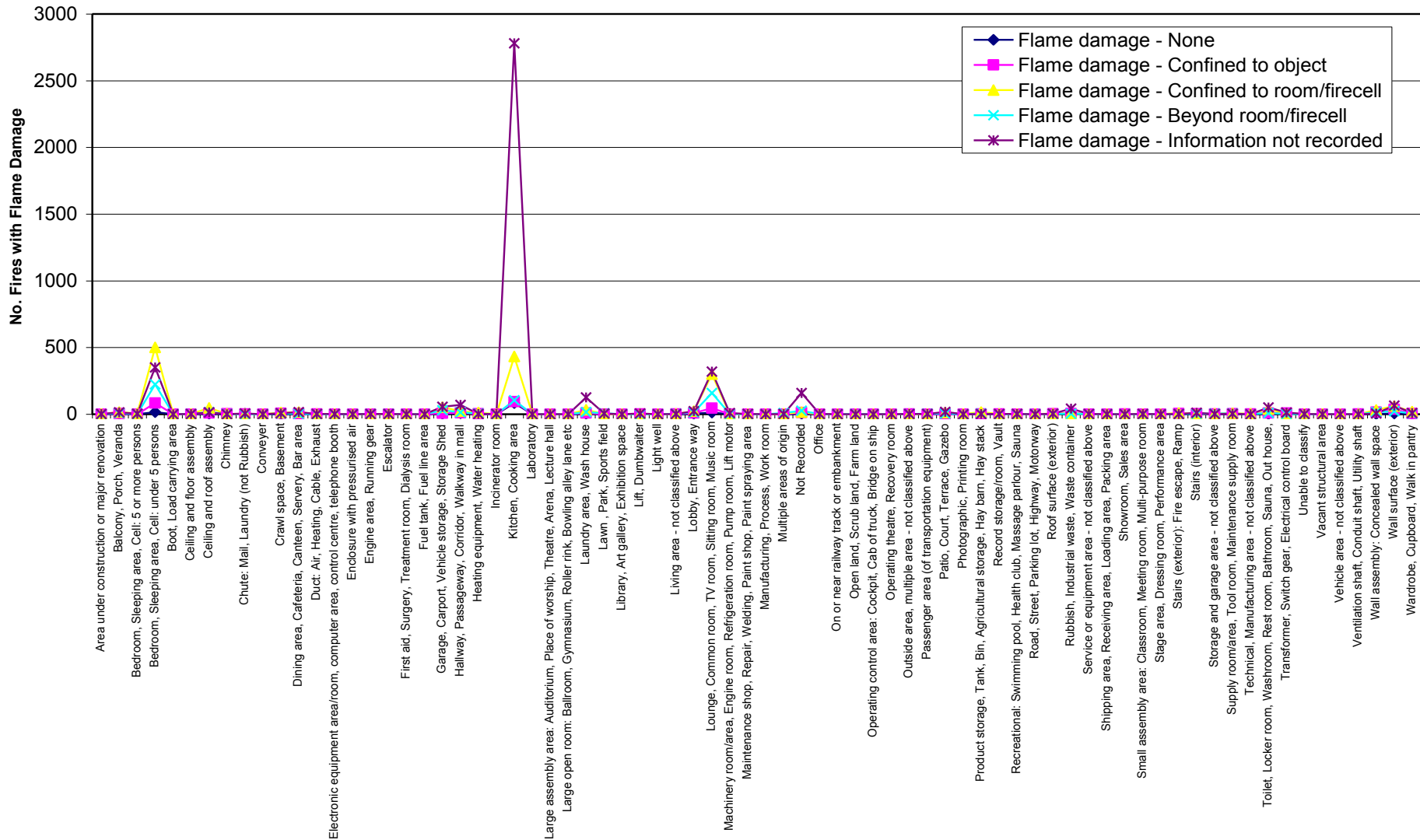


Figure 168: Number of apartment fires according to extent of flame damage and room of fire origin (1986-2005).

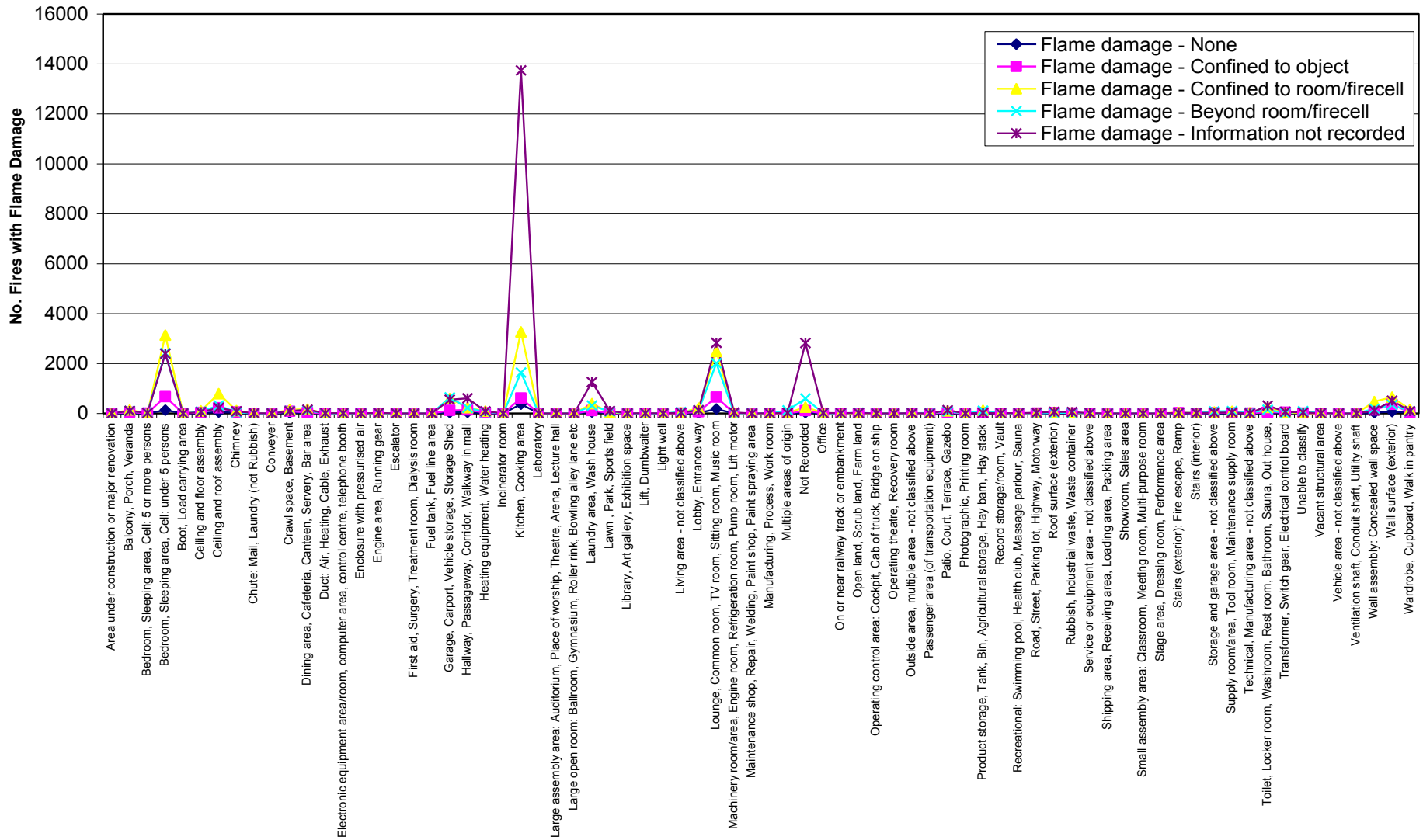


Figure 169: Number of all residential fires according to extent of flame damage and room of fire origin (1986-2005):.

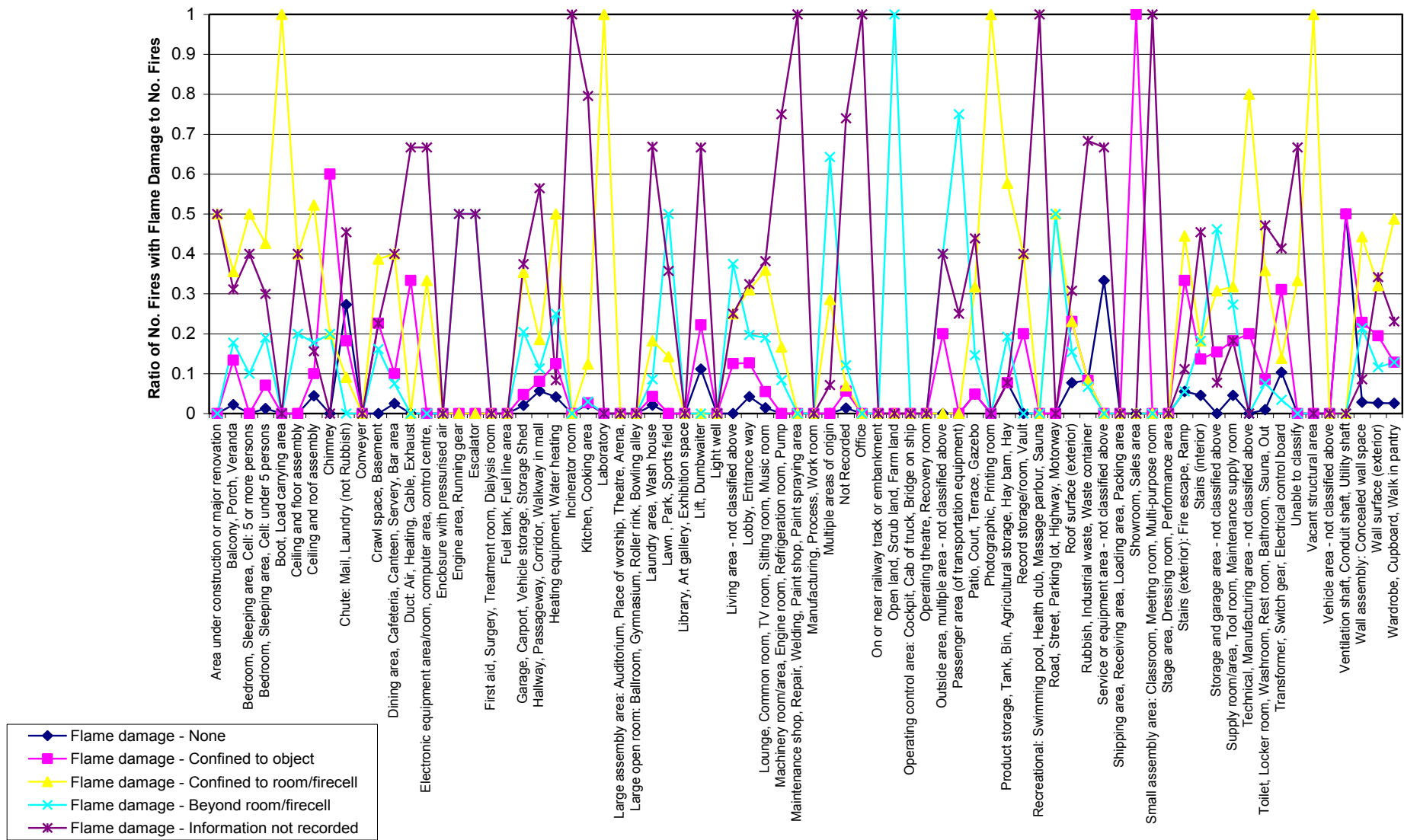


Figure 170: Ratio of apartment fires with flame damage to total fires for each room of fire origin (1986 – 2005).

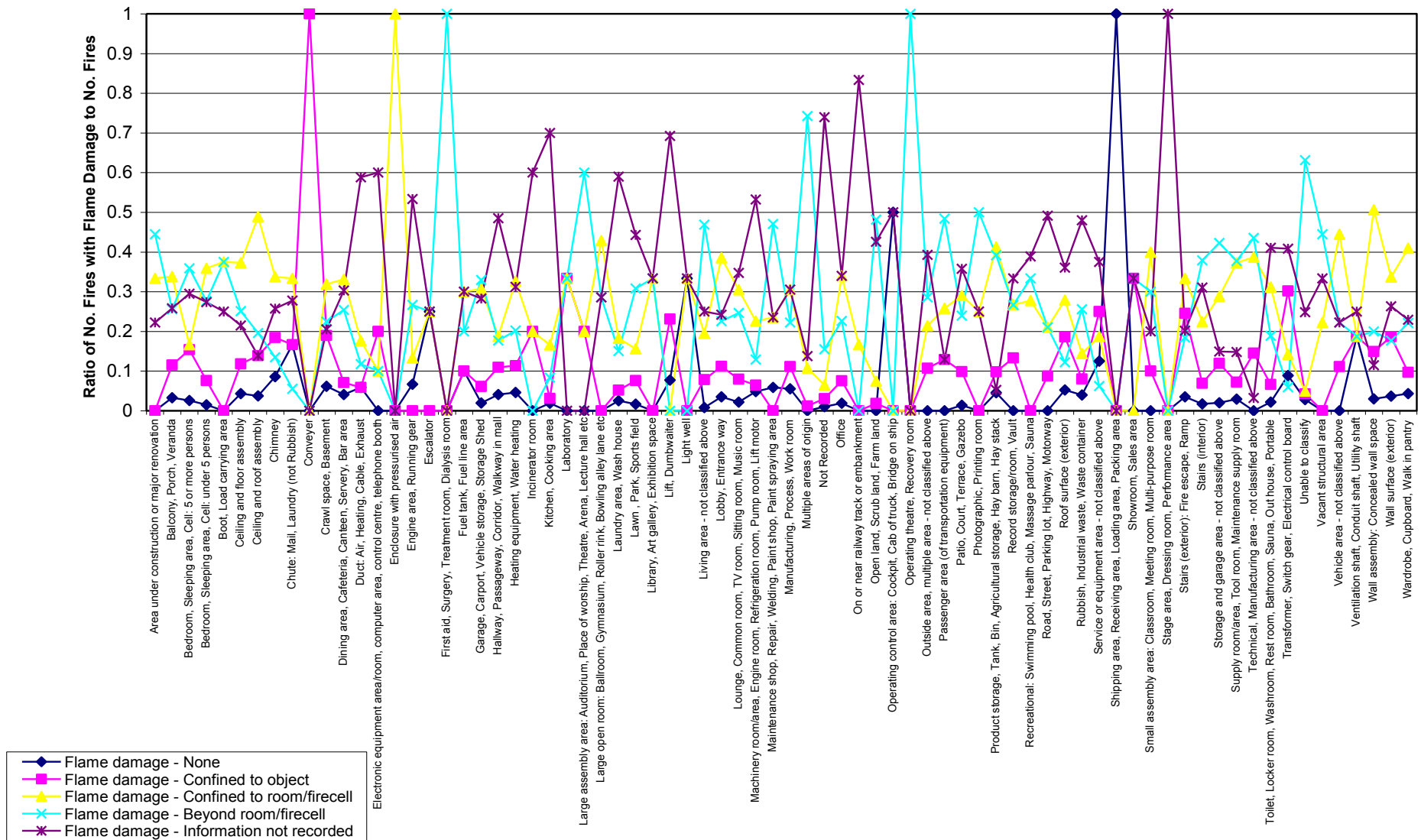


Figure 171: Ratio of all residential fires with flame damage to total fires for each room of fire origin (1986 – 2005).

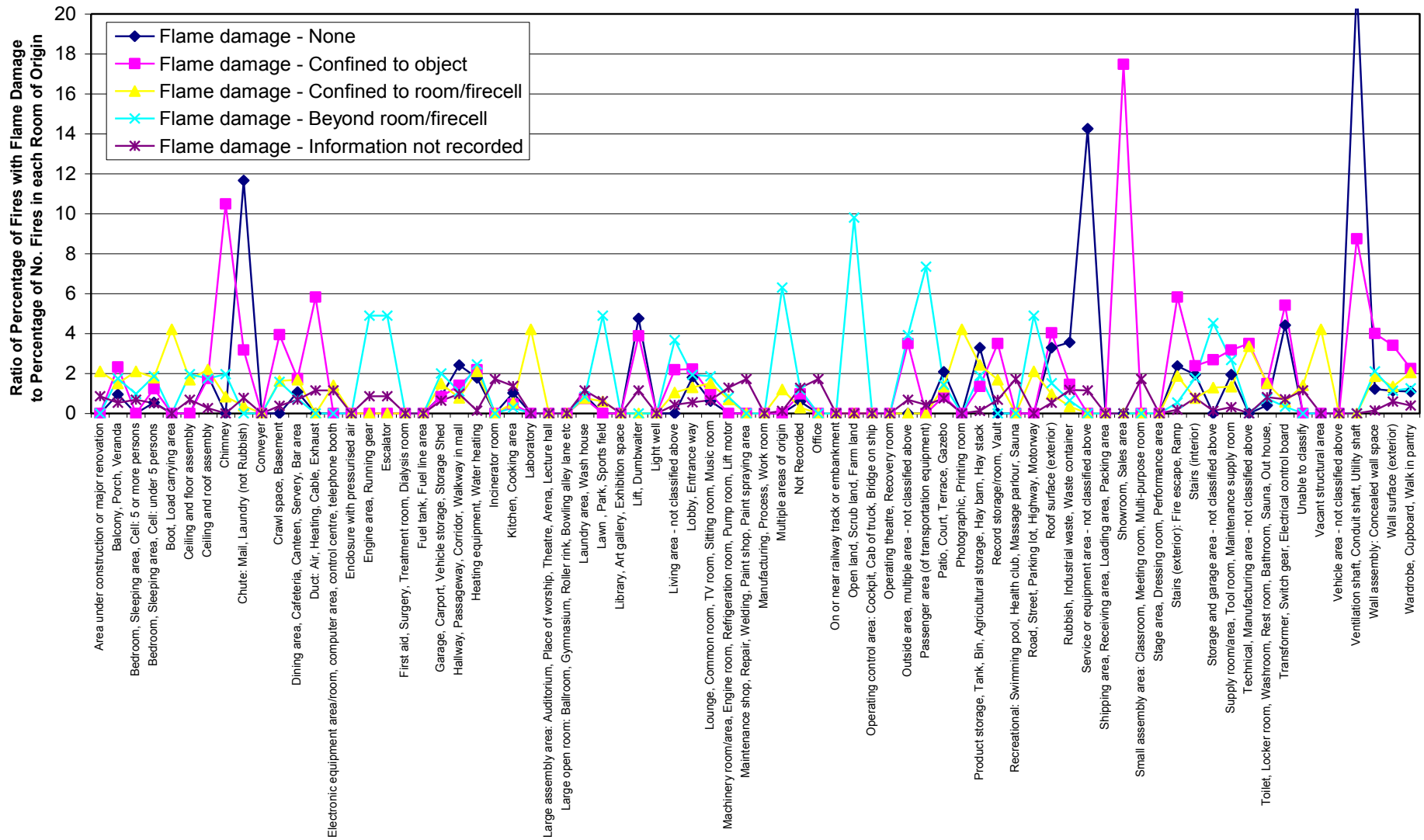


Figure 172: Ratio of percentages of apartment fires with flame damage to percentages of total fires for each room of fire origin (1986 – 2005).

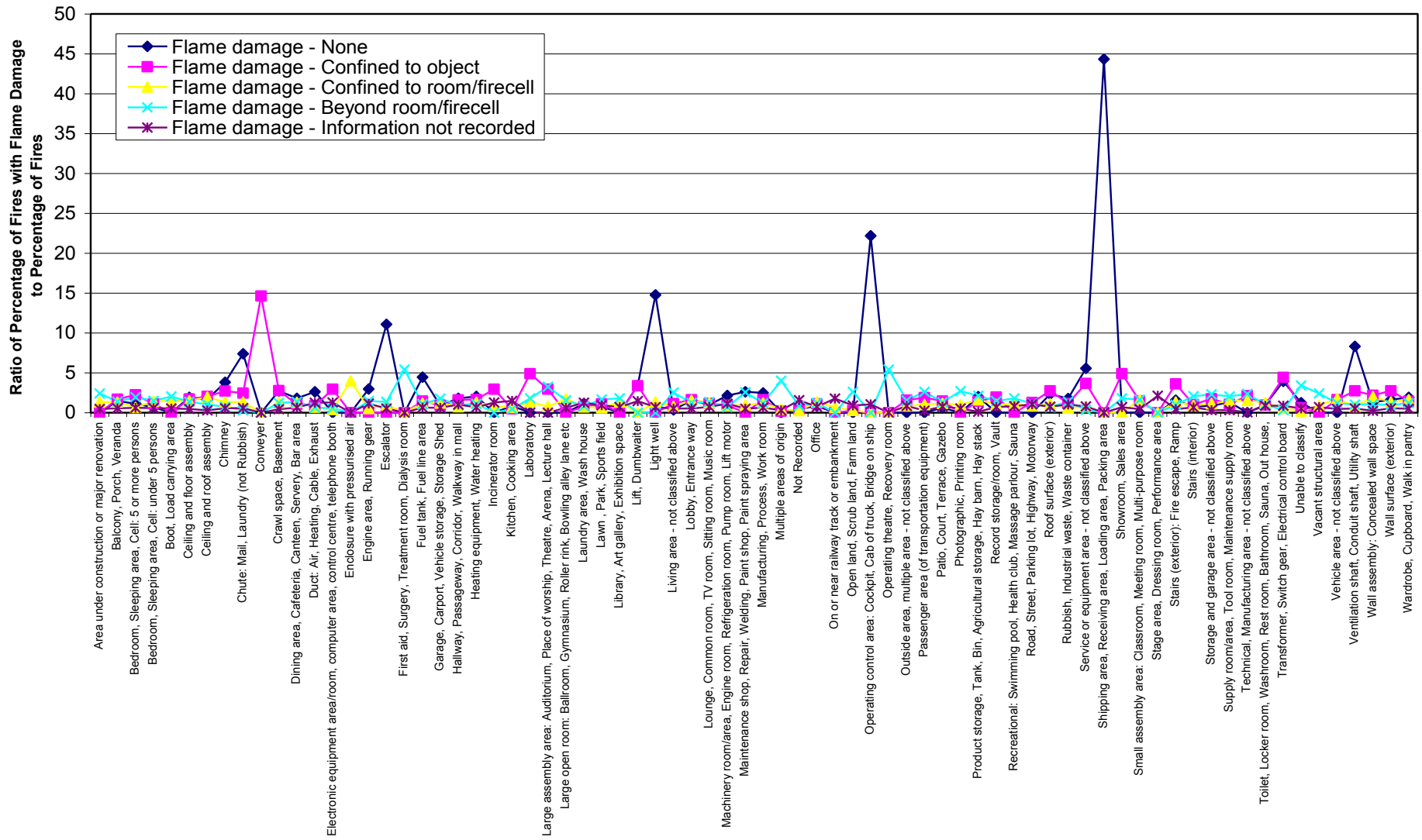


Figure 173: Ratio of percentages of all residential fires with flame damage to percentages of total fires for each room of fire origin (1986 – 2005).

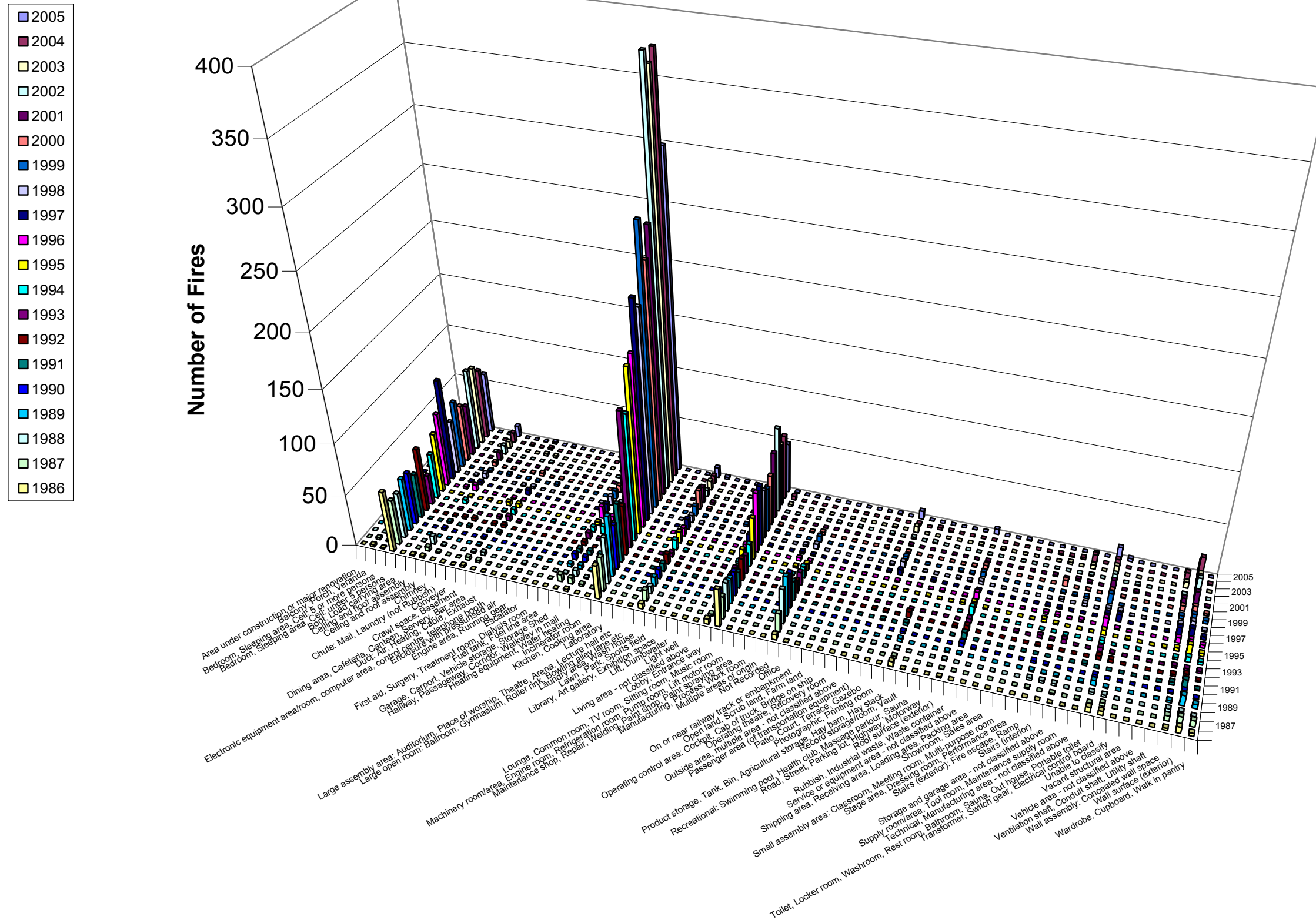


Figure 174: Number of fires that occurred each year in apartments for each room of fire origin (1986 – 2005).

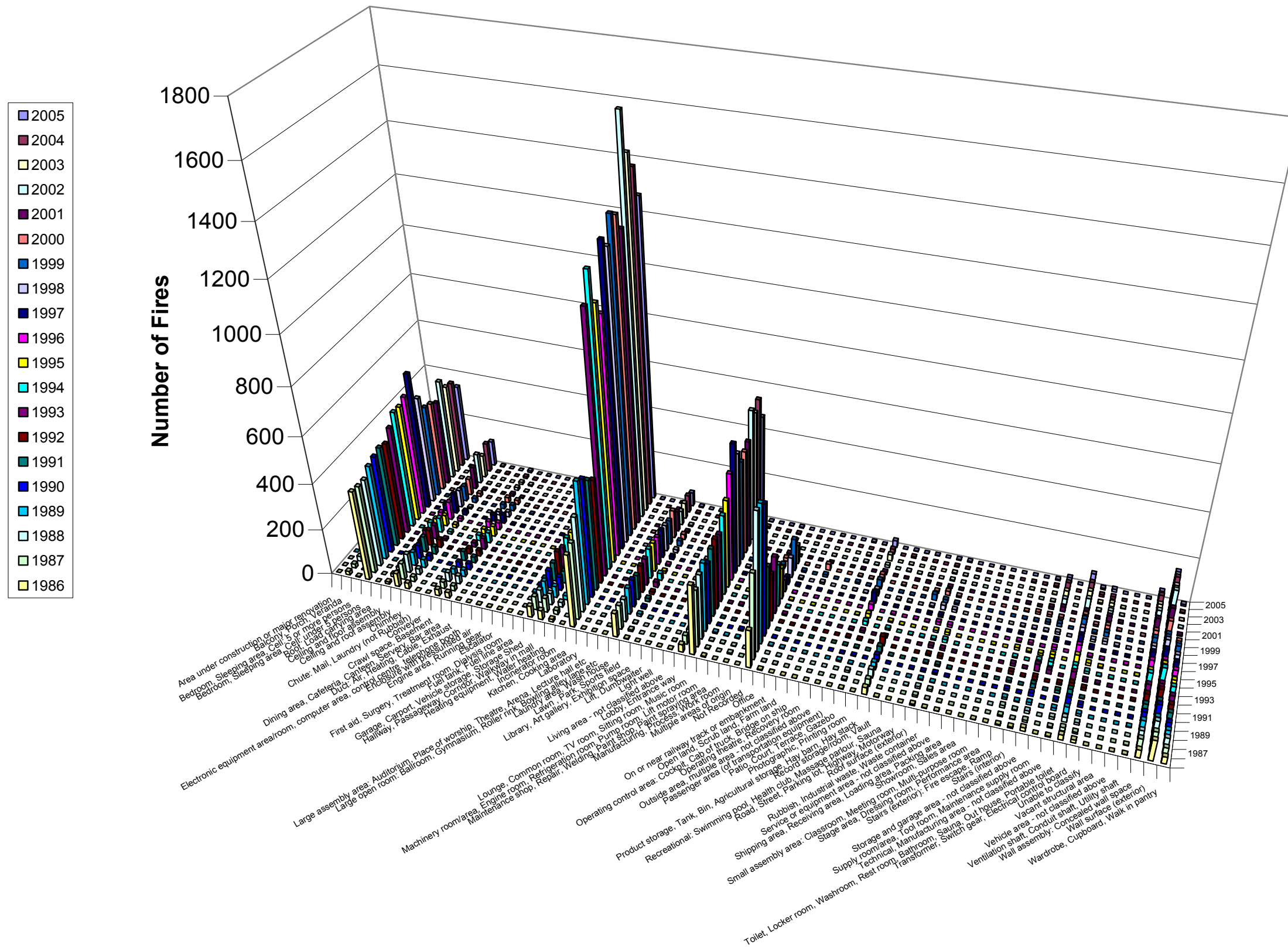


Figure 175: Number of fires that occurred each year in all residential structures for each room of fire origin (1986 – 2005).

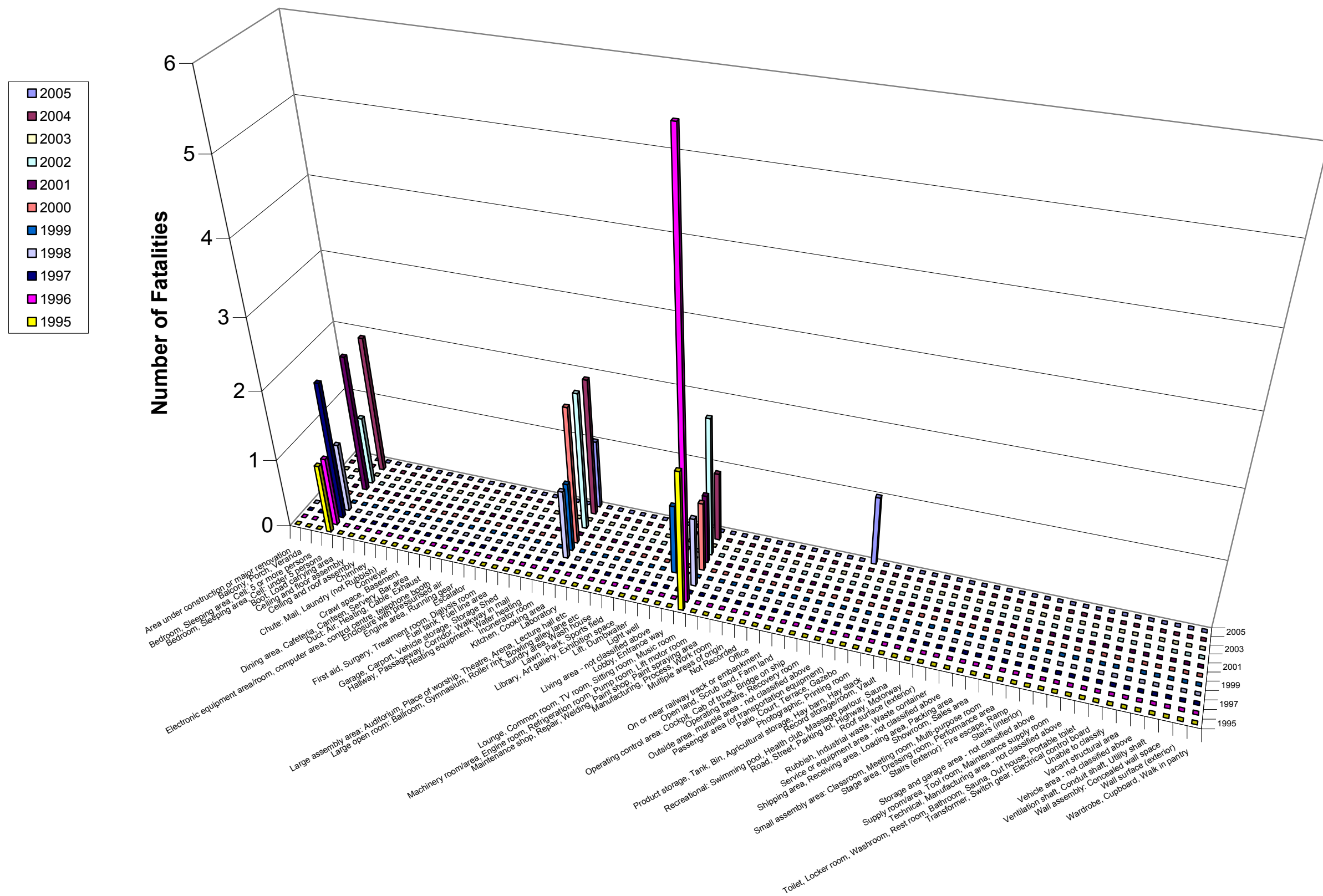


Figure 176: Number of fatalities for each room of fire origin considered for apartment fires (1995 – 2005).

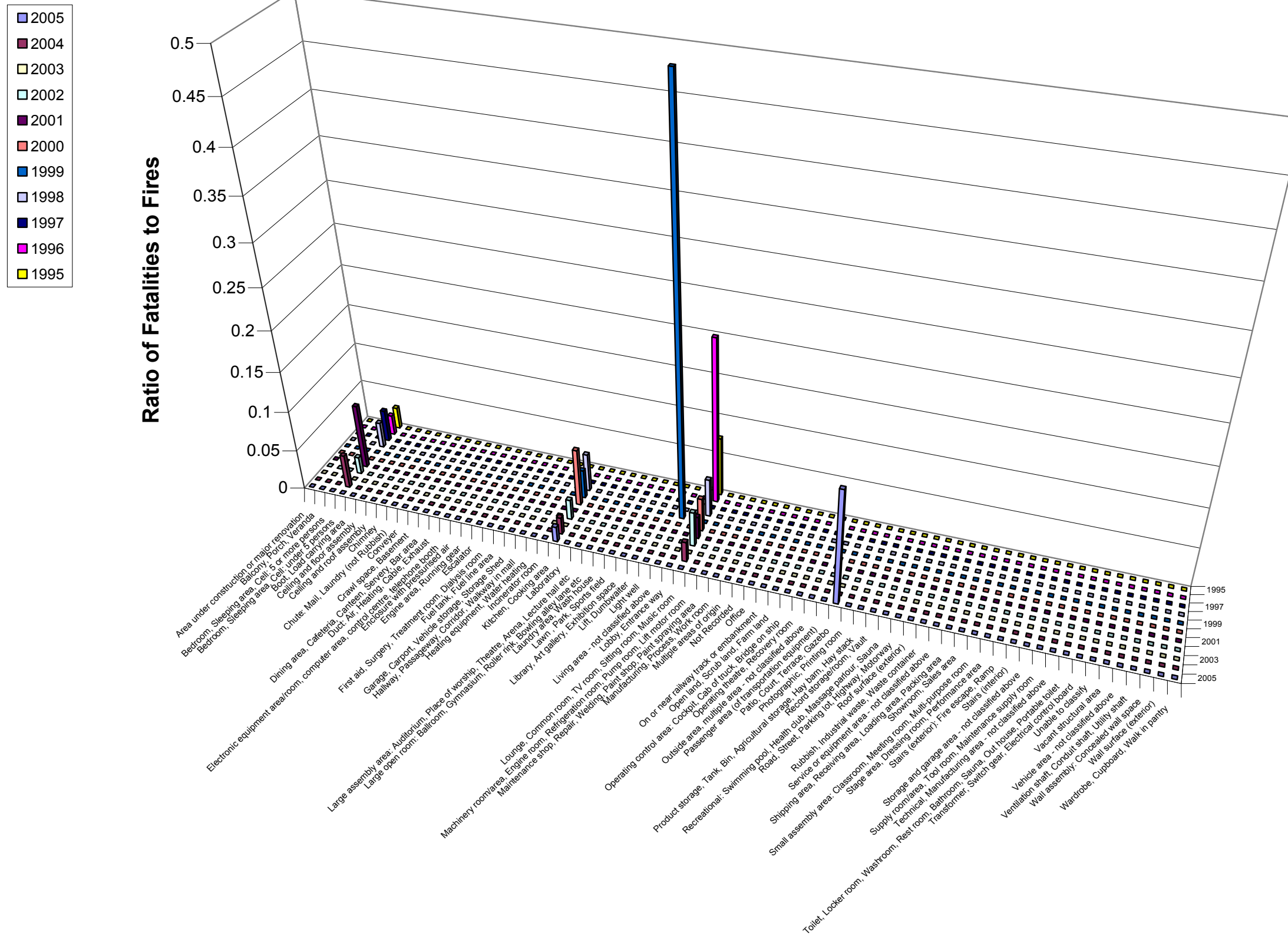


Figure 177: Ratio of the number of fatalities to number of fires in apartments each year for each room of fire origin considered (1995 – 2005).

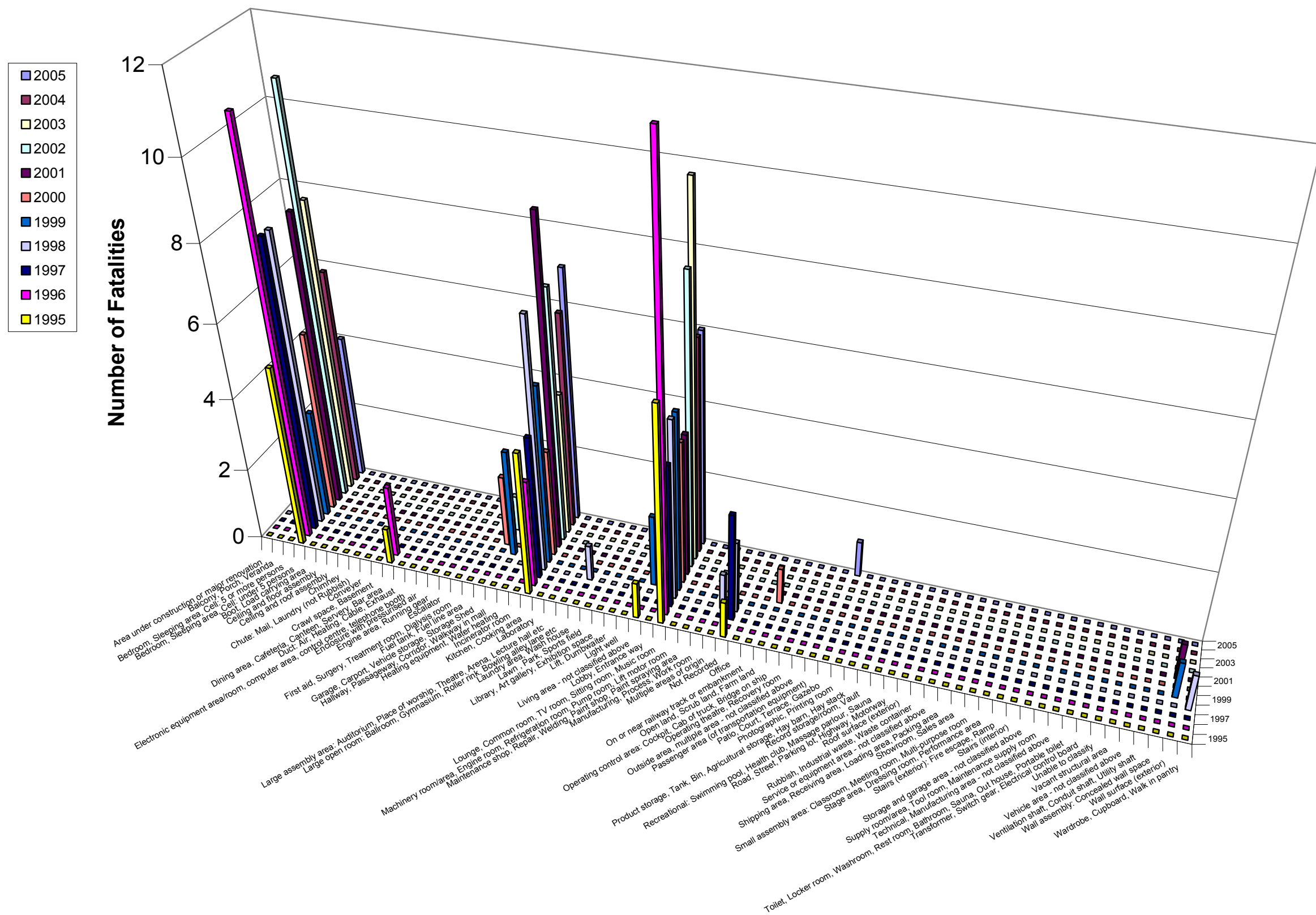


Figure 178: Fatalities from all residential property fires each year for each room of fire origin (1995 – 2005).

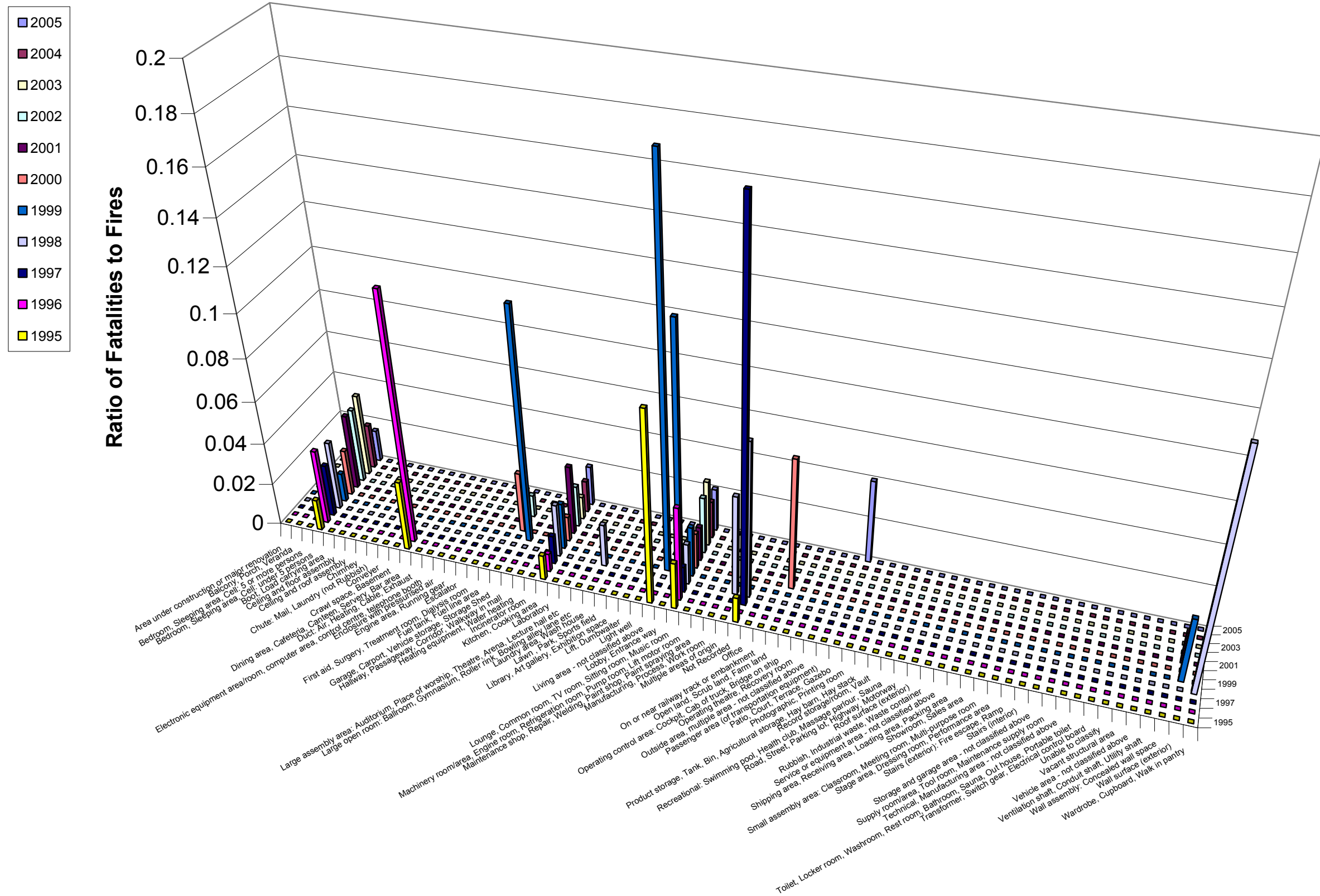


Figure 179: Ratio of the number of fatalities to number of fires in all residential structures each year for each room of fire origin considered (1995 – 2005).

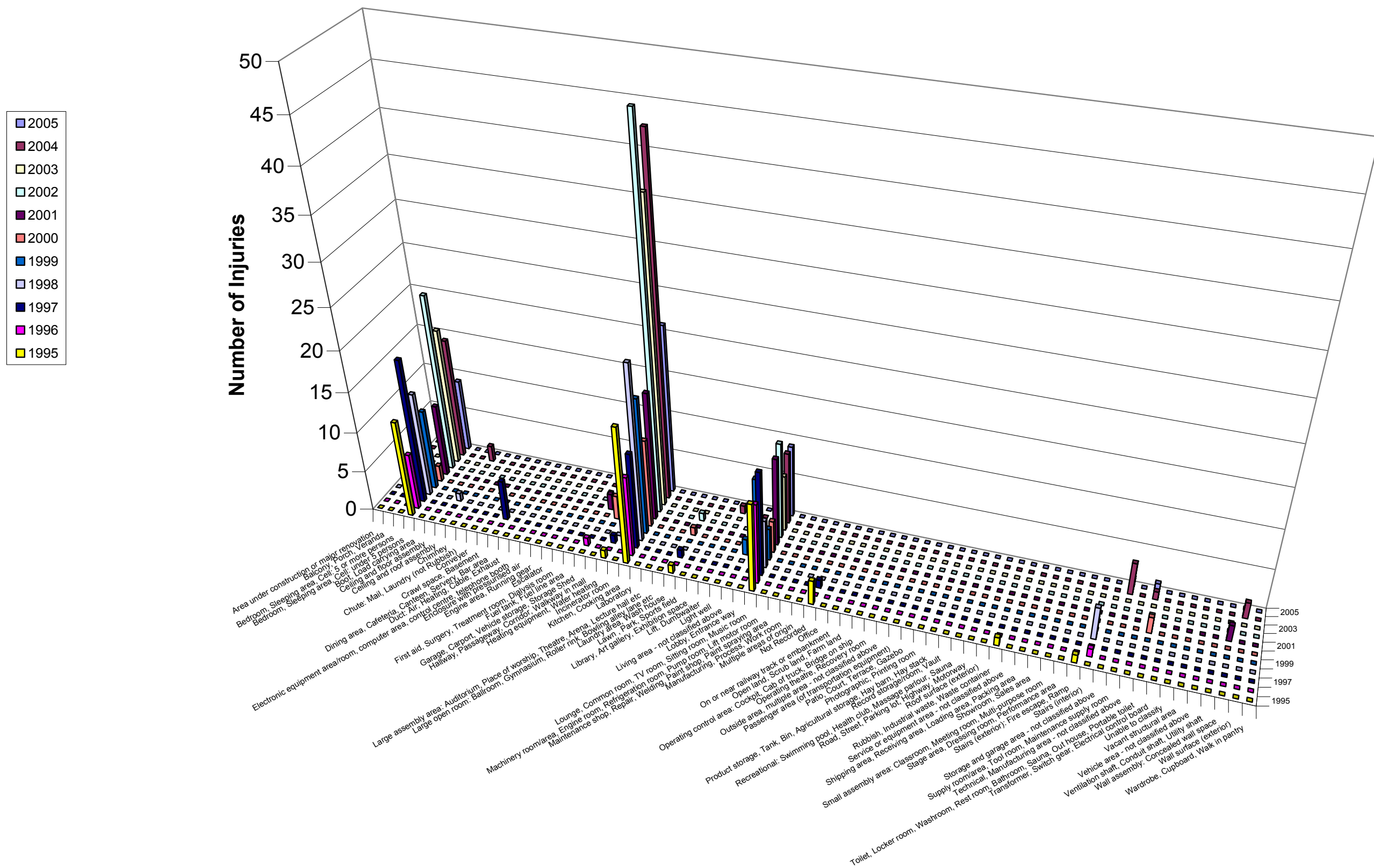


Figure 180: Number of injuries from fires in apartments each year for each room of fire origin considered (1995 – 2005).

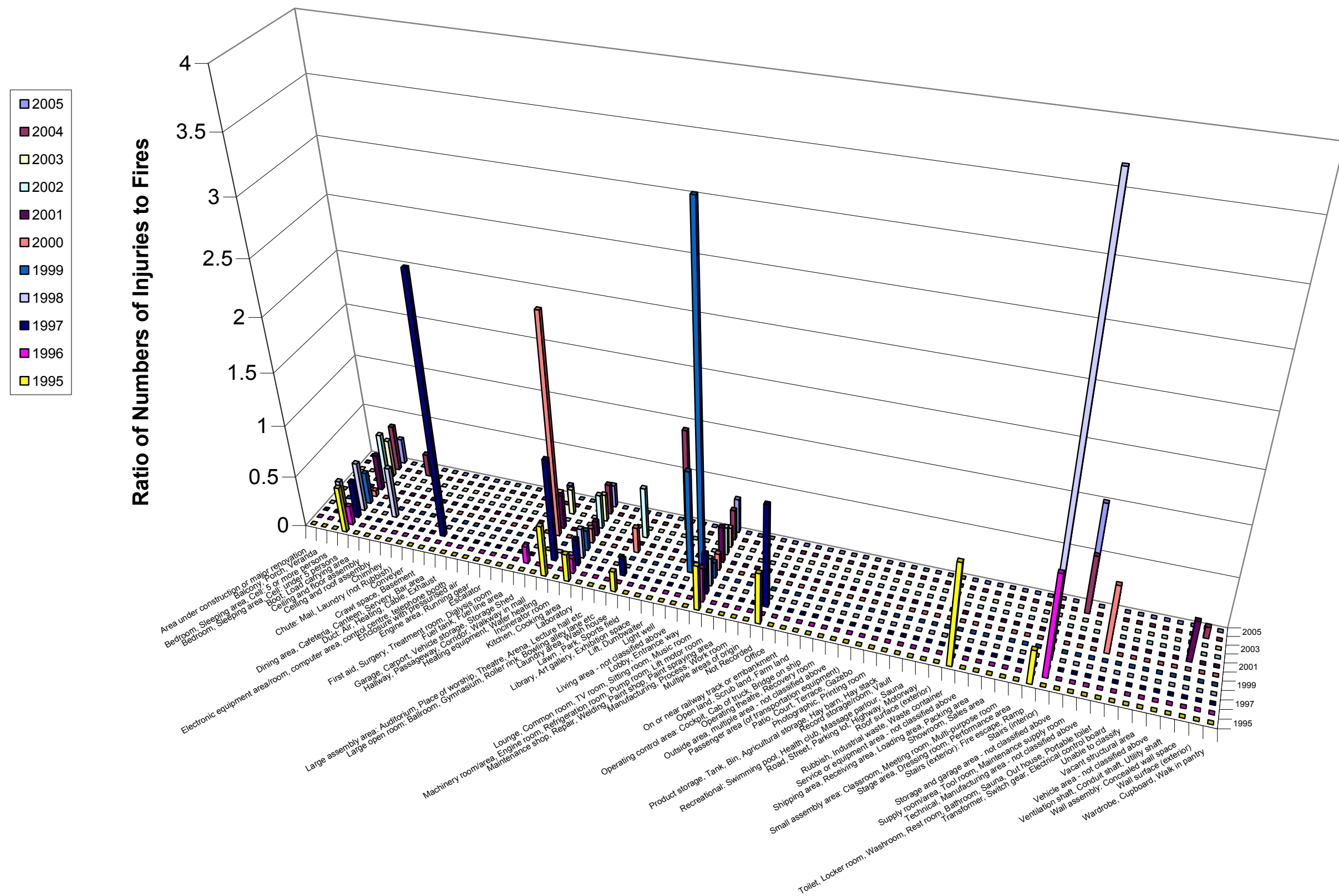


Figure 181: Ratio of numbers of injuries to number of fires that occurred in apartments each year for each room of fire origin (1995 – 2005).

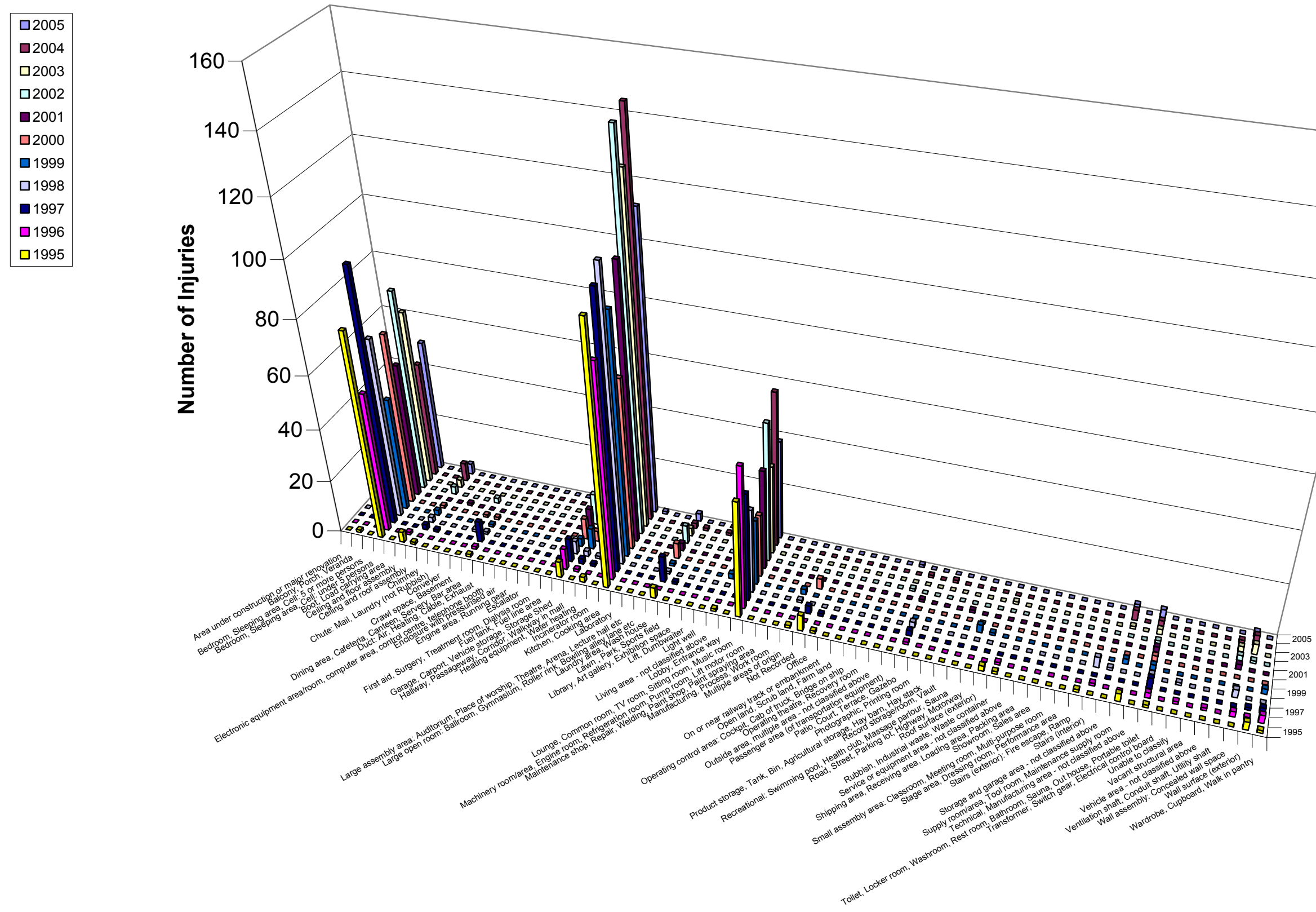


Figure 182: Number of injuries from fires in all residential structures each year for each room of fire origin considered (1995 – 2005).

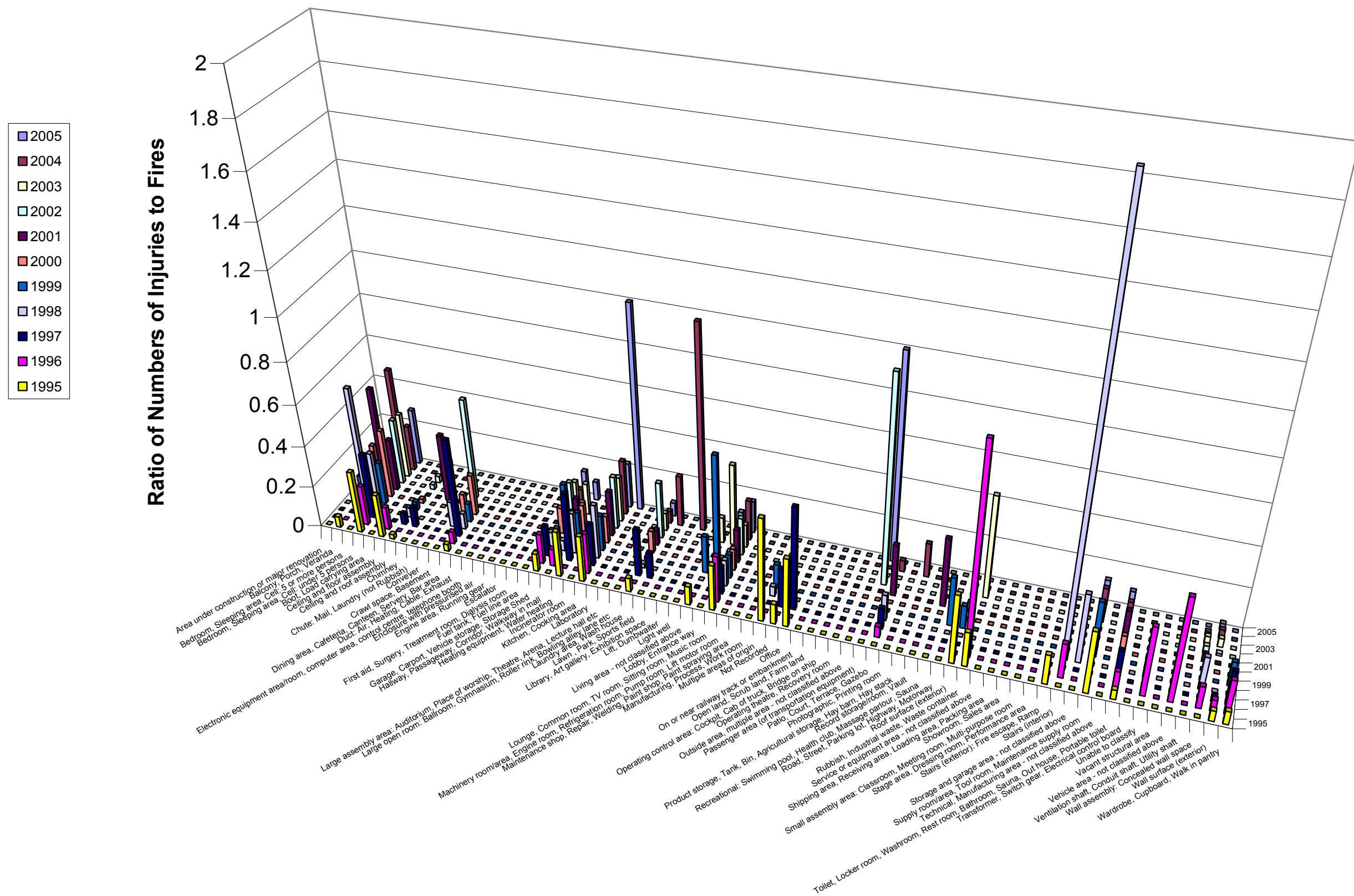


Figure 183: Ratio of the numbers of injuries to the numbers of fires that occurred in all residential structures each year for each room of fire origin (1995 – 2005).

APPENDIX G EQUIPMENT INVOLVED IN IGNITION – DATA ANALYSIS OF ALL CLASSES

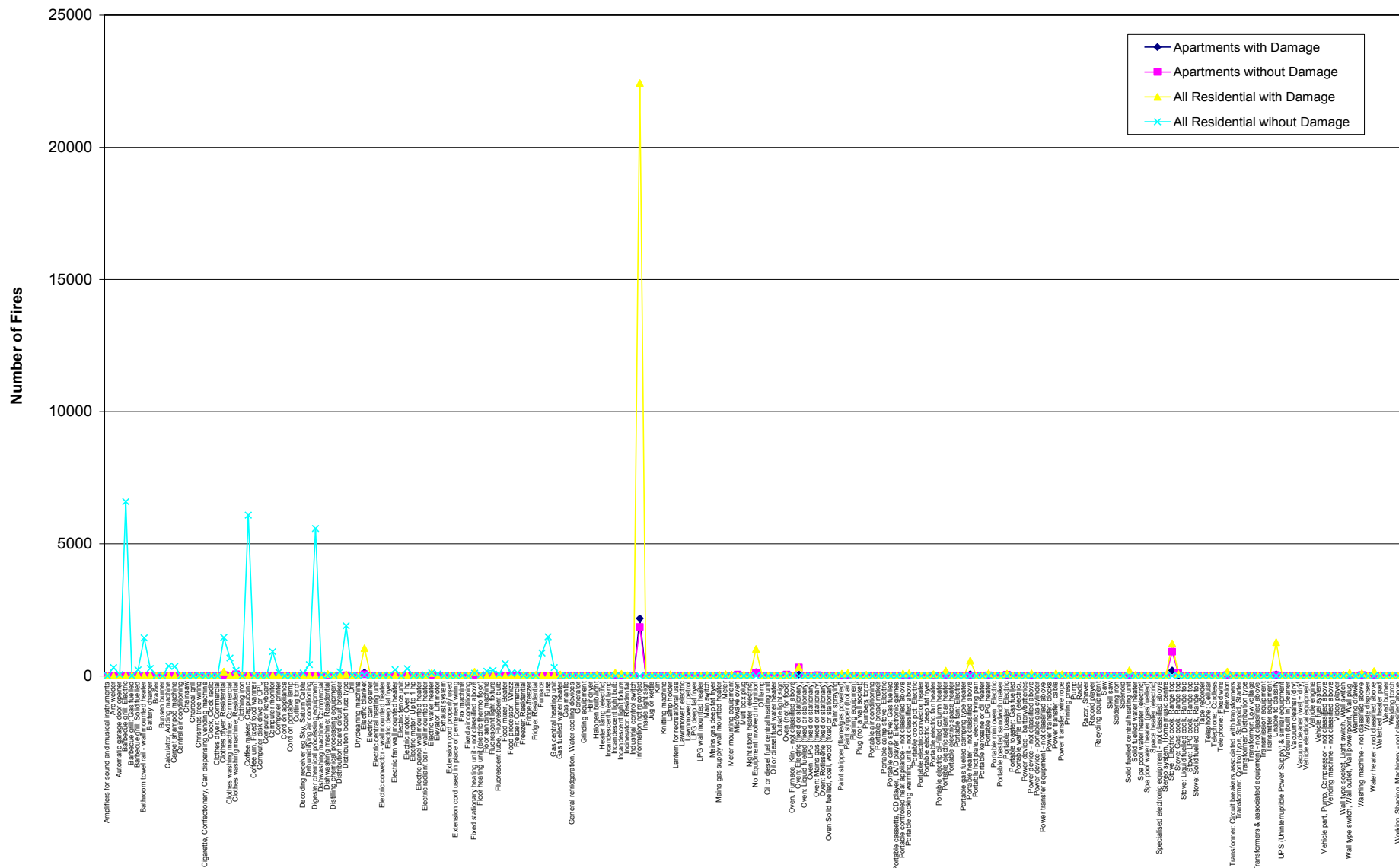


Figure 184: Number of fires in residential structures, with and without damage, according to the equipment involved in ignition (1986-2005).

Table 34: Ranking of the most common equipment involved in ignition by percentage of total fires (using NZFS from 1986 – 2005).

Apartments with damage		Apartments without damage		All residential with damage		All residential without damage	
Equipment Involved in Ignition	% Total Fires	Equipment Involved in Ignition	% Total Fires	Equipment Involved in Ignition	% Total Fires	Equipment Involved in Ignition	% Total Fires
Information not recorded	67.4	Information not recorded	45.7	Information not recorded	69.5	Information not recorded	50.6
Stove: Electric cook, Range top	6.4	Stove: Electric cook, Range top	22.6	Unable to classify	3.9	Stove: Electric cook, Range top	15.6
No Equipment Involved in Ignition	4.3	Oven: Electric (fixed or stationary)	7.8	Stove: Electric cook, Range top	3.8	Oven: Electric (fixed or stationary)	7.4
Electric blanket	3.9	No Equipment Involved in Ignition	2.8	Electric blanket	3.2	No Equipment Involved in Ignition	2.1
Portable heater - not classified above	2.0	Stove: Gas cook, Range top	2.6	No Equipment Involved in Ignition	3.1	Electric blanket	1.7
Unable to classify	1.8	Clothes washing machine: Residential	1.4	Portable heater - not classified above	1.8	Clothes washing machine: Residential	1.6
Oven: Electric (fixed or stationary)	1.6	Electric blanket	1.4	Oven: Electric (fixed or stationary)	1.0	Washing machine - not classified above	1.4
Television	0.8	Microwave oven	1.1	Solid fuelled central heating unit	0.7	Stove: Gas cook, Range top	1.3
Portable electric radiant bar heater	0.8	Oven (not for food)	1.1	Portable electric radiant bar heater	0.6	Dishwashing machine: Residential	1.0
Power device - not classified above	0.5	Portable toaster: Electric	1.0	Water heater - not classified above	0.6	Clothes dryer: Residential	1.0

Table 35: Ranking of the most common equipment involved in ignition by percentage of total fires (using NZFS from 1986 – 2005).

Apartments		All residential	
Equipment Involved in Ignition	% Total Fires	Equipment Involved in Ignition	% Total Fires
Information not recorded	55.3	Information not recorded	61.2
Stove: Electric cook, Range top	15.4	Stove: Electric cook, Range top	8.9
Oven: Electric (fixed or stationary)	5.1	Oven: Electric (fixed or stationary)	3.8
No Equipment Involved in Ignition	3.5	No Equipment Involved in Ignition	2.7
Electric blanket	2.5	Unable to classify	2.6
Stove: Gas cook, Range top	1.6	Electric blanket	2.5
Unable to classify	1.2	Portable heater - not classified above	1.1
Portable heater - not classified above	0.9	Washing machine - not classified above	0.8
Clothes washing machine: Residential	0.9	Clothes washing machine: Residential	0.8
Television	0.8	Clothes dryer: Residential	0.7

Table 36: Ranking of the most common equipment involved in ignition by percentage of total civilian fatalities (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Equipment Involved in Ignition	% Total Fatalities	Equipment Involved in Ignition	% Total Fatalities	Equipment Involved in Ignition	% Total Fatalities	Equipment Involved in Ignition	% Total Fatalities
Information not recorded	61.8	Information not recorded	100.0	Information not recorded	64.9	Information not recorded	66.7
Stove: Electric cook, Range top	14.7			Stove: Electric cook, Range top	8.0	Charcoal grill	11.1
Electric blanket	5.9			Electric blanket	4.4	No Equipment Involved in Ignition	11.1
No Equipment Involved in Ignition	2.9			No Equipment Involved in Ignition	4.4	Stove: Electric cook, Range top	11.1
Oven: Electric (fixed or stationary)	2.9			Portable electric radiant bar heater	3.1		
Oven: Mains gas (fixed or stationary)	2.9			Oven: Electric (fixed or stationary)	2.7		
Portable LPG heater	2.9			Unable to classify	2.7		
Power device - not classified above	2.9			Television	1.8		
Video player	2.9			Wall type switch, Wall outlet, Wall powerpoint, Wall plug	1.8		
				Portable LPG heater	1.3		

Table 37: Ranking of the most common equipment involved in ignition by percentage of total civilian fatalities (1995 – 2005).

Apartments		All Residential	
Equipment Involved in Ignition	% Total Fatalities	Equipment Involved in Ignition	% Total Fatalities
Information not recorded	62.9	Information not recorded	65.0
Stove: Electric cook, Range top	14.3	Stove: Electric cook, Range top	8.1
Electric blanket	5.7	No Equipment Involved in Ignition	4.7
No Equipment Involved in Ignition	2.9	Electric blanket	4.3
Oven: Electric (fixed or stationary)	2.9	Portable electric radiant bar heater	3.0
Oven: Mains gas (fixed or stationary)	2.9	Oven: Electric (fixed or stationary)	2.6
Portable LPG heater	2.9	Unable to classify	2.6
Power device - not classified above	2.9	Television	1.7
Video player	2.9	Wall type switch, Wall outlet, Wall powerpoint, Wall plug	1.7
Amplifiers for sound and musical instruments	0.0	Portable LPG heater	1.3

Table 38: Ranking of the most common equipment involved in ignition by percentage of total civilian injuries (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Equipment Involved in Ignition	% Total Injuries	Equipment Involved in Ignition	% Total Injuries	Equipment Involved in Ignition	% Total Injuries	Equipment Involved in Ignition	% Total Injuries
Information not recorded	59.0	Information not recorded	48.8	Information not recorded	57.3	Information not recorded	50.7
Stove: Electric cook, Range top	13.0	Stove: Electric cook, Range top	27.6	Stove: Electric cook, Range top	12.8	Stove: Electric cook, Range top	21.7
No Equipment Involved in Ignition	6.3	No Equipment Involved in Ignition	4.1	No Equipment Involved in Ignition	6.3	Oven: Electric (fixed or stationary)	4.9
Oven: Electric (fixed or stationary)	2.3	Oven: Electric (fixed or stationary)	3.7	Oven: Electric (fixed or stationary)	2.6	No Equipment Involved in Ignition	3.5
Portable electric radiant bar heater	2.3	Electric blanket	2.8	Electric blanket	1.7	Electric blanket	2.9
Unable to classify	1.3	Portable electric radiant bar heater	2.4	Unable to classify	1.7	Portable electric radiant bar heater	1.5
Portable electric fan heater	1.0	Oven (not for food)	1.6	Portable electric radiant bar heater	1.6	Stove: Gas cook, Range top	1.2
Television	1.0	Stove: Gas cook, Range top	1.6	Portable LPG heater	1.4	Oven (not for food)	1.1
Clothes washing machine: Residential	0.7	Microwave oven	1.2	Television	0.9	Portable LPG heater	1.1
Dehumidifying air conditioning	0.7	Portable electric fan heater	0.8	Oven (not for food)	0.7	Television	0.7

Table 39: Ranking of the most common equipment involved in ignition by percentage of total civilian injuries (1995 – 2005).

Apartments		All Residential	
Equipment Involved in Ignition	% Total Injuries	Equipment Involved in Ignition	% Total Injuries
Information not recorded	54.4	Information not recorded	54.6
Stove: Electric cook, Range top	19.6	Stove: Electric cook, Range top	16.5
No Equipment Involved in Ignition	5.3	No Equipment Involved in Ignition	5.1
Oven: Electric (fixed or stationary)	2.9	Oven: Electric (fixed or stationary)	3.6
Portable electric radiant bar heater	2.4	Electric blanket	2.2
Electric blanket	1.6	Portable electric radiant bar heater	1.5
Stove: Gas cook, Range top	1.1	Portable LPG heater	1.3
Oven (not for food)	0.9	Unable to classify	1.2
Unable to classify	0.9	Oven (not for food)	0.9
Microwave oven	0.9	Stove: Gas cook, Range top	0.8

Table 40: Highest ratios of numbers of civilian fatalities to numbers of fires each year for each item of equipment involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Equipment Involved in Ignition	Ratio of Fatalities to Fires	Equipment Involved in Ignition	Ratio of Fatalities to Fires	Equipment Involved in Ignition	Ratio of Fatalities to Fires	Equipment Involved in Ignition	Ratio of Fatalities to Fires
Video player	0.3333	Information not recorded	0.0005	Electric deep fat fryer	0.1250	Decoding receiver eg Sky, Saturn Cable	0.0288
Oven: Mains gas (fixed or stationary)	0.2500			Cord on Portable lamp	0.1000	Electric blanket	0.0270
Portable LPG heater	0.0714			Video player	0.0909	Digester chemical processing equipment	0.0120
Power device - not classified above	0.0667			Oven: Mains gas (fixed or stationary)	0.0714	Barbecue grill: Electric	0.0112
Stove: Electric cook, Range top	0.0244			Jug or kettle	0.0400	Coffee maker, Cappuccino	0.0092
Oven: Electric (fixed or stationary)	0.0189			Portable electric radiant bar heater	0.0357	Carpet shampoo machine	0.0084
Electric blanket	0.0159			Wall type switch, Wall outlet, Wall powerpoint, Wall plug	0.0342	Distribution board circuit breaker	0.0065
Information not recorded	0.0097			Portable LPG heater	0.0306	Dehumidifying air conditioning	0.0047
No Equipment Involved in Ignition	0.0071			Solid fuelled water heater	0.0286	Clothes washing machine: Commercial	0.0044
				Television	0.0248	Electric fan wall mounted heater	0.0043

Table 41: Highest average ratios of numbers of civilian fatalities to numbers of fires for each item of equipment involved in ignition (1995 – 2005).

Apartments		All Residential	
Equipment Involved in Ignition	Ratio of Fatalities to Fires	Equipment Involved in Ignition	Ratio of Fatalities to Fires
Video player	0.2500	Video player	0.0909
Power device - not classified above	0.0667	Cord on Portable lamp	0.0714
Oven: Mains gas (fixed or stationary)	0.0385	Oven: Mains gas (fixed or stationary)	0.0714
Portable LPG heater	0.0333	Jug or kettle	0.0400
Electric blanket	0.0110	Portable electric radiant bar heater	0.0357
Information not recorded	0.0055	Wall type switch, Wall outlet, Wall powerpoint, Wall plug	0.0342
Stove: Electric cook, Range top	0.0045	Portable LPG heater	0.0306
No Equipment Involved in Ignition	0.0040	Decoding receiver eg Sky, Saturn Cable	0.0288
Oven: Electric (fixed or stationary)	0.0027	Electric deep fat fryer	0.0286
Amplifiers for sound and musical instruments	0.0000	Solid fuelled water heater	0.0286

Table 42: Highest average ratios of numbers of civilian injuries to numbers of fires for each item of equipment involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Equipment Involved in Ignition	Ratio of Injuries to Fires	Equipment Involved in Ignition	Ratio of Injuries to Fires	Equipment Involved in Ignition	Ratio of Injuries to Fires	Equipment Involved in Ignition	Ratio of Injuries to Fires
Portable camp stove: Gas fuelled	2.0000	Fax machine	1.0000	Barbecue grill: Electric	1.0000	Coffee urn, Fixed food warmer	0.3333
Bunsen burner	1.0000	Portable gas fuelled camping type heater	0.5000	Vehicle engine	1.0000	Floor heating unit (electric thermo floor)	0.1250
Dehumidifying air conditioning	1.0000	Multi box plug	0.3333	Clock, Clock radio	0.5714	Electric panel wall mounted heater	0.0909
Heater lamp (electric)	1.0000	Electric radiant bar - wall mounted heater	0.2500	Portable cassette, CD player, DVD player, Electronic games deck	0.5455	Coffee maker, Cappuccino	0.0888
Oil lamp	1.0000	Jug or kettle	0.2500	Bunsen burner	0.5000	Electric deep fat fryer	0.0741
Portable hot plate, electric frying pan	1.0000	Portable electric fan heater	0.2500	Dehumidifying air conditioning	0.5000	Automatic garage door opener	0.0727
Power device - Portable gas cylinder	1.0000	Portable electric radiant bar heater	0.2308	Portable hot plate, electric frying pan	0.3571	Brazier	0.0714
Solid fuelled water heater	1.0000	Portable camp stove: Gas fuelled	0.2000	Drill	0.3333	Barbecue grill: Electric	0.0705
Computer monitor	0.5000	Portable mini oven: Electric	0.1667	Transformer: Circuit breakers associated with transformers	0.3333	Fluorescent light fixture	0.0577
Grinding equipment	0.5000	Electric blanket	0.1250	Microwave oven	0.3043	Electric radiant bar - wall mounted heater	0.0556

Table 43: Highest average ratios of numbers of civilian injuries to numbers of fires each year for each item of equipment involved in ignition (1995 – 2005).

Apartments		All Residential	
Equipment Involved in Ignition	Ratio of Injuries to Fires	Equipment Involved in Ignition	Ratio of Injuries to Fires
Bunsen burner	1.0000	Vehicle engine	1.0000
Dehumidifying air conditioning	1.0000	Portable cassette, CD player, DVD player, Electronic games deck	0.5455
Fax machine	1.0000	Clock, Clock radio	0.5000
Grinding equipment	0.5000	Portable hot plate, electric frying pan	0.3571
Heater lamp (electric)	0.5000	Bunsen burner	0.3333
Portable camp stove: Gas fuelled	0.5000	Coffee urn, Fixed food warmer	0.3333
Multi box plug	0.3750	Transformer: Circuit breakers associated with transformers	0.3333
Computer monitor	0.3333	Microwave oven	0.3043
Oil lamp	0.3333	Portable camp stove: Gas fuelled	0.2778
Portable gas fuelled camping type heater	0.3333	Video player	0.2727

Table 44: Highest average ratio of percentage of civilian fatalities to percentage of fires for each item of equipment involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Equipment Involved in Ignition	Ratio of %Fatalities to %Fires	Equipment Involved in Ignition	Ratio of %Fatalities to %Fires	Equipment Involved in Ignition	Ratio of %Fatalities to %Fires	Equipment Involved in Ignition	Ratio of %Fatalities to %Fires
Video player	31.5980	Information not recorded	2.1865	Electric deep fat fryer	17.9422	Decoding receiver eg Sky, Saturn Cable	4.1405
Oven: Mains gas (fixed or stationary)	23.6985			Cord on Portable lamp	14.3538	Electric blanket	3.8794
Portable LPG heater	6.7710			Video player	13.0489	Digester chemical processing equipment	1.7256
Power device - not classified above	6.3196			Oven: Mains gas (fixed or stationary)	10.2527	Barbecue grill: Electric	1.6108
Stove: Electric cook, Range top	2.3121			Jug or kettle	5.7415	Coffee maker, Cappuccino	1.3212
Oven: Electric (fixed or stationary)	1.7886			Portable electric radiant bar heater	5.1263	Carpet shampoo machine	1.2096
Electric blanket	1.5047			Wall type switch, Wall outlet, Wall powerpoint, Wall plug	4.9073	Distribution board circuit breaker	0.9382
Information not recorded	0.9165			Portable LPG heater	4.3940	Dehumidifying air conditioning	0.6755
No Equipment Involved in Ignition	0.6771			Solid fuelled water heater	4.1011	Clothes washing machine: Commercial	0.6379
				Television	3.5662	Electric fan wall mounted heater	0.6187

Table 45: Highest average ratio of percentage of civilian fatalities to percentage of fires for each item of equipment involved in ignition (1995 – 2005).

Apartments		All Residential	
Equipment Involved in Ignition	Ratio of %Fatalities to %Fires	Equipment Involved in Ignition	Ratio of %Fatalities to %Fires
Video player	51.9143	Video player	13.0489
Power device - not classified above	13.8438	Cord on Portable lamp	10.2527
Oven: Mains gas (fixed or stationary)	7.9868	Oven: Mains gas (fixed or stationary)	10.2527
Portable LPG heater	6.9219	Jug or kettle	5.7415
Electric blanket	2.2819	Portable electric radiant bar heater	5.1263
Information not recorded	1.1359	Wall type switch, Wall outlet, Wall powerpoint, Wall plug	4.9073
Stove: Electric cook, Range top	0.9279	Portable LPG heater	4.3940
No Equipment Involved in Ignition	0.8240	Decoding receiver eg Sky, Saturn Cable	4.1405
Oven: Electric (fixed or stationary)	0.5612	Electric deep fat fryer	4.1011
		Solid fuelled water heater	4.1011

Table 46: Highest average ratio of percentage of civilian injuries to percentage of fires each year for each item of equipment involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Equipment Involved in Ignition	Ratio of %Injuries to %Fires	Equipment Involved in Ignition	Ratio of %Injuries to %Fires	Equipment Involved in Ignition	Ratio of %Injuries to %Fires	Equipment Involved in Ignition	Ratio of %Injuries to %Fires
Portable camp stove: Gas fuelled	21.49	Fax machine	16.44	Barbecue grill: Electric	20.60	Coffee urn, Fixed food warmer	6.87
Bunsen burner	10.74	Portable gas fuelled camping type heater	8.22	Vehicle engine	20.60	Floor heating unit (electric thermo floor)	2.57
Dehumidifying air conditioning	10.74	Multi box plug	5.48	Clock, Clock radio	11.77	Electric panel wall mounted heater	1.87
Heater lamp (electric)	10.74	Electric radiant bar - wall mounted heater	4.11	Portable cassette, CD player, DVD player, Electronic games deck	11.23	Coffee maker, Cappuccino	1.83
Oil lamp	10.74	Jug or kettle	4.11	Bunsen burner	10.30	Electric deep fat fryer	1.53
Portable hot plate, electric frying pan	10.74	Portable electric fan heater	4.11	Dehumidifying air conditioning	10.30	Automatic garage door opener	1.50
Power device - Portable gas cylinder	10.74	Portable electric radiant bar heater	3.79	Portable hot plate, electric frying pan	7.36	Brazier	1.47
Solid fuelled water heater	10.74	Portable camp stove: Gas fuelled	3.29	Drill	6.87	Barbecue grill: Electric	1.45
Computer monitor	5.37	Portable mini oven: Electric	2.74	Transformer: Circuit breakers associated with transformers	6.87	Fluorescent light fixture	1.19
Grinding equipment	5.37	Lamp holder	2.06	Microwave oven	6.27	Electric radiant bar - wall mounted heater	1.14

Table 47: Highest average ratio of percentage of civilian injuries to percentage of fires each year for each item of equipment involved in ignition (1995 – 2005).

Apartments		All Residential	
Equipment Involved in Ignition	Ratio of %Injuries to %Fires	Equipment Involved in Ignition	Ratio of %Injuries to %Fires
Bunsen burner	13.31	Vehicle engine	20.60
Dehumidifying air conditioning	13.31	Portable cassette, CD player, DVD player, Electronic games deck	11.23
Fax machine	13.31	Clock, Clock radio	10.30
Grinding equipment	6.66	Portable hot plate, electric frying pan	7.36
Heater lamp (electric)	6.66	Bunsen burner	6.87
Portable camp stove: Gas fuelled	6.66	Coffee urn, Fixed food warmer	6.87
Multi box plug	4.99	Transformer: Circuit breakers associated with transformers	6.87
Computer monitor	4.44	Microwave oven	6.27
Oil lamp	4.44	Portable camp stove: Gas fuelled	5.72
Portable gas fuelled camping type heater	4.44	Video player	5.62

Table 48: Ranking of equipment involved in ignition (1986 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material First Ignited	% Total Fires	Material First Ignited	% Total Fires	Material First Ignited	% Total Fires	Material First Ignited	% Total Fires
Information not recorded	68.4	Information not recorded	46.4	Information not recorded	70.2	Information not recorded	51.2
Stove: Electric cook, Range top	6.3	Stove: Electric cook, Range top	22.2	Unable to classify	4.0	Stove: Electric cook, Range top	15.3
Electric blanket	4.0	Oven: Electric (fixed or stationary)	8.0	Stove: Electric cook, Range top	3.7	Oven: Electric (fixed or stationary)	7.4
No Equipment Involved in Ignition	3.8	Stove: Gas cook, Range top	2.6	Electric blanket	3.3	No Equipment Involved in Ignition	1.9
Portable heater - not classified above	2.0	No Equipment Involved in Ignition	2.5	No Equipment Involved in Ignition	2.7	Electric blanket	1.7
Unable to classify	1.7	Electric blanket	1.4	Portable heater - not classified above	1.8	Clothes washing machine: Residential	1.6
Oven: Electric (fixed or stationary)	1.7	Clothes washing machine: Residential	1.3	Oven: Electric (fixed or stationary)	1.0	Washing machine - not classified above	1.4
Portable electric radiant bar heater	0.8	Oven (not for food)	1.1	Solid fuelled central heating unit	0.7	Stove: Gas cook, Range top	1.3
Television	0.8	Microwave oven	1.1	Portable electric radiant bar heater	0.6	Dishwashing machine: Residential	1.0
Power device - not classified above	0.5	Portable toaster: Electric	1.0	Water heater - not classified above	0.6	Clothes dryer: Residential	1.0

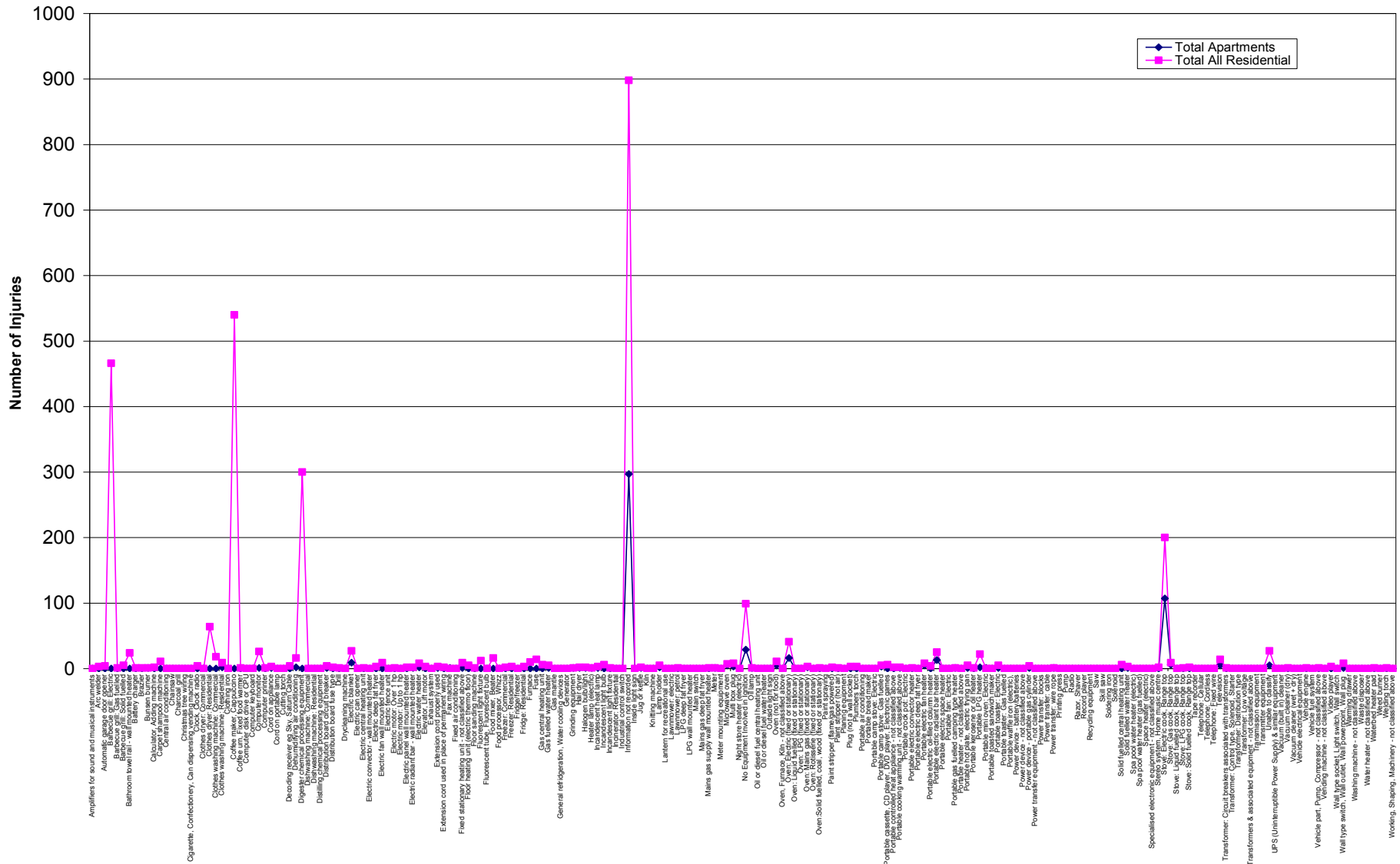


Figure 189: Number of injuries from all apartment and all residential fires according to the equipment involved in ignition (1995-2005).

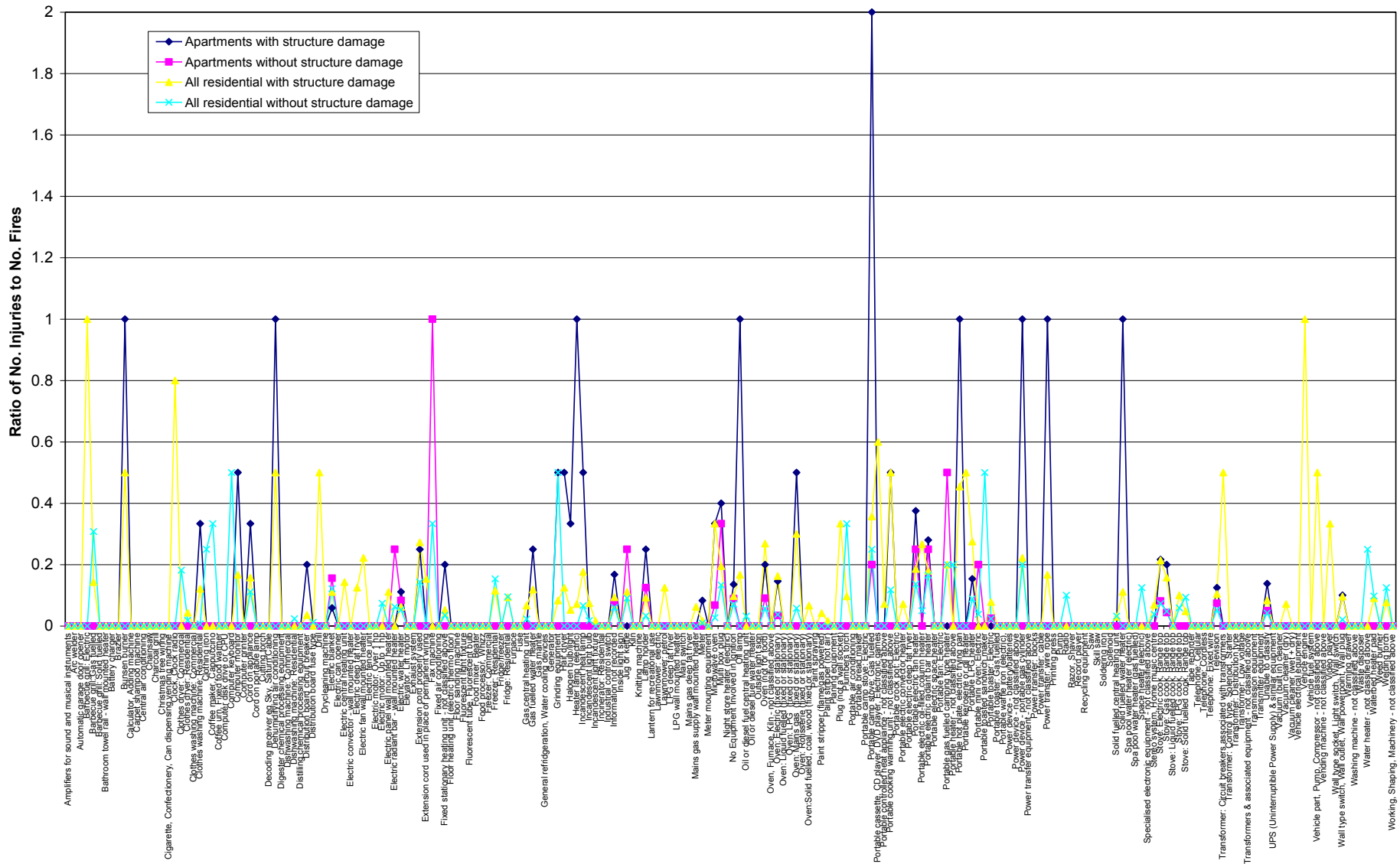


Figure 191: Ratio of numbers of injuries to numbers of fires recorded according to equipment involved in ignition (1995-2005).

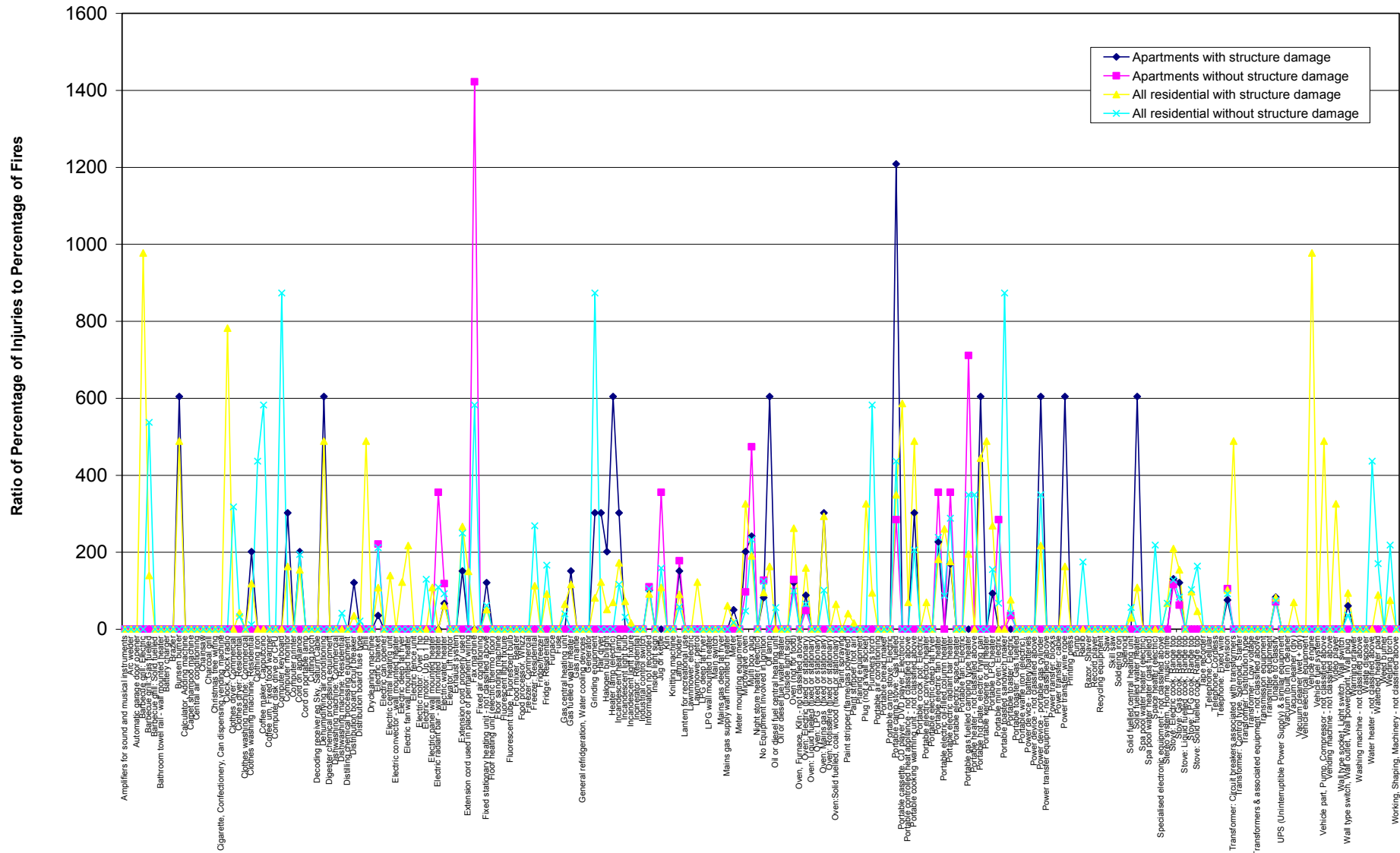


Figure 193: Ratio of percentage of total injuries to percentage of total fires recorded according to equipment involved in ignition (1995-2005).

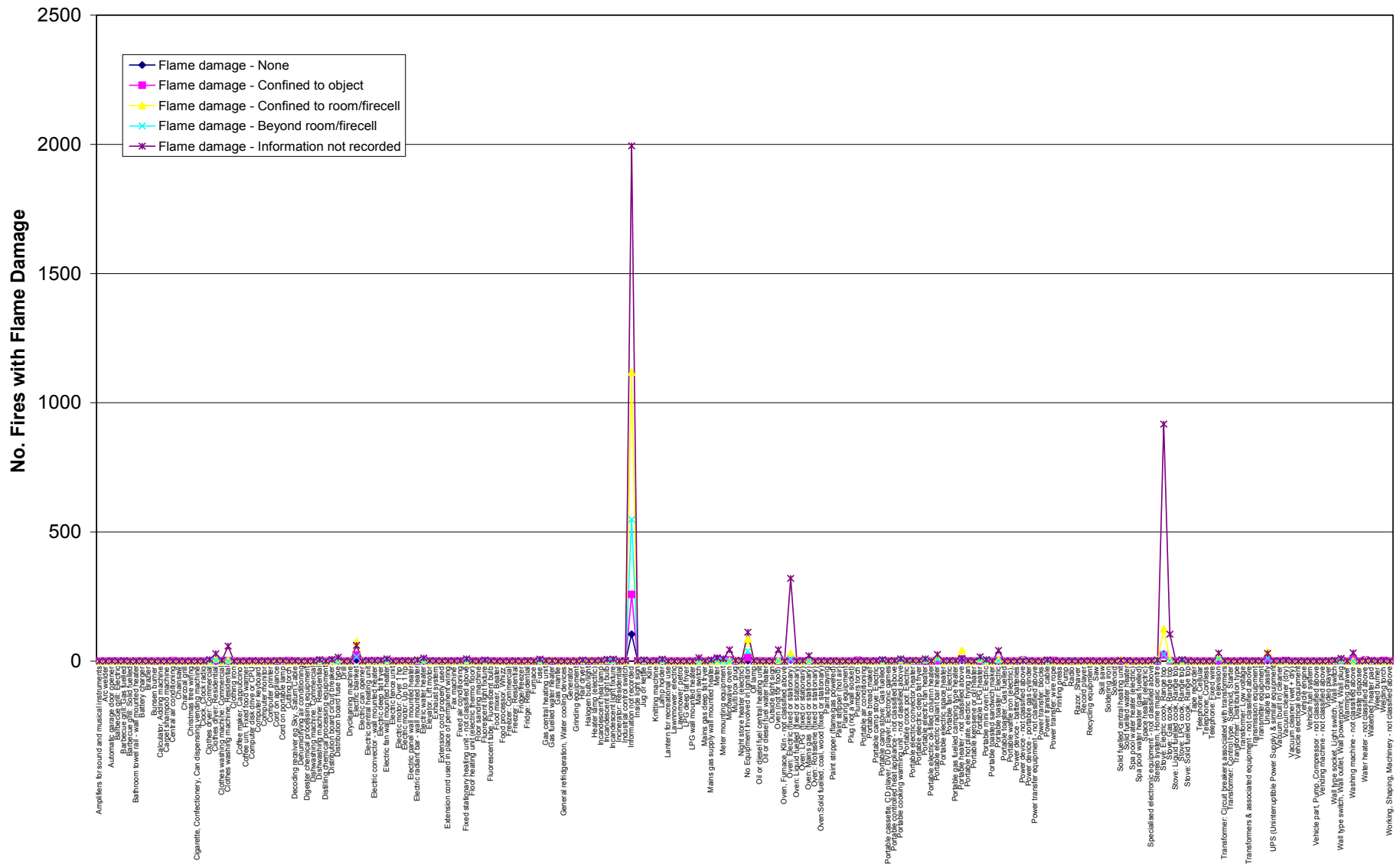


Figure 194: Number of apartment fires according to extent of flame damage and equipment involved in ignition (1986-2005).

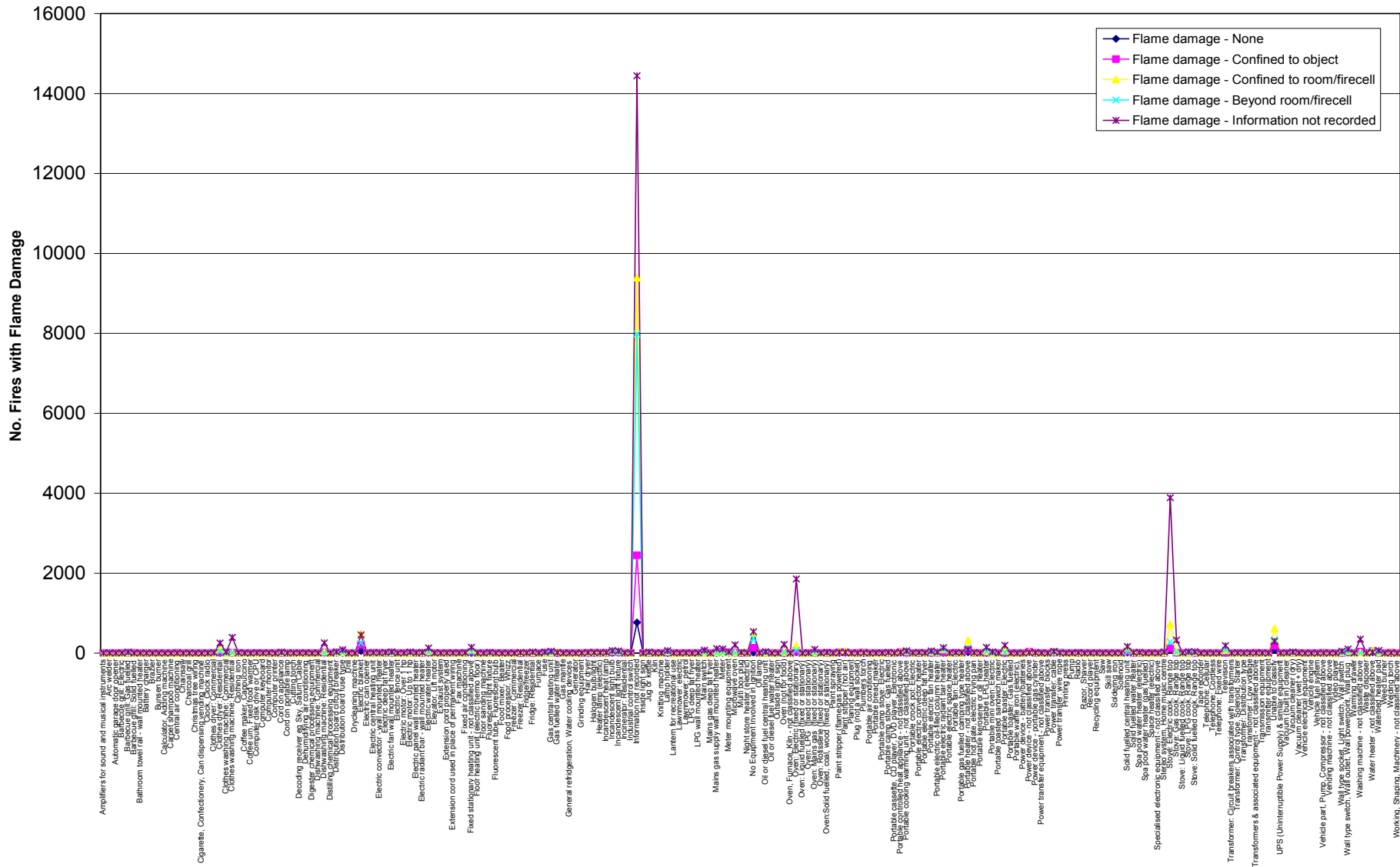


Figure 195: Number of all residential fires according to extent of flame damage and equipment involved in ignition (1986-2005).

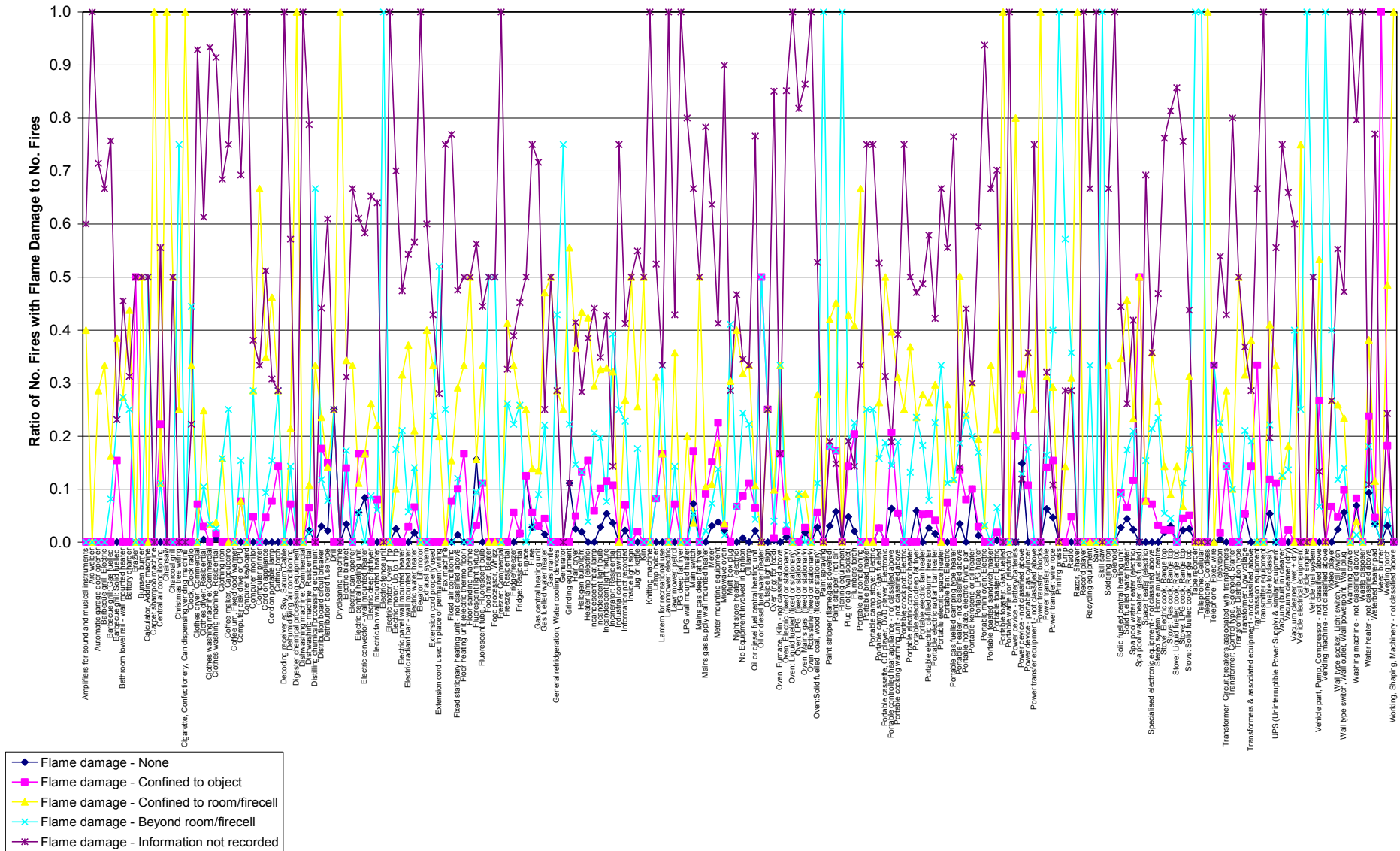


Figure 197: Ratio of the number of all residential fires according to extent of flame damage to the number of fires associated with each type of equipment involved in ignition (1986-2005).

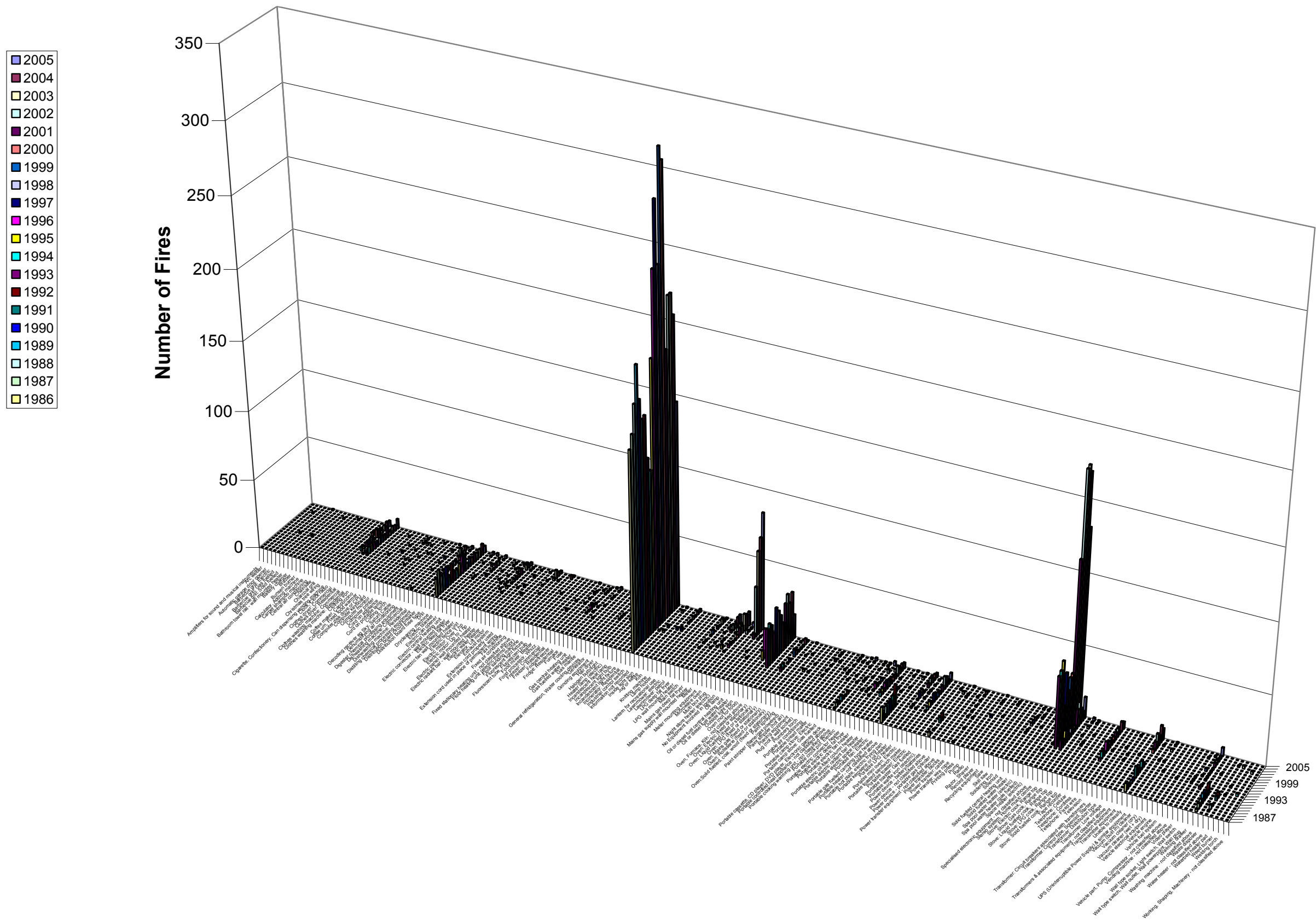


Figure 200: Number of fires that occurred in apartments each year for each type of equipment involved in ignition (1986 – 2005).

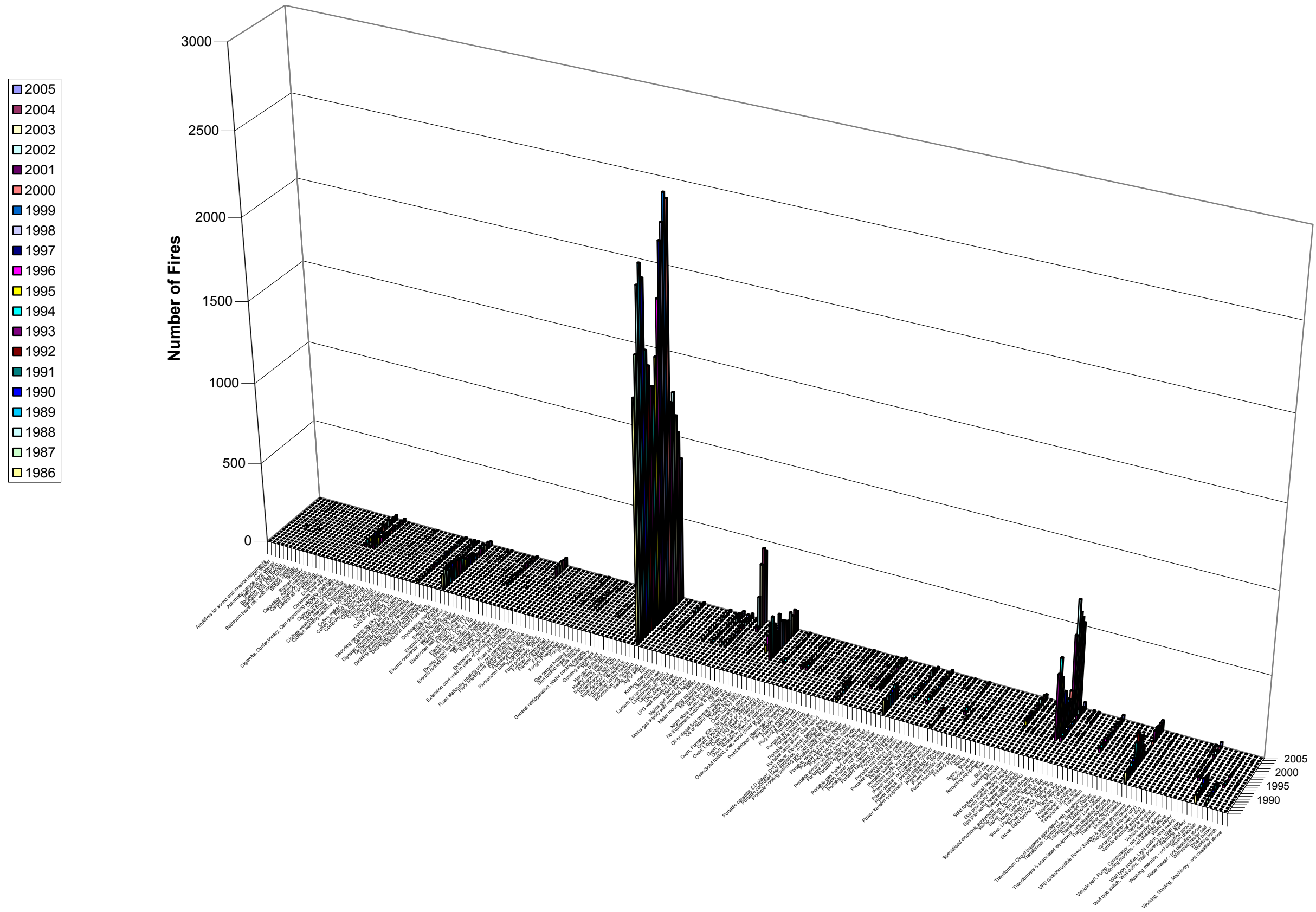


Figure 201: Number of fires that occurred in all residential structures each year for each type of equipment involved in ignition (1986 – 2005).

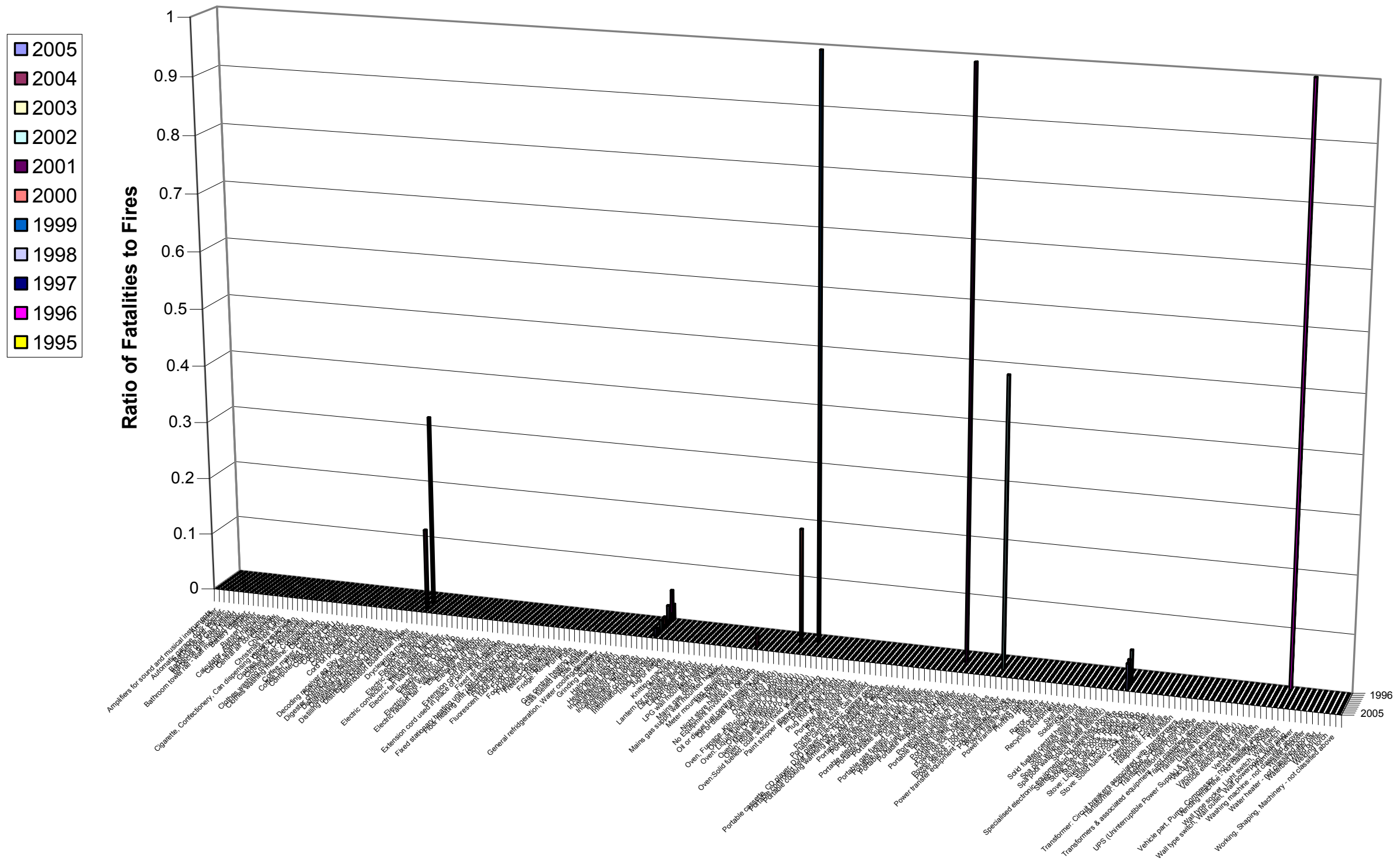


Figure 203: Ratio of number of fatalities to number of fires in apartments each year for each item of equipment involved in ignition considered (1986 – 2005).

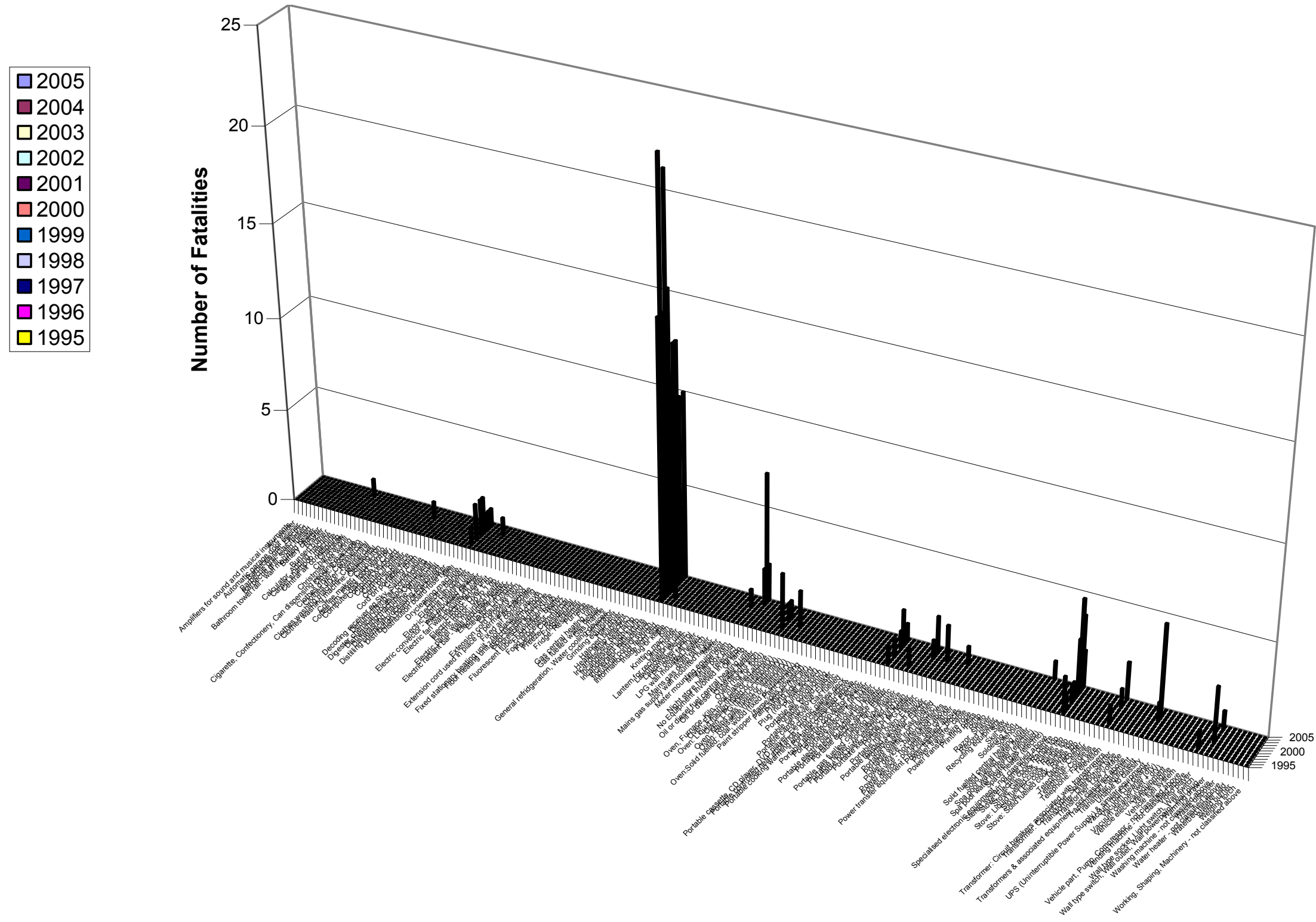


Figure 204: Fatalities from all residential fires each year for equipment involved in ignition (1995 – 2005).

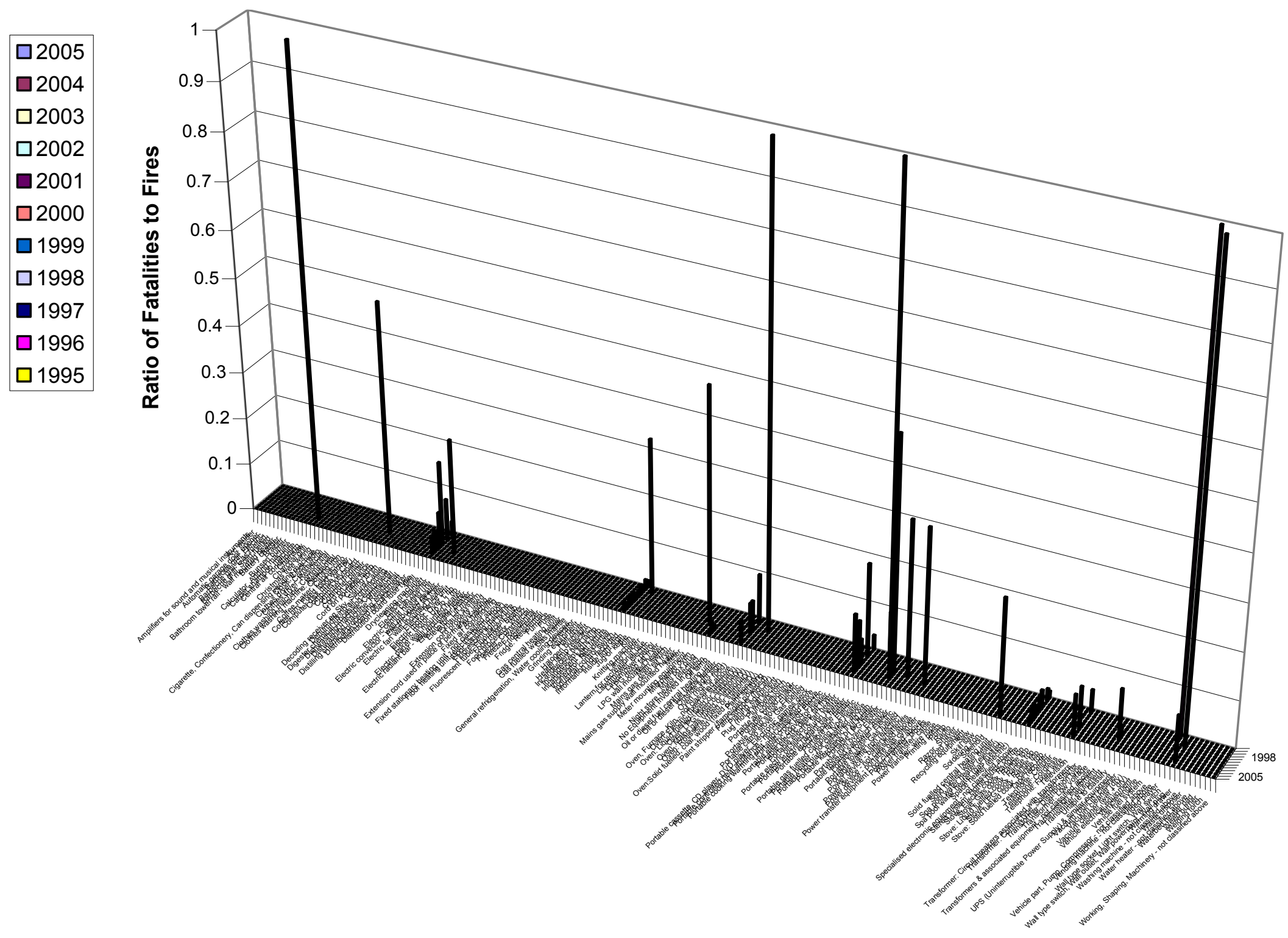


Figure 205: Ratio of number of fatalities to number of fires in all residential structures each year for each item of equipment involved in ignition considered (1986 – 2005).

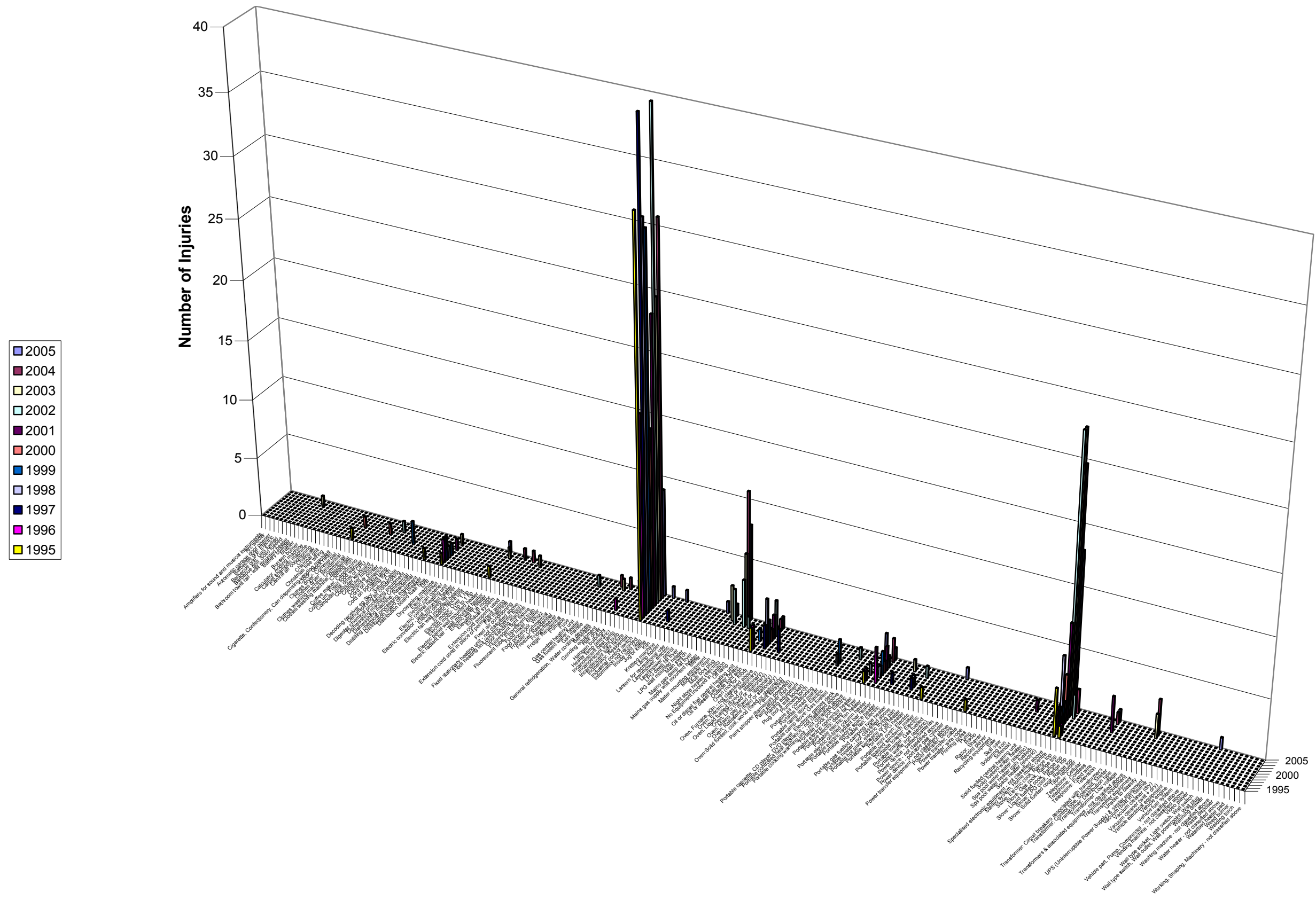


Figure 206: Number of injuries from fires in apartments each year for each item of equipment involved in ignition considered (1995 – 2005).

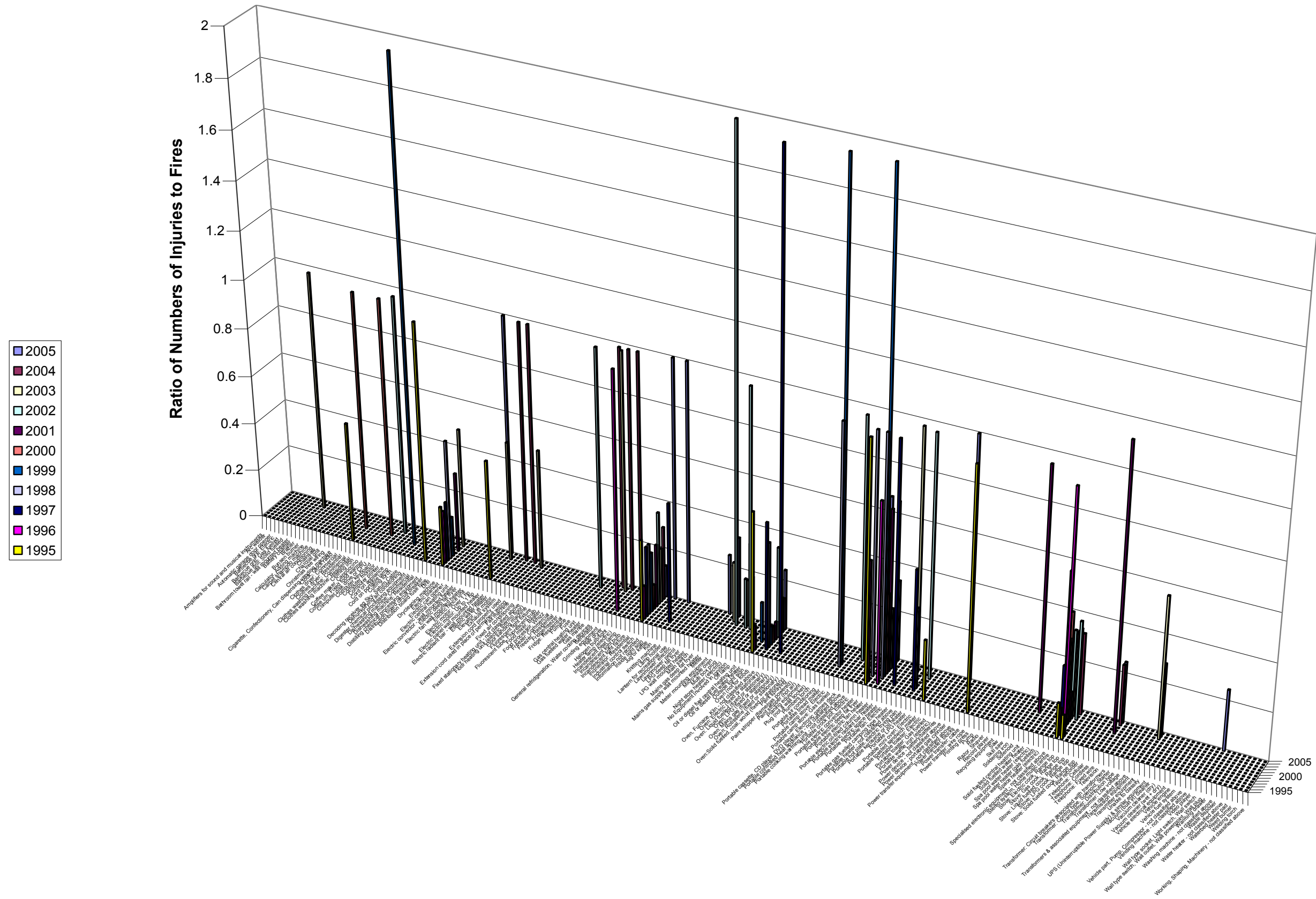


Figure 207: Ratio of the numbers of injuries to the numbers of fires that occurred in apartments each year for each type of equipment involved in ignition (1995 – 2005).

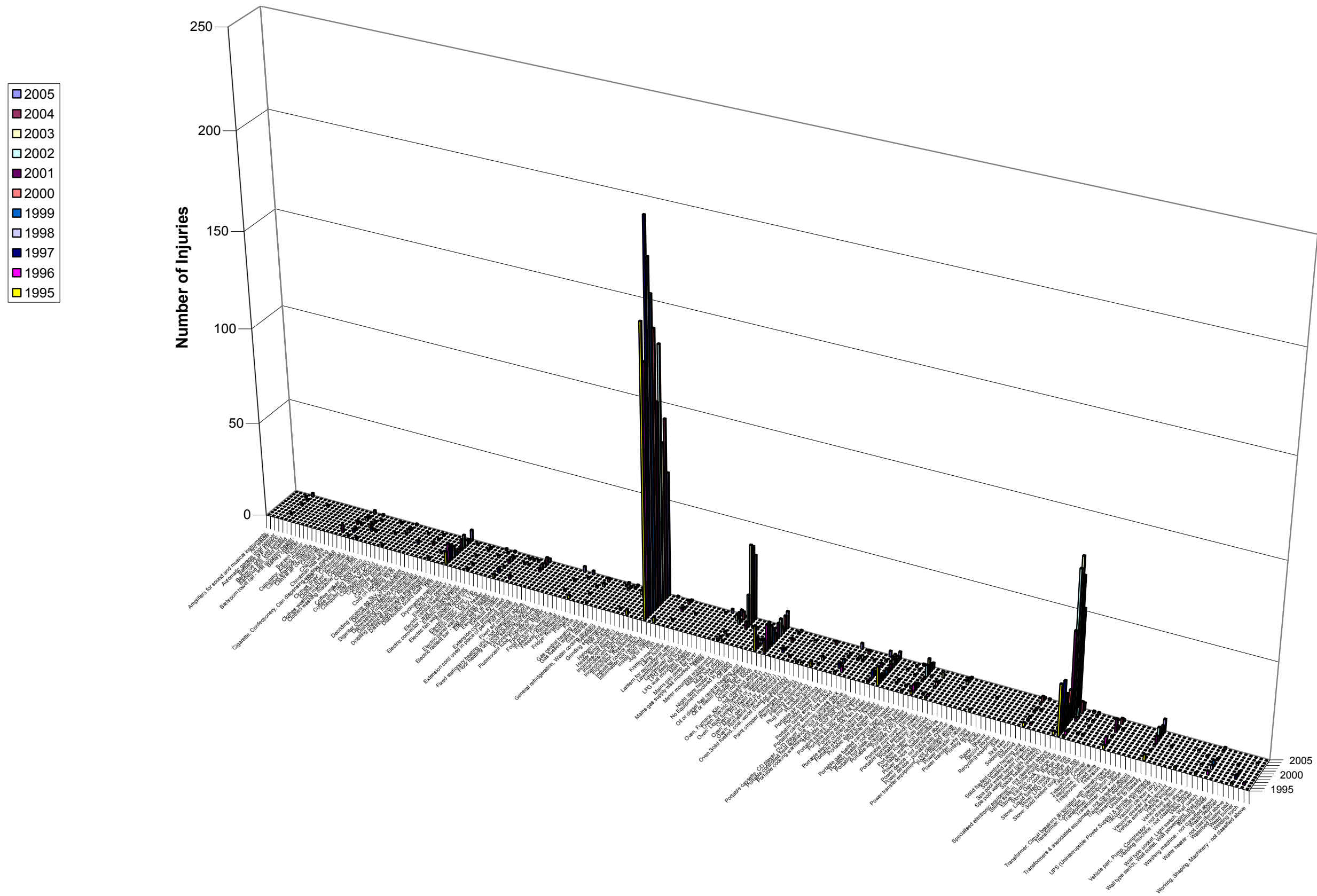


Figure 208: Number of injuries from fires in all residential structures each year for each item of equipment involved in ignition considered (1995 – 2005).

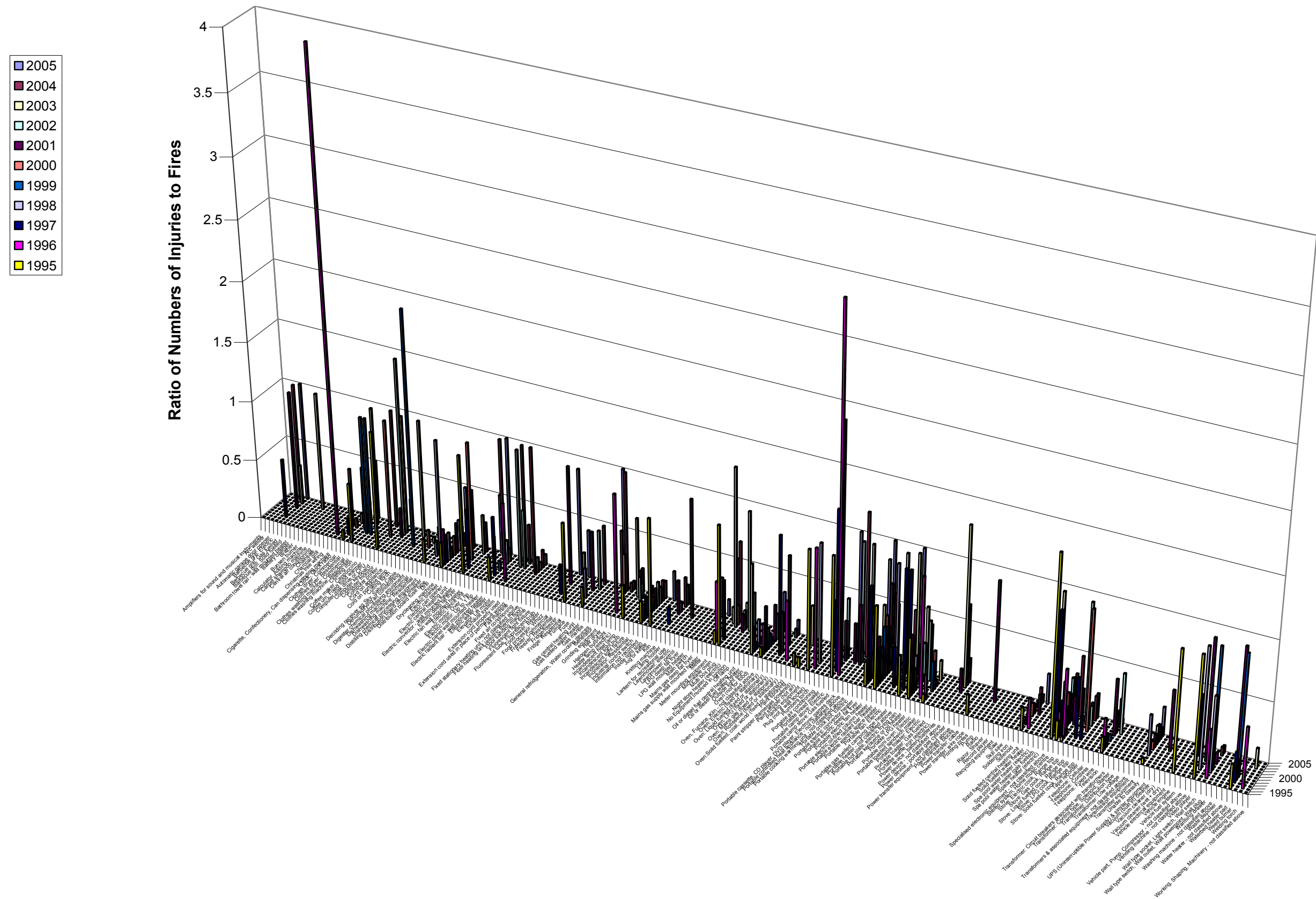


Figure 209: Ratio of the number of injuries to the number of fires in all residential structures for each year for each type of equipment involved in ignition (1995 – 2005).

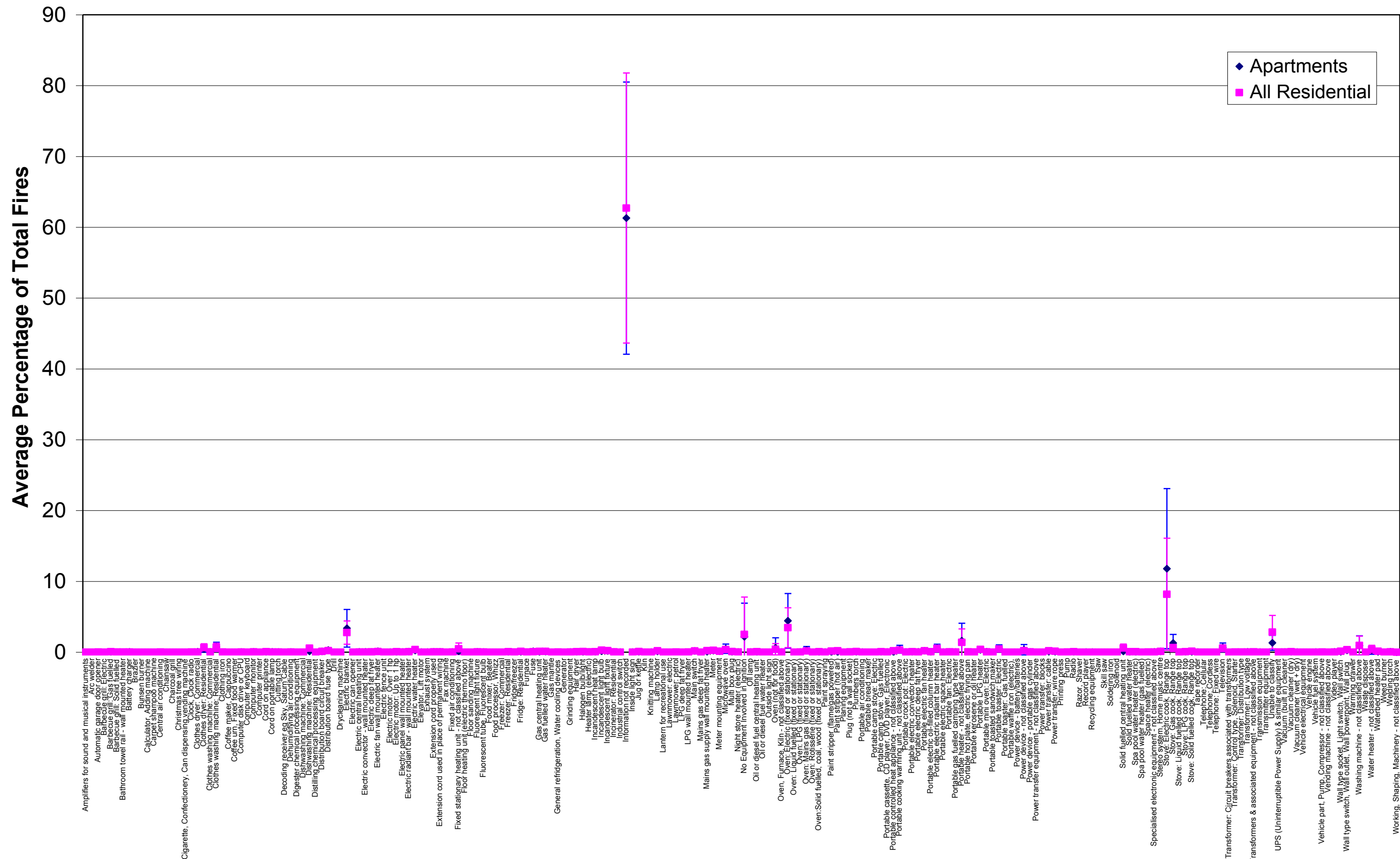


Figure 210: Average percentage of total fires from all residential structures for each type of equipment involved in ignition (1995 – 2005).

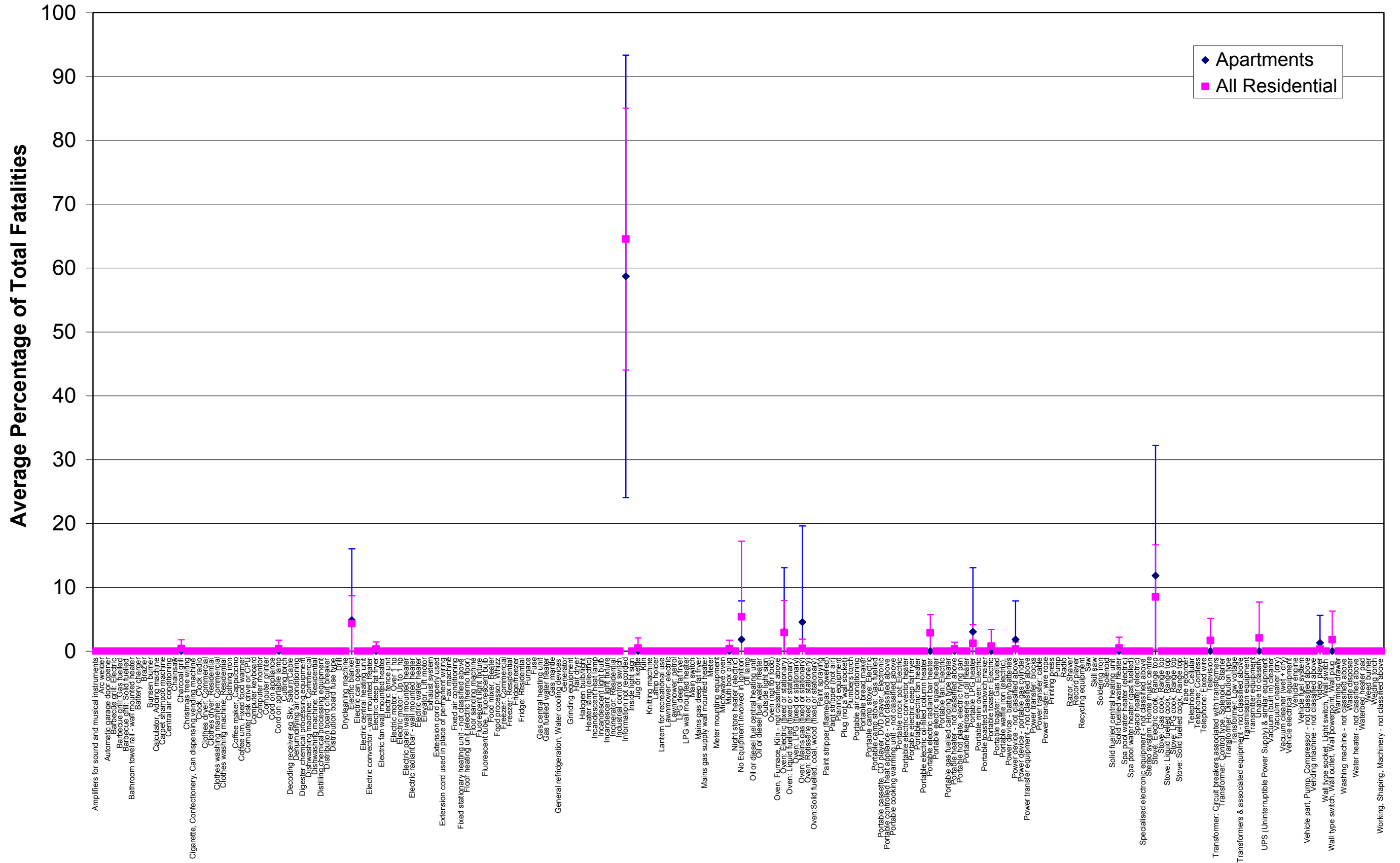


Figure 211: Average percentage of total fatalities for each type of equipment involved in ignition (1995 – 2005).

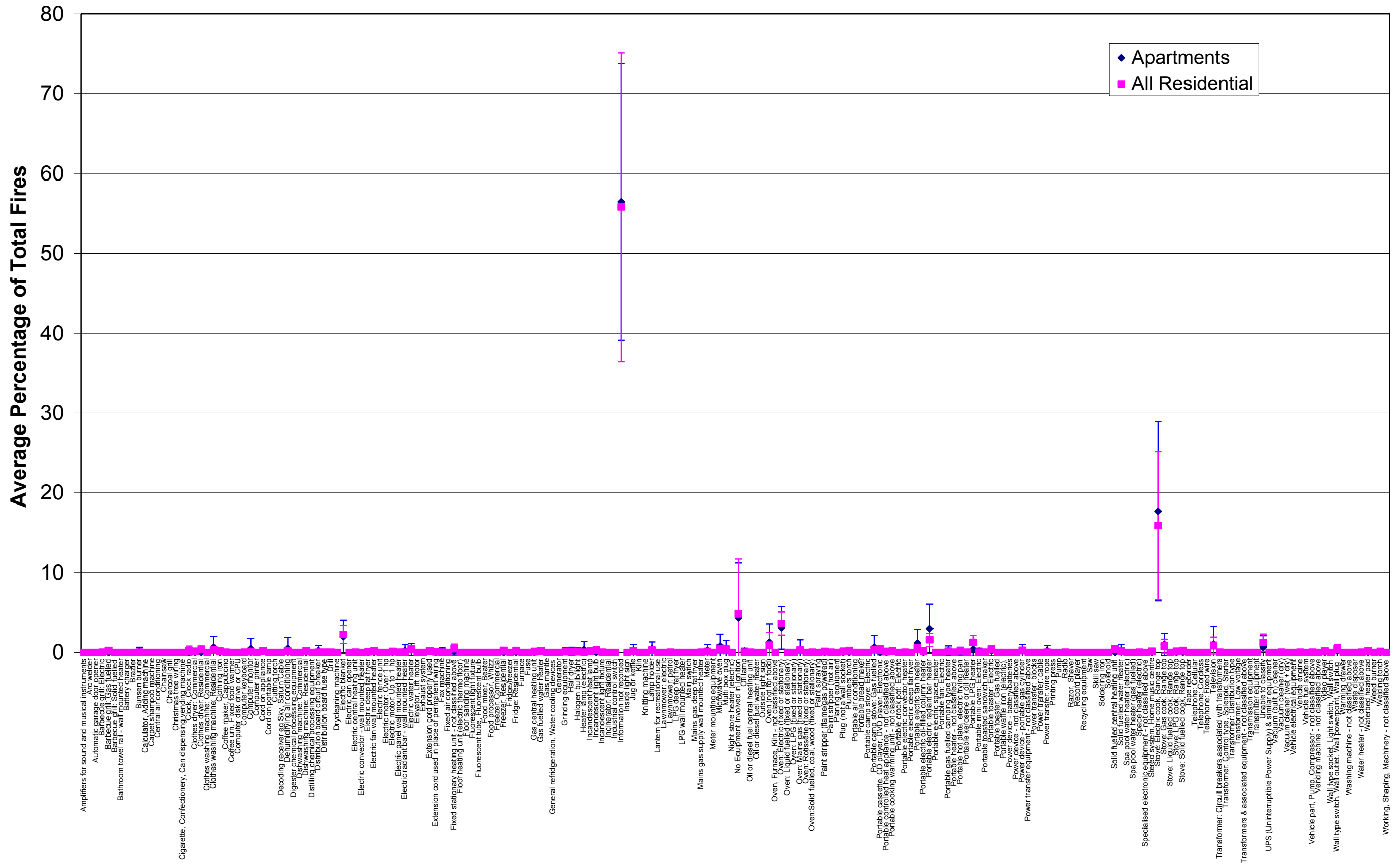


Figure 212: Average percentage of total injuries for each type of equipment involved in ignition (1995 – 2005).

APPENDIX H FIRST MATERIAL IGNITED – DATA ANALYSIS OF ALL CLASSES

Table 49: Ranking of the most common first material involved in ignition by percentage of total fires (using NZFS from 1986 – 2005).

Apartments with damage		Apartments without damage		All residential with damage		All residential without damage	
First Material Involved in Ignition	% Total Fires	First Material Involved in Ignition	% Total Fires	First Material Involved in Ignition	% Total Fires	First Material Involved in Ignition	% Total Fires
Fabric, Fibre (finished)	12.0	Food, Starch (not fat and grease)	27.7	Wood: sawn, finished timber	20.0	Fat, Grease, Butter	17.7
Wood: sawn, finished timber	11.2	Fat, Grease, Butter	20.7	Fabric, Fibre (finished)	9.5	Food, Starch (not fat and grease)	16.5
Cotton, Canvas, Rayon (not oiled canvas)	7.2	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	9.9	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	6.1	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	12.8
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	6.5	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	8.9	Cotton, Canvas, Rayon (not oiled canvas)	5.4	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	8.5
Fat, Grease, Butter	5.4	Fabric, Fibre (finished)	4.6	Multiple materials first ignited	4.8	Information not recorded	7.4
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	4.9	Rubbish (material having no value in the same container or pile)	3.1	Information not recorded	4.6	Fabric, Fibre (finished)	5.2
Multiple materials first ignited	4.8	Information not recorded	2.8	Fat, Grease, Butter	4.5	Wood: sawn, finished timber	2.9
Paper e.g. Uncoated, untreated, ground up & recycled, used as insulation	3.9	Cotton, Canvas, Rayon (not oiled canvas)	2.7	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	4.0	Cotton, Canvas, Rayon (not oiled canvas)	2.8
Wool, Wool mixtures (finished goods)	3.9	Unknown	1.7	Unknown	3.6	Unknown	2.7
Information not recorded	3.7	Plastics - not classified above	1.6	Paper e.g. Uncoated, untreated, ground up & recycled, used as insulation	3.4	Plastics - not classified above	2.1

Table 50: Ranking of the most common first material involved in ignition by percentage of total fires (using NZFS from 1986 – 2005).

Apartments		All residential	
First Material Involved in Ignition	% Total Fires	First Material Involved in Ignition	% Total Fires
Food, Starch (not fat and grease)	16.6	Wood: sawn, finished timber	12.6
Fat, Grease, Butter	13.9	Fat, Grease, Butter	10.2
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	8.4	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	9.0
Fabric, Fibre (finished)	7.9	Food, Starch (not fat and grease)	8.0
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	7.2	Fabric, Fibre (finished)	7.6
Wood: sawn, finished timber	5.8	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	6.0
Cotton, Canvas, Rayon (not oiled canvas)	4.7	Information not recorded	5.8
Information not recorded	3.2	Cotton, Canvas, Rayon (not oiled canvas)	4.3
Rubbish (material having no value in the same container or pile)	2.9	Multiple materials first ignited	3.3
Multiple materials first ignited	2.5	Unknown	3.2

Table 51: Ranking of the most common first material involved in ignition by percentage of total civilian fatalities (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
First Material Involved in Ignition	% Total Fatalities	First Material Involved in Ignition	% Total Fatalities	First Material Involved in Ignition	% Total Fatalities	First Material Involved in Ignition	% Total Fatalities
Unknown	20.6	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	100.0	Fabric, Fibre (finished)	16.4	Cotton, Canvas, Rayon (not oiled canvas)	11.1
Multiple materials first ignited	11.8			Unknown	15.6	Fabric, Fibre (finished)	11.1
Cotton, Canvas, Rayon (not oiled canvas)	8.8			Wood: sawn, finished timber	8.4	Fat, Grease, Butter	11.1
Fabric, Fibre (finished)	8.8			Polyurethane e.g. Furnishings, Upholstery, Mattresses	7.6	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	11.1
Rubbish (material having no value in the same container or pile)	8.8			Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	7.1	Food, Starch (not fat and grease)	11.1
Fat, Grease, Butter	5.9			Multiple materials first ignited	5.8	Petrol	11.1
Polyurethane e.g. Furnishings, Upholstery, Mattresses	5.9			Petrol	4.9	Trees: dead, rotten wood (not felled)	11.1
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	5.9			Food, Starch (not fat and grease)	4.4	Unable to classify	11.1
Unable to classify	5.9			PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	4.0	Unknown	11.1
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	2.9			Cotton, Canvas, Rayon (not oiled canvas)	3.6		

Table 52: Ranking of the most common first material involved in ignition by percentage of total civilian fatalities (1995 – 2005).

Apartments		All Residential	
First Material Involved in Ignition	% Total Fatalities	First Material Involved in Ignition	% Total Fatalities
Unknown	20.0	Fabric, Fibre (finished)	16.2
Multiple materials first ignited	11.4	Unknown	15.4
Cotton, Canvas, Rayon (not oiled canvas)	8.6	Wood: sawn, finished timber	8.1
Fabric, Fibre (finished)	8.6	Polyurethane e.g. Furnishings, Upholstery, Mattresses	7.3
Rubbish (material having no value in the same container or pile)	8.6	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	6.8
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	5.7	Multiple materials first ignited	5.6
Fat, Grease, Butter	5.7	Petrol	5.1
Polyurethane e.g. Furnishings, Upholstery, Mattresses	5.7	Food, Starch (not fat and grease)	4.7
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	5.7	Cotton, Canvas, Rayon (not oiled canvas)	3.8
Unable to classify	5.7	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	3.8

Table 53: Ranking of the most common first material involved in ignition by percentage of total civilian injuries (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
First Material Involved in Ignition	% Total Injuries	First Material Involved in Ignition	% Total Injuries	First Material Involved in Ignition	% Total Injuries	First Material Involved in Ignition	% Total Injuries
Fabric, Fibre (finished)	20.3	Fat, Grease, Butter	21.5	Fabric, Fibre (finished)	16.5	Fat, Grease, Butter	20.5
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	9.7	Food, Starch (not fat and grease)	21.1	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	11.2	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	16.3
Unknown	8.7	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	14.6	Fat, Grease, Butter	9.3	Food, Starch (not fat and grease)	12.5
Cotton, Canvas, Rayon (not oiled canvas)	8.0	Fabric, Fibre (finished)	9.8	Cotton, Canvas, Rayon (not oiled canvas)	6.1	Fabric, Fibre (finished)	11.0
Fat, Grease, Butter	6.7	Plastics - not classified above	3.3	Polyurethane e.g. Furnishings, Upholstery, Mattresses	6.0	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	5.8
Polyurethane e.g. Furnishings, Upholstery, Mattresses	6.0	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	3.3	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	6.0	Cotton, Canvas, Rayon (not oiled canvas)	4.7
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	4.3	Cotton, Canvas, Rayon (not oiled canvas)	2.8	Unknown	6.0	Polyurethane e.g. Furnishings, Upholstery, Mattresses	3.2
Wood: sawn, finished timber	4.3	Grain, Natural fibres, Flax, Hessian, Kapok	2.4	Wood: sawn, finished timber	5.7	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	1.9
Food, Starch (not fat and grease)	4.0	Information not recorded	2.0	Petrol	3.3	Plastics - not classified above	1.7
Wool, Wool mixtures (finished goods)	3.0	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	1.6	Food, Starch (not fat and grease)	3.1	Wood: sawn, finished timber	1.7

Table 54: Ranking of the most common first material involved in ignition by percentage of total civilian injuries (1995 – 2005).

Apartments		All Residential	
First Material Involved in Ignition	% Total Injuries	First Material Involved in Ignition	% Total Injuries
Fabric, Fibre (finished)	15.6	Fabric, Fibre (finished)	14.2
Fat, Grease, Butter	13.4	Fat, Grease, Butter	13.9
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	11.9	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	13.3
Food, Starch (not fat and grease)	11.7	Food, Starch (not fat and grease)	7.0
Cotton, Canvas, Rayon (not oiled canvas)	5.7	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	5.9
Unknown	5.1	Cotton, Canvas, Rayon (not oiled canvas)	5.5
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	3.8	Polyurethane e.g. Furnishings, Upholstery, Mattresses	4.8
Polyurethane e.g. Furnishings, Upholstery, Mattresses	3.8	Wood: sawn, finished timber	4.0
Wood: sawn, finished timber	3.1	Unknown	4.0
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	2.2	Petrol	2.5

Table 55: Highest ratios of numbers of civilian fatalities to numbers of fires for each first material involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
First Material Involved in Ignition	Ratio of Fatalities to Fires	First Material Involved in Ignition	Ratio of Fatalities to Fires	First Material Involved in Ignition	Ratio of Fatalities to Fires	First Material Involved in Ignition	Ratio of Fatalities to Fires
Natural gas	0.1429	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.0556	Unknown	0.0322	Trees: dead, rotten wood (not felled)	0.0175
Unable to classify	0.0952			Fur, Silk, Other Fabric (finished goods)	0.0308	Petrol	0.0090
Unknown	0.0722			Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.0298	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.0072
Rubbish (material having no value in the same container or pile)	0.0345			Unable to classify	0.0286	Unable to classify	0.0039
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.0303			Food, Starch (not fat and grease)	0.0234	Unknown	0.0015
Multiple materials first ignited	0.0260			Natural gas	0.0233	Cotton, Canvas, Rayon (not oiled canvas)	0.0014
Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.0213			Petrol	0.0207	Fabric, Fibre (finished)	0.0008
Fabric, Textiles, Wool, Hair - not classified above	0.0200			Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.0152	Food, Starch (not fat and grease)	0.0002
Particle board, Hardboard, Pinex, Fibre board	0.0182			Vinyl e.g. Floor coverings, Wallpaper (but NOT vinyl-coated)	0.0149	Fat, Grease, Butter	0.0002
Cotton, Canvas, Rayon (not oiled canvas)	0.0129			Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	0.0130		

Table 56: Highest average ratios of numbers of civilian fatalities to numbers of fires for each first material involved in ignition (1995 – 2005).

Apartments		All Residential	
First Material Involved in Ignition	Ratio of Fatalities to Fires	First Material Involved in Ignition	Ratio of Fatalities to Fires
Natural gas	0.0556	Fur, Silk, Other Fabric (finished goods)	0.0227
Unknown	0.0422	Unknown	0.0203
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.0392	Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.0202
Unable to classify	0.0308	Petrol	0.0187
Multiple materials first ignited	0.0220	Unable to classify	0.0139
Fabric, Textiles, Wool, Hair - not classified above	0.0172	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.0125
Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.0160	Trees: dead, rotten wood (not felled)	0.0098
Rubbish (material having no value in the same container or pile)	0.0142	Vinyl e.g. Floor coverings, Wallpaper (but NOT vinyl-coated)	0.0095
Particle board, Hardboard, Pinex, Fibre board	0.0141	Fabric, Fibre (finished)	0.0091
Cotton, Canvas, Rayon (not oiled canvas)	0.0088	Natural gas	0.0077

Table 57: Highest average ratios of numbers of civilian injuries to numbers of fires for each first material involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
First Material Involved in Ignition	Ratio of Injuries to Fires	First Material Involved in Ignition	Ratio of Injuries to Fires	First Material Involved in Ignition	Ratio of Injuries to Fires	First Material Involved in Ignition	Ratio of Injuries to Fires
Cork	1.0000	Acetylene	1.0000	Cork	1.0000	Acetylene	0.5000
Solid Chemical e.g. Explosives	0.5000	Linoleum	1.0000	Toi Toi	0.5000	Combustible Metal e.g. Magnesium, Titanium, Zirconium	0.4286
Vinyl e.g. Plastic-coated fabrics, Upholstery fabrics (NOT floor covering)	0.2727	Fur, Silk, Other Fabric (finished goods)	0.5000	Combustible Metal e.g. Magnesium, Titanium, Zirconium	0.2222	Human hair	0.2500
Unknown	0.2680	Plywood	0.5000	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.1749	Fur, Silk, Other Fabric (finished goods)	0.1739
Natural products - not classified above	0.2500	Flammable Combustible Liquid - not classified above	0.3333	Human hair	0.1667	Flammable Combustible Liquid - not classified above	0.1667
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.2424	Paint, Varnish	0.2500	Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.1646	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.1522
Unable to classify	0.2381	Particle board, Hardboard, Pinex, Fibre board	0.2500	Natural gas	0.1628	Petrol	0.1441
Gypsum board, Gib board, Elephant board	0.2000	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.2222	Solid Chemical e.g. Explosives	0.1429	Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.1301
Volatile, solid chemical - not classified above	0.2000	Grain, Natural fibres, Flax, Hessian, Kapok	0.2000	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	0.1420	Polyurethane e.g. Foam plastic, Fridge & domestic insulation	0.1279
Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.1915	Polycarbonate e.g. Safety screens	0.1667	Polycarbonate e.g. Safety screens	0.1212	Linoleum	0.1250

Table 58: Highest average ratios of numbers of civilian injuries to numbers of fires for each first material involved in ignition (1995 – 2005).

Apartments		All Residential	
First Material Involved in Ignition	Ratio of Injuries to Fires	First Material Involved in Ignition	Ratio of Injuries to Fires
Acetylene	1.0000	Combustible Metal e.g. Magnesium, Titanium, Zirconium	0.3667
Linoleum	0.5000	Toi Toi	0.2500
Cork	0.2500	Acetylene	0.2000
Fur, Silk, Other Fabric (finished goods)	0.2500	Cork	0.2000
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.2353	Human hair	0.2000
Solid Chemical e.g. Explosives	0.2000	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.1671
Gypsum board, Gib board, Elephant board	0.1818	Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.1536
Unknown	0.1687	Petrol	0.1059
Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.1680	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	0.1057
Vinyl e.g. Plastic-coated fabrics, Upholstery fabrics (NOT floor covering)	0.1667	Fur, Silk, Other Fabric (finished goods)	0.1023

Table 59: Highest average ratio of percentage of civilian fatalities to percentage of fires each year for each first material involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
First Material Involved in Ignition	Ratio of %Fatalities to %Fires	First Material Involved in Ignition	Ratio of %Fatalities to %Fires	First Material Involved in Ignition	Ratio of %Fatalities to %Fires	First Material Involved in Ignition	Ratio of %Fatalities to %Fires
Natural gas	13.54	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	224.72	Unknown	4.37	Trees: dead, rotten wood (not felled)	48.55
Unable to classify	9.03			Fur, Silk, Other Fabric (finished goods)	4.18	Petrol	24.93
Unknown	6.84			Polyurethane e.g. Furnishings, Upholstery, Mattresses	4.04	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	20.05
Rubbish (material having no value in the same container or pile)	3.27			Unable to classify	3.88	Unable to classify	10.73
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	2.87			Food, Starch (not fat and grease)	3.18	Unknown	4.05
Multiple materials first ignited	2.46			Natural gas	3.16	Cotton, Canvas, Rayon (not oiled canvas)	3.99
Polyurethane e.g. Furnishings, Upholstery, Mattresses	2.02			Petrol	2.81	Fabric, Fibre (finished)	2.14
Fabric, Textiles, Wool, Hair - not classified above	1.90			Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	2.07	Food, Starch (not fat and grease)	0.68
Particle board, Hardboard, Pinex, Fibre board	1.72			Vinyl e.g. Floor coverings, Wallpaper (but NOT vinyl-coated)	2.03	Fat, Grease, Butter	0.63
Cotton, Canvas, Rayon (not oiled canvas)	1.23			Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	1.76		

Table 60: Highest average ratio of percentage of civilian fatalities to percentage of fires each year for each first material involved in ignition (1995 – 2005).

Apartments		All Residential	
First Material Involved in Ignition	Ratio of %Fatalities to %Fires	First Material Involved in Ignition	Ratio of %Fatalities to %Fires
Natural gas	11.54	Fur, Silk, Other Fabric (finished goods)	5.39
Unknown	8.76	Unknown	4.82
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	8.14	Polyurethane e.g. Furnishings, Upholstery, Mattresses	4.80
Unable to classify	6.39	Petrol	4.43
Multiple materials first ignited	4.56	Unable to classify	3.28
Fabric, Textiles, Wool, Hair - not classified above	3.58	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	2.96
Polyurethane e.g. Furnishings, Upholstery, Mattresses	3.32	Trees: dead, rotten wood (not felled)	2.32
Rubbish (material having no value in the same container or pile)	2.95	Vinyl e.g. Floor coverings, Wallpaper (but NOT vinyl-coated)	2.26
Particle board, Hardboard, Pinex, Fibre board	2.92	Fabric, Fibre (finished)	2.15
Cotton, Canvas, Rayon (not oiled canvas)	1.82	Natural gas	1.82

Table 61: Highest average ratio of percentage of civilian injuries to percentage of fires each year for each first material involved in ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
First Material Involved in Ignition	Ratio of %Injuries to %Fires	First Material Involved in Ignition	Ratio of %Injuries to %Fires	First Material Involved in Ignition	Ratio of %Injuries to %Fires	First Material Involved in Ignition	Ratio of %Injuries to %Fires
Cork	10.74	Acetylene	16.44	Cork	19.48	Acetylene	11.32
Solid Chemical e.g. Explosives	5.37	Linoleum	16.44	Toi Toi	9.74	Combustible Metal e.g. Magnesium, Titanium, Zirconium	9.70
Vinyl e.g. Plastic-coated fabrics, Upholstery fabrics (NOT floor covering)	2.93	Fur, Silk, Other Fabric (finished goods)	8.22	Combustible Metal e.g. Magnesium, Titanium, Zirconium	4.33	Human hair	5.66
Unknown	2.88	Plywood	8.22	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	3.41	Fur, Silk, Other Fabric (finished goods)	3.94
Natural products - not classified above	2.69	Flammable Combustible Liquid - not classified above	5.48	Human hair	3.25	Flammable Combustible Liquid - not classified above	3.77
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	2.60	Paint, Varnish	4.11	Polyurethane e.g. Furnishings, Upholstery, Mattresses	3.21	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	3.45
Unable to classify	2.56	Particle board, Hardboard, Pinex, Fibre board	4.11	Natural gas	3.17	Petrol	3.26
Gypsum board, Gib board, Elephant board	2.15	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	3.65	Solid Chemical e.g. Explosives	2.78	Polyurethane e.g. Furnishings, Upholstery, Mattresses	2.95
Volatile, solid chemical - not classified above	2.15	Grain, Natural fibres, Flax, Hessian, Kapok	3.29	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	2.77	Polyurethane e.g. Foam plastic, Fridge & domestic insulation	2.90
Polyurethane e.g. Furnishings, Upholstery, Mattresses	2.06	Polycarbonate e.g. Safety screens	2.74	Polycarbonate e.g. Safety screens	2.36	Linoleum	2.83

Table 62: Highest average ratio of percentage of civilian injuries to percentage of fires each year for each first material involved in ignition (1995 – 2005).

Apartments		All Residential	
First Material Involved in Ignition	Ratio of %Injuries to %Fires	First Material Involved in Ignition	Ratio of %Injuries to %Fires
Acetylene	13.31	Combustible Metal e.g. Magnesium, Titanium, Zirconium	7.62
Linoleum	6.66	Toi Toi	5.20
Cork	3.33	Acetylene	4.16
Fur, Silk, Other Fabric (finished goods)	3.33	Cork	4.16
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	3.13	Human hair	4.16
Solid Chemical e.g. Explosives	2.66	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	3.47
Gypsum board, Gib board, Elephant board	2.42	Polyurethane e.g. Furnishings, Upholstery, Mattresses	3.19
Unknown	2.25	Petrol	2.20
Polyurethane e.g. Furnishings, Upholstery, Mattresses	2.24	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	2.20
Volatile, solid chemical - not classified above	2.22	Fur, Silk, Other Fabric (finished goods)	2.13

Table 63: First material ignited for fires with structure damage (1986 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material First Ignited	% Total Fires	Material First Ignited	% Total Fires	Material First Ignited	% Total Fires	Material First Ignited	% Total Fires
Fabric, Fibre (finished)	12.0	Food, Starch (not fat and grease)	27.5	Wood: sawn, finished timber	20.3	Fat, Grease, Butter	17.7
Wood: sawn, finished timber	11.2	Fat, Grease, Butter	20.8	Fabric, Fibre (finished)	9.3	Food, Starch (not fat and grease)	16.3
Cotton, Canvas, Rayon (not oiled canvas)	7.3	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	9.9	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	5.7	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	12.7
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	6.2	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	9.0	Cotton, Canvas, Rayon (not oiled canvas)	5.5	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	8.5
Fat, Grease, Butter	5.3	Fabric, Fibre (finished)	4.6	Multiple materials first ignited	5.2	Information not recorded	7.5
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	4.9	Rubbish (material having no value in the same container or pile)	3.0	Information not recorded	4.7	Fabric, Fibre (finished)	5.2
Multiple materials first ignited	4.9	Information not recorded	2.9	Fat, Grease, Butter	4.4	Wood: sawn, finished timber	2.9
Wool, Wool mixtures (finished goods)	4.1	Cotton, Canvas, Rayon (not oiled canvas)	2.8	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	3.9	Cotton, Canvas, Rayon (not oiled canvas)	2.8
Paper e.g. Uncoated, untreated, ground up & recycled, used as insulation	3.9	Unknown	1.8	Paper e.g. Uncoated, untreated, ground up & recycled, used as insulation	3.5	Unknown	2.8
Information not recorded	3.7	Plastics - not classified above	1.5	Unknown	3.4	Plastics - not classified above	2.1

Table 64: Ranking of first material ignited by fatalities in fires without structure damage (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material First Ignited	% Total Fatalities	Material First Ignited	% Total Fatalities	Material First Ignited	% Total Fatalities	Material First Ignited	% Total Fatalities
Unknown	21.2	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	100.0	Fabric, Fibre (finished)	19.3	Cotton, Canvas, Rayon (not oiled canvas)	12.5
Multiple materials first ignited	12.1			Unknown	19.3	Fabric, Fibre (finished)	12.5
Cotton, Canvas, Rayon (not oiled canvas)	9.1			Wood: sawn, finished timber	9.9	Fat, Grease, Butter	12.5
Fabric, Fibre (finished)	9.1			Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	8.8	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	12.5
Rubbish (material having no value in the same container or pile)	9.1			Polyurethane e.g. Furnishings, Upholstery, Mattresses	8.3	Food, Starch (not fat and grease)	12.5
Fat, Grease, Butter	6.1			Multiple materials first ignited	7.2	Petrol	12.5
Polyurethane e.g. Furnishings, Upholstery, Mattresses	6.1			Petrol	6.1	Trees: dead, rotten wood (not felled)	12.5
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	6.1			Food, Starch (not fat and grease)	5.5	Unable to classify	12.5
Unable to classify	6.1			PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	4.4	Unknown	12.5
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	3.0			Fat, Grease, Butter	3.9	Acetylene	0.0

Table 65: Ranking of first material ignited by injuries in fires without structure damage (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material First Ignited	% Total Injuries	Material First Ignited	% Total Injuries	Material First Ignited	% Total Injuries	Material First Ignited	% Total Injuries
Fabric, Fibre (finished)	3.46	Fat, Grease, Butter	1.49	Fabric, Fibre (finished)	1.70	Fat, Grease, Butter	1.15
Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	1.58	Food, Starch (not fat and grease)	1.43	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	1.10	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	0.92
Unknown	1.47	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	1.05	Fat, Grease, Butter	1.00	Food, Starch (not fat and grease)	0.68
Cotton, Canvas, Rayon (not oiled canvas)	1.29	Fabric, Fibre (finished)	0.69	Unknown	0.64	Fabric, Fibre (finished)	0.62
Fat, Grease, Butter	1.11	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	0.24	Cotton, Canvas, Rayon (not oiled canvas)	0.63	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	0.33
Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.94	Cotton, Canvas, Rayon (not oiled canvas)	0.21	PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	0.61	Cotton, Canvas, Rayon (not oiled canvas)	0.26
Food, Starch (not fat and grease)	0.70	Plastics - not classified above	0.21	Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.60	Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.17
Wood: sawn, finished timber	0.70	Grain, Natural fibres, Flax, Hessian, Kapok	0.18	Wood: sawn, finished timber	0.58	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.11
PVC e.g. Floor Tiles, Guttering/Pipes, Plastic Bags, Elec. Insulation	0.64	Information not recorded	0.15	Petrol	0.35	Plastics - not classified above	0.10
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.47	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.12	Food, Starch (not fat and grease)	0.33	Wood: sawn, finished timber	0.09

Table 66: Highest ratios of numbers of fatalities to numbers of fires for first material ignited (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material first ignited	Ratio of Fatalities to Fires	Material first ignited	Ratio of Fatalities to Fires	Material first ignited	Ratio of Fatalities to Fires	Material first ignited	Ratio of Fatalities to Fires
Natural gas	0.200	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.071	Fabric, Textiles, Wool, Hair - not classified above	0.061	Trees: dead, rotten wood (not felled)	0.019
Fabric, Textiles, Wool, Hair - not classified above	0.167			Natural gas	0.059	Petrol	0.011
Multiple materials first ignited	0.105			Petrol	0.052	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.009
Unable to classify	0.105			Fur, Silk, Other Fabric (finished goods)	0.048	Unable to classify	0.005
Unknown	0.074			Food, Starch (not fat and grease)	0.034	Cotton, Canvas, Rayon (not oiled canvas)	0.002
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.042			LPG	0.033	Unknown	0.001
Rubbish (material having no value in the same container or pile)	0.037			Natural products - not classified above	0.033	Fabric, Fibre (finished)	0.001
Cotton, Canvas, Rayon (not oiled canvas)	0.033			Unknown	0.033	Fat, Grease, Butter	< 0.001
Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.026			Multiple materials first ignited	0.033	Food, Starch (not fat and grease)	< 0.001
Particle board, Hardboard, Pinex, Fibre board	0.024			Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.031		

Table 67: Highest ratios of numbers of injuries to numbers of fires for each first material ignited (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material first ignited	Ratio of Injuries to Fires	Material first ignited	Ratio of Injuries to Fires	Material first ignited	Ratio of Injuries to Fires	Material first ignited	Ratio of Injuries to Fires
Cork	1.000	Acetylene	1.000	Cork	1.000	Acetylene	0.500
Grease (non food)	1.000	Linoleum	1.000	Toi Toi	0.500	Combustible Metal e.g. Magnesium, Titanium, Zirconium	0.450
Fur, Silk, Other Fabric (finished goods)	0.500	Flammable Combustible Liquid - not classified above	0.667	Natural gas	0.412	Human hair	0.333
Natural products - not classified above	0.500	Fur, Silk, Other Fabric (finished goods)	0.500	Human hair	0.333	Flammable Combustible Liquid - not classified above	0.235
Solid Chemical e.g. Explosives	0.500	Plywood	0.500	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.319	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.200
Rubber	0.429	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.286	LPG	0.300	Fur, Silk, Other Fabric (finished goods)	0.182
LPG	0.400	Grain, Natural fibres, Flax, Hessian, Kapok	0.273	Combustible Metal e.g. Magnesium, Titanium, Zirconium	0.286	Polyurethane e.g. Foam plastic, Fridge & domestic insulation	0.157
Vinyl e.g. Plastic-coated fabrics, Upholstery fabrics (NOT floor covering)	0.353	Particle board, Hardboard, Pinex, Fibre board	0.250	Flammable Combustible Liquid - not classified above	0.267	Polyurethane e.g. Furnishings, Upholstery, Mattresses	0.153
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	0.333	Plastics - not classified above	0.200	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	0.255	Petrol	0.149
Volatile, solid chemical - not classified above	0.333	Polycarbonate e.g. Safety screens	0.188	Solid Chemical e.g. Explosives	0.250	Linoleum	0.143

Table 68: Ratio of percentage of total fatalities to percentage of total fires for each first material ignited (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material first ignited	Ratio of %Fatalities to %Fires	Material first ignited	Ratio of %Fatalities to %Fires	Material first ignited	Ratio of %Fatalities to %Fires	Material first ignited	Ratio of %Fatalities to %Fires
Natural gas	10.3	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	239.1	Fabric, Textiles, Wool, Hair - not classified above	4.9	Trees: dead, rotten wood (not felled)	43.6
Fabric, Textiles, Wool, Hair - not classified above	8.6			Natural gas	4.7	Petrol	24.6
Multiple materials first ignited	5.4			Petrol	4.2	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	21.0
Unable to classify	5.4			Fur, Silk, Other Fabric (finished goods)	3.8	Unable to classify	10.6
Unknown	3.8			Food, Starch (not fat and grease)	2.8	Cotton, Canvas, Rayon (not oiled canvas)	4.1
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	2.2			LPG	2.7	Unknown	3.4
Rubbish (material having no value in the same container or pile)	1.9			Natural products - not classified above	2.7	Fabric, Fibre (finished)	2.0
Cotton, Canvas, Rayon (not oiled canvas)	1.7			Unknown	2.6	Fat, Grease, Butter	0.7
Polyurethane e.g. Furnishings, Upholstery, Mattresses	1.3			Multiple materials first ignited	2.6	Food, Starch (not fat and grease)	0.7
Particle board, Hardboard, Pinex, Fibre board	1.3			Polyurethane e.g. Furnishings, Upholstery, Mattresses	2.5	Acetylene	0.0

Table 69: Ratio of percentage of total injuries to percentage of total fires for each first material ignited (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Material first ignited	Ratio of %Injuries to %Fires	Material first ignited	Ratio of %Injuries to %Fires	Material first ignited	Ratio of %Injuries to %Fires	Material first ignited	Ratio of %Injuries to %Fires
Cork	6.0	Acetylene	14.4	Cork	9.7	Acetylene	9.0
Grease (non food)	6.0	Linoleum	14.4	Toi Toi	4.8	Combustible Metal e.g. Magnesium, Titanium, Zirconium	8.1
Fur, Silk, Other Fabric (finished goods)	3.0	Flammable Combustible Liquid - not classified above	9.6	Natural gas	4.0	Human hair	6.0
Natural products - not classified above	3.0	Fur, Silk, Other Fabric (finished goods)	7.2	Human hair	3.2	Flammable Combustible Liquid - not classified above	4.2
Solid Chemical e.g. Explosives	3.0	Plywood	7.2	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	3.1	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	3.6
Rubber	2.6	Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	4.1	LPG	2.9	Fur, Silk, Other Fabric (finished goods)	3.3
LPG	2.4	Grain, Natural fibres, Flax, Hessian, Kapok	3.9	Combustible Metal e.g. Magnesium, Titanium, Zirconium	2.8	Polyurethane e.g. Foam plastic, Fridge & domestic insulation	2.8
Vinyl e.g. Plastic-coated fabrics, Upholstery fabrics (NOT floor covering)	2.1	Particle board, Hardboard, Pinex, Fibre board	3.6	Flammable Combustible Liquid - not classified above	2.6	Polyurethane e.g. Furnishings, Upholstery, Mattresses	2.7
Flammable Liquid e.g. Kerosene, Methylated spirit, Ethanol, Turpentine	2.0	Plastics - not classified above	2.9	Combustible Liquid e.g. Linseed, Lubricant, Cooking oil	2.5	Petrol	2.7
Volatile, solid chemical - not classified above	2.0	Polycarbonate e.g. Safety screens	2.7	Solid Chemical e.g. Explosives	2.4	Linoleum	2.6

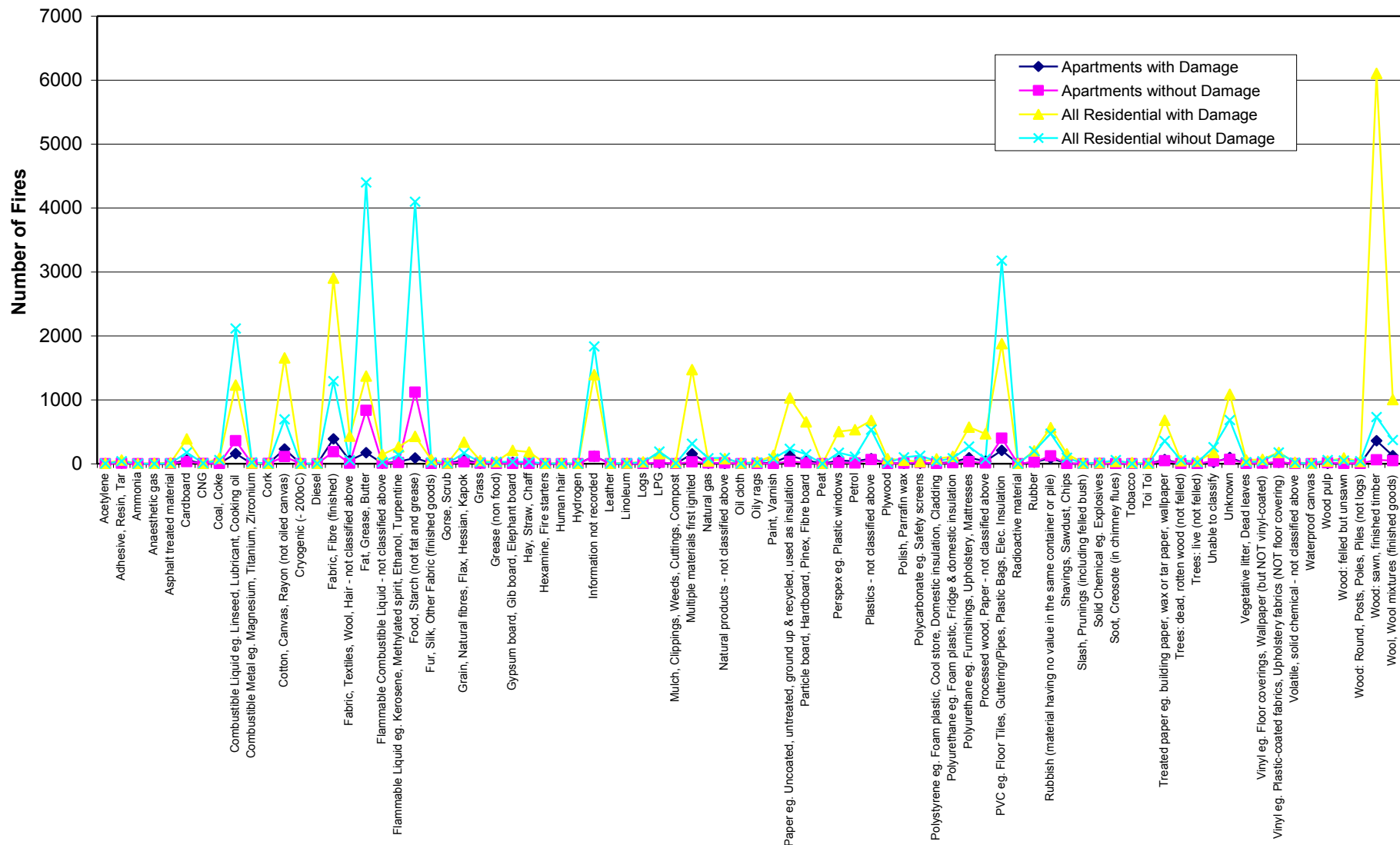


Figure 213: Number of fires in residential structures, with and without damage, according to the material first ignited (1986-2005).

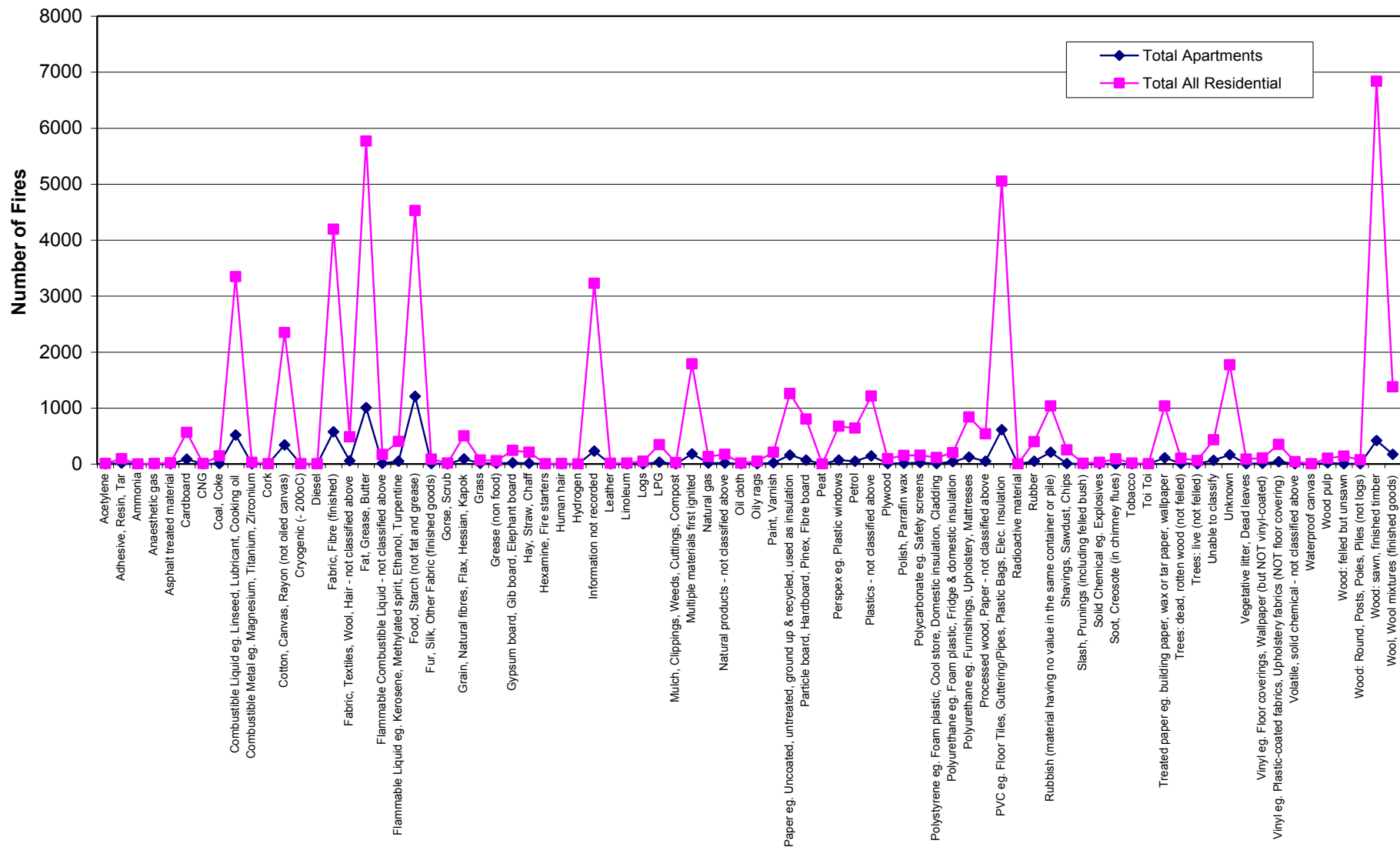


Figure 214: Number of fires in all apartment and all residential structures according to the material first ignited (1986-2005).

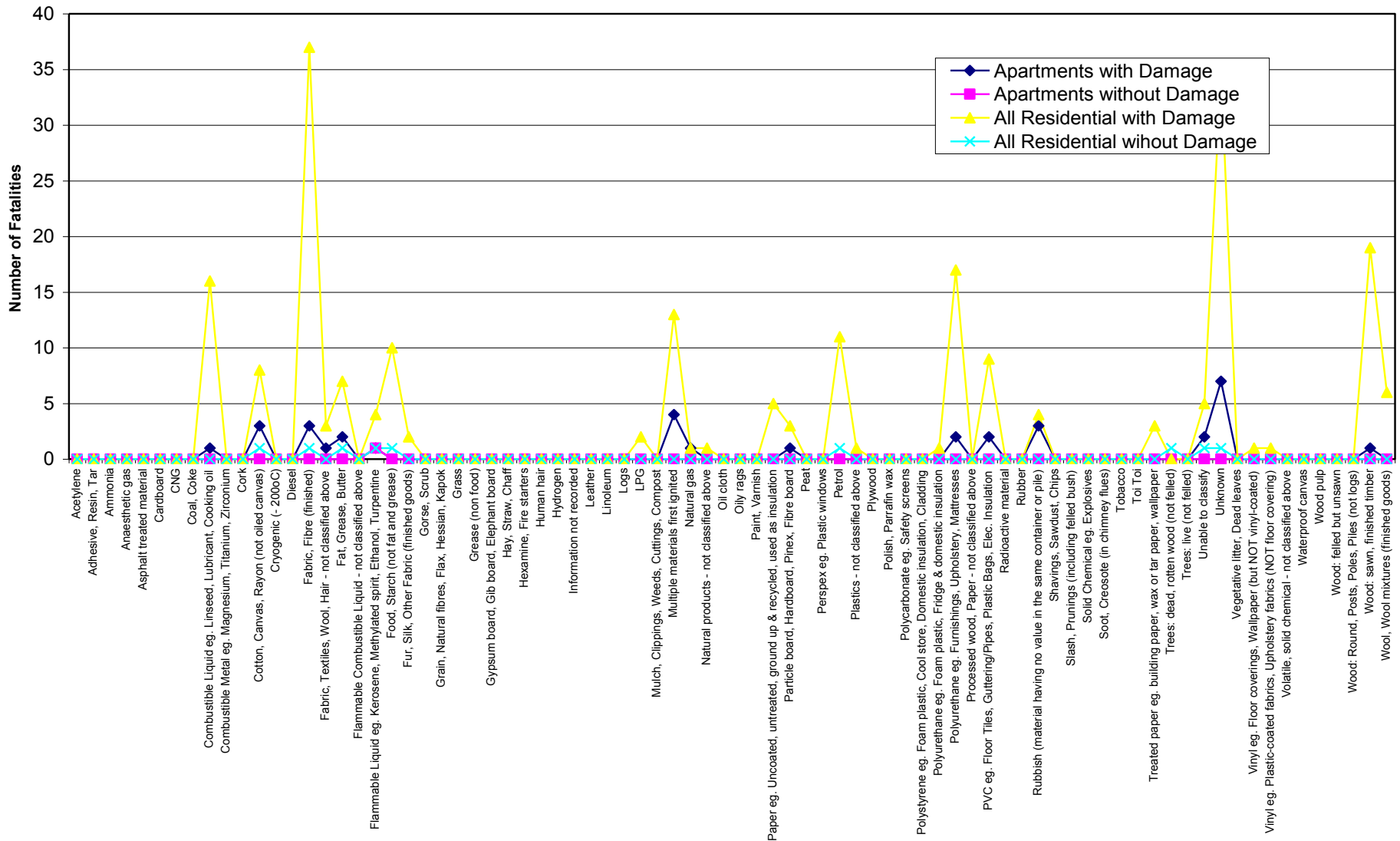


Figure 215: Number of fatalities from residential property fires, with and without damage, according to the material first ignited (1995-2005).

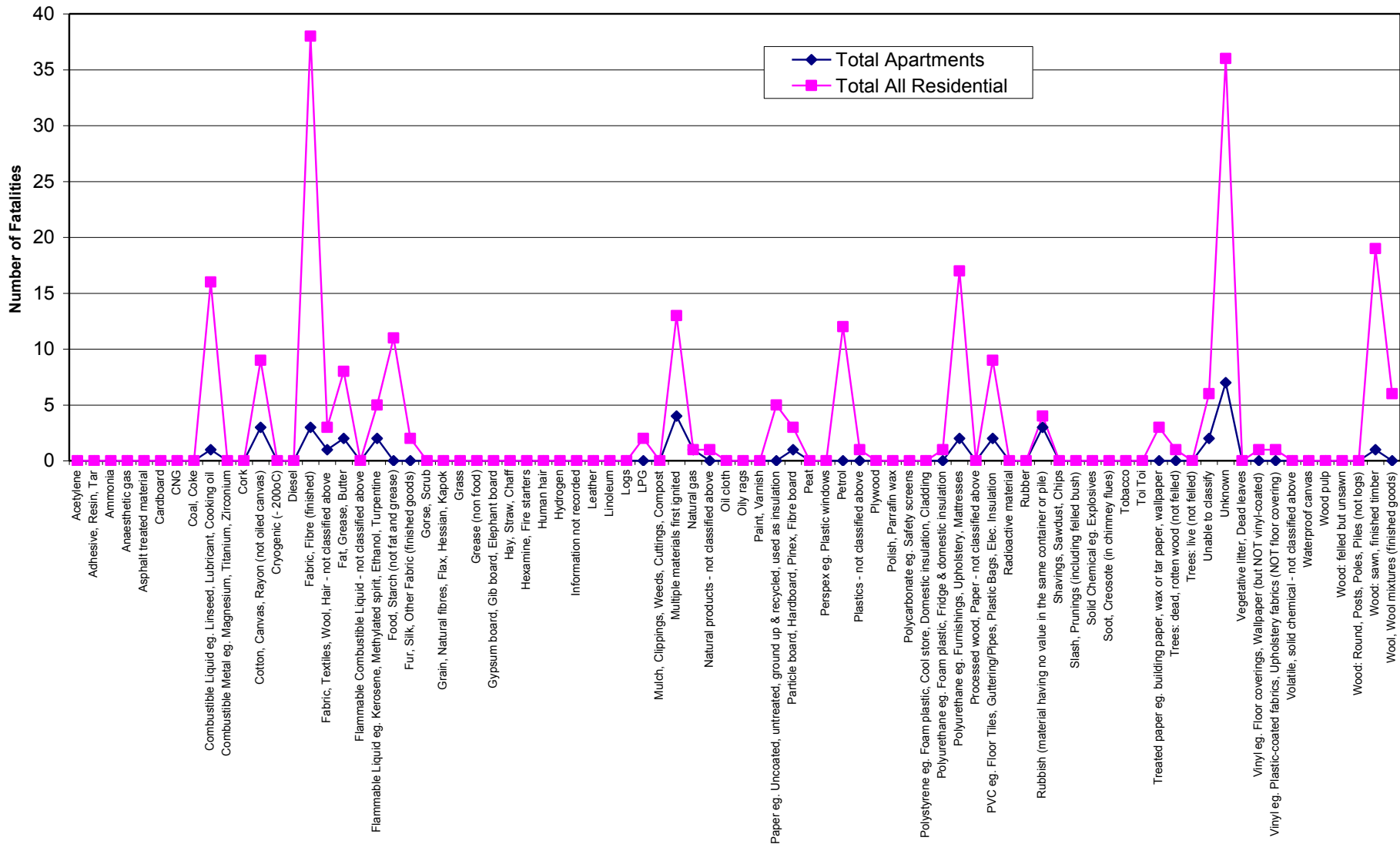


Figure 216: Number of fatalities from all apartment and all residential property fires according to the material first ignited (1995-2005).

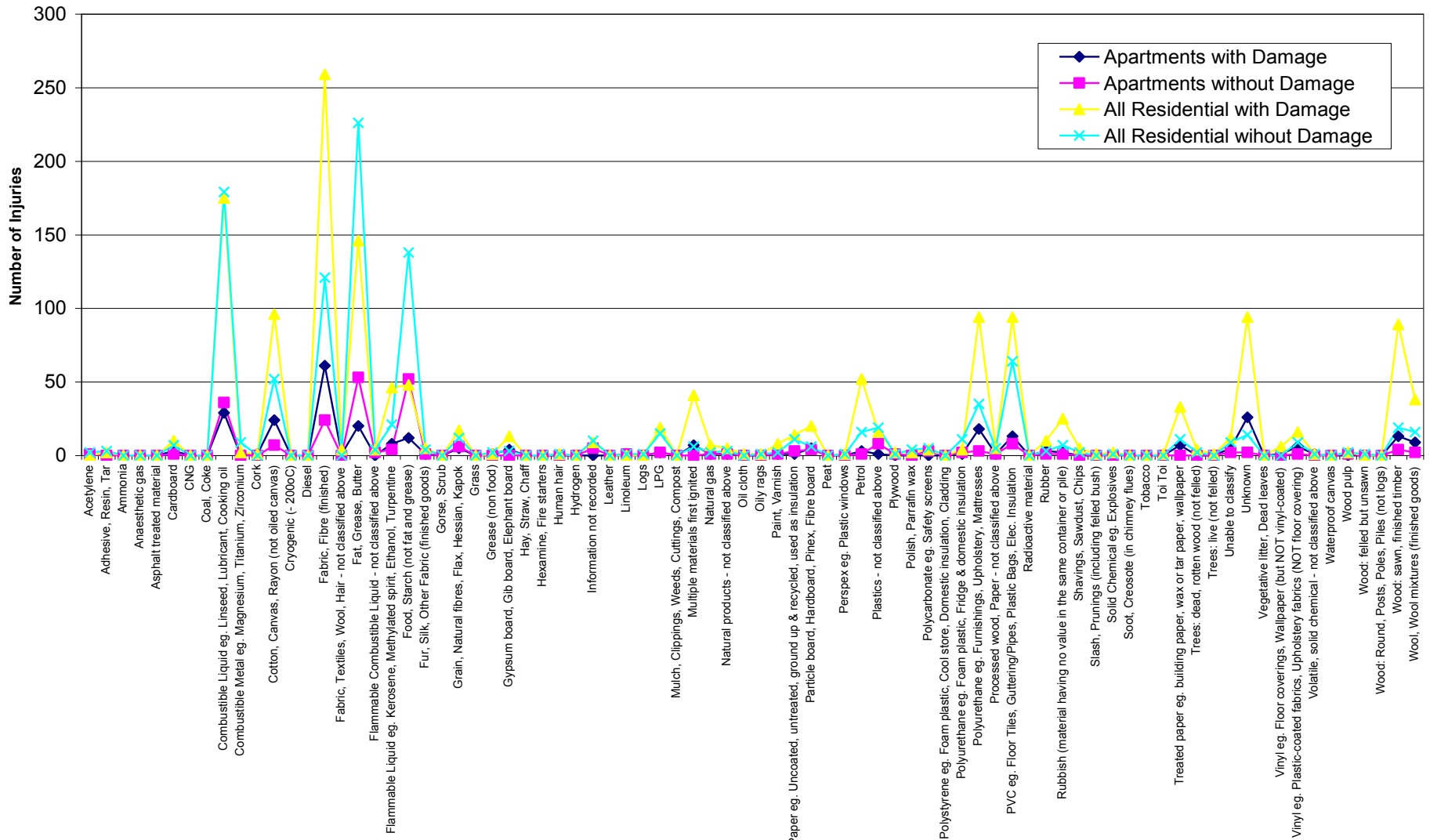


Figure 217: Number of injuries from apartment and all residential fires, with and without damage, according to the material first ignited (1995-2005).

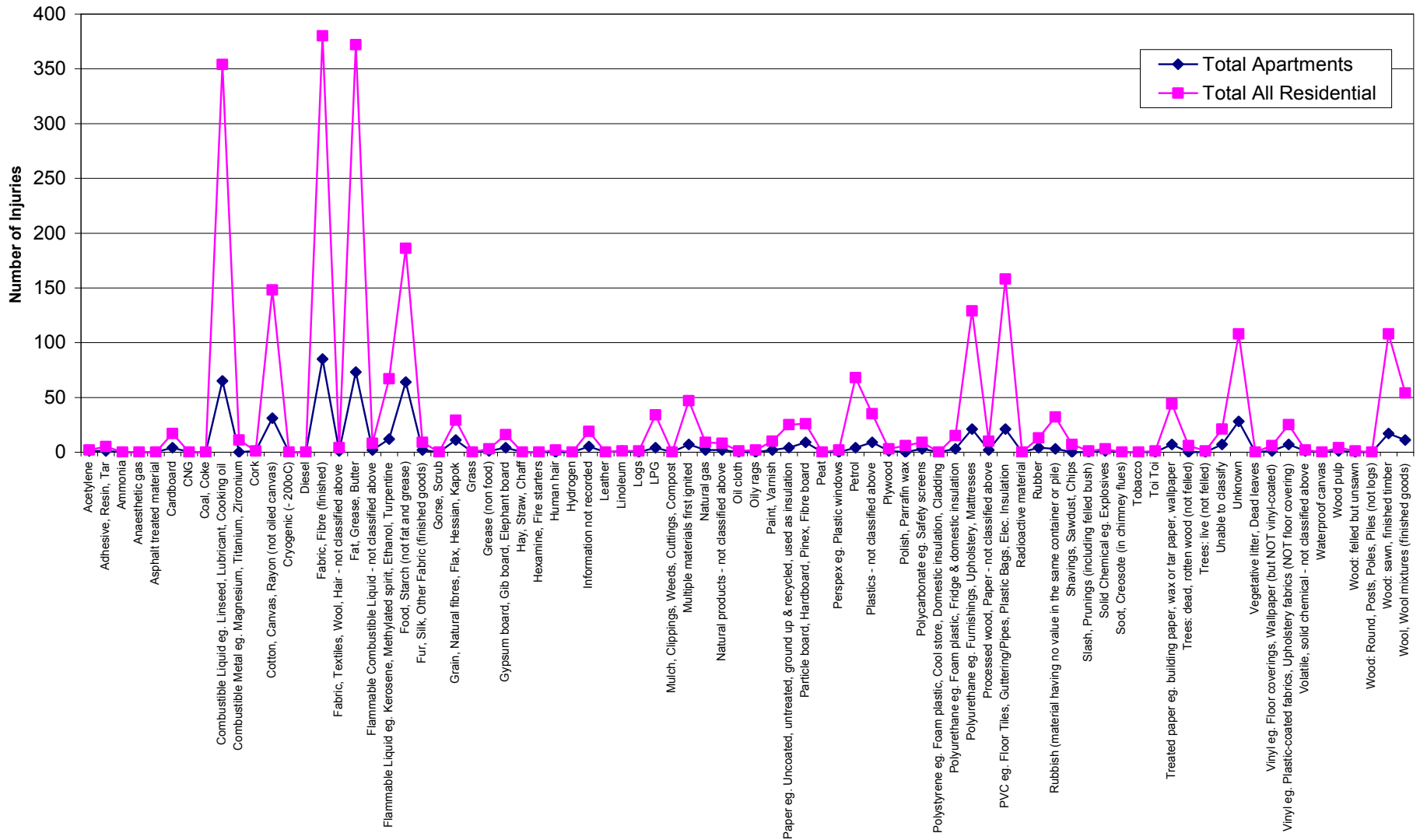


Figure 218: Number of injuries from all apartment and all residential fires according to the material first ignited (1995-2005).

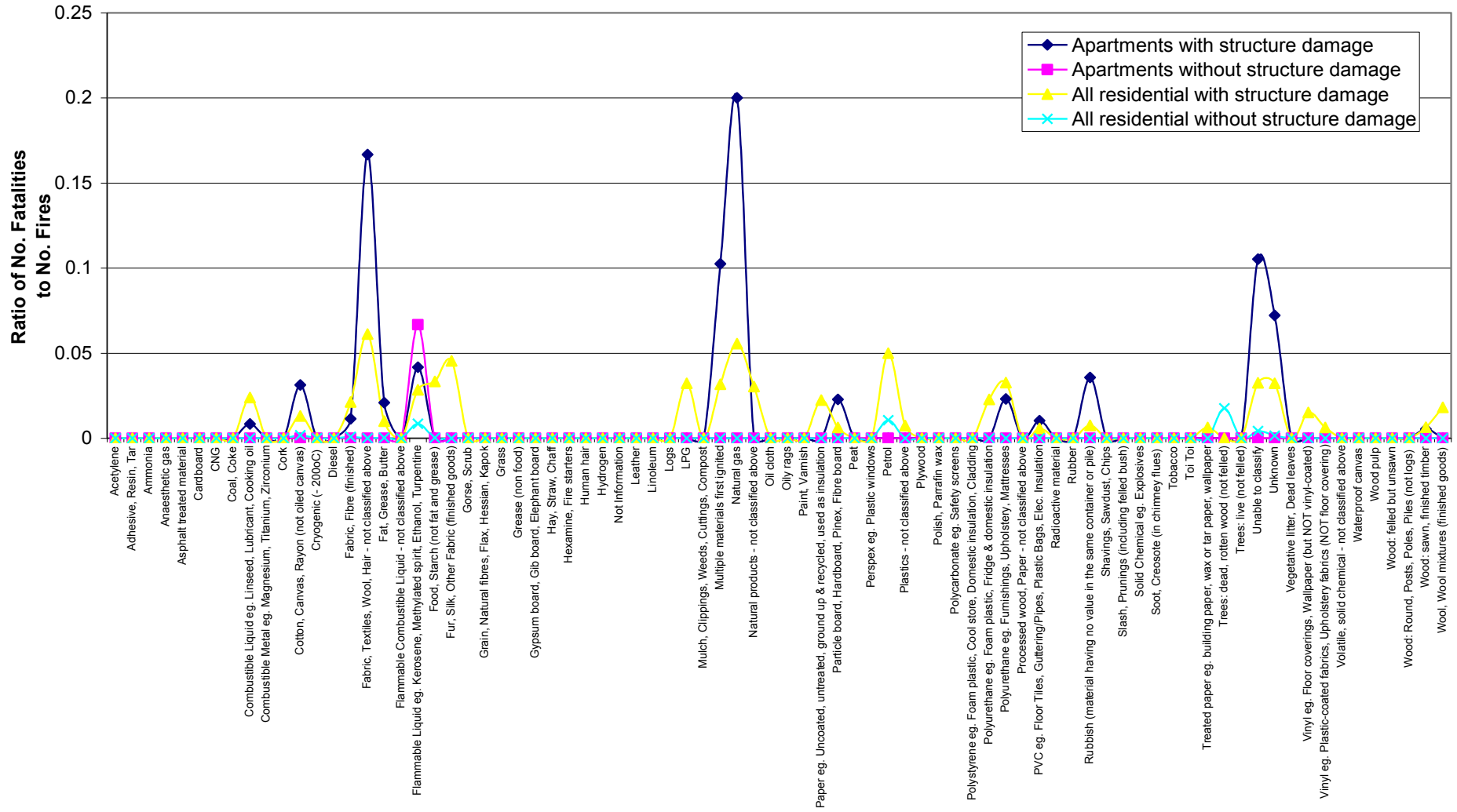


Figure 219: Ratio of numbers of fatalities to numbers of fires recorded according to material first ignited (1995-2005).

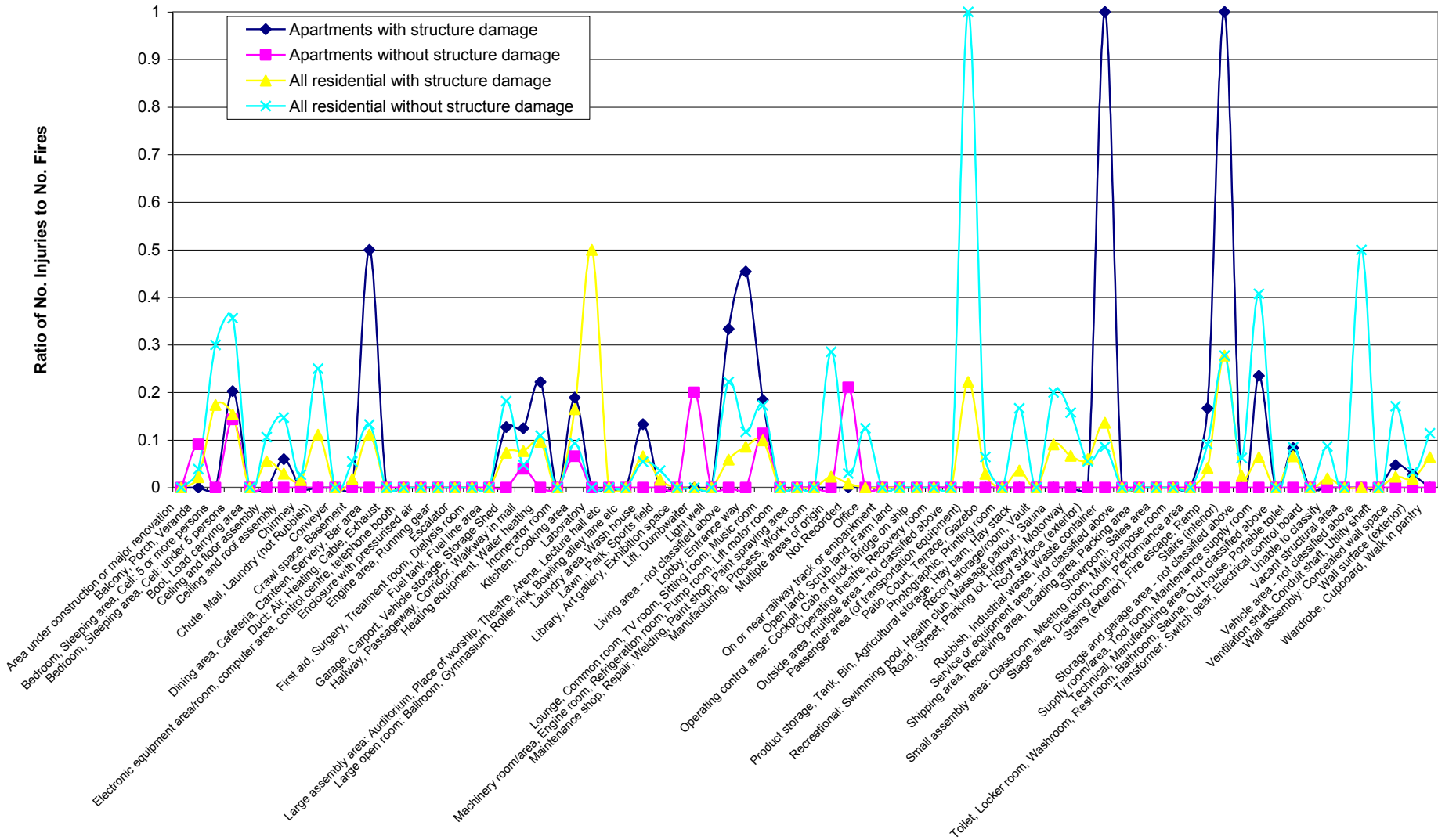


Figure 220: Ratio of numbers of injuries to numbers of fires recorded according to material first ignited (1995-2005).

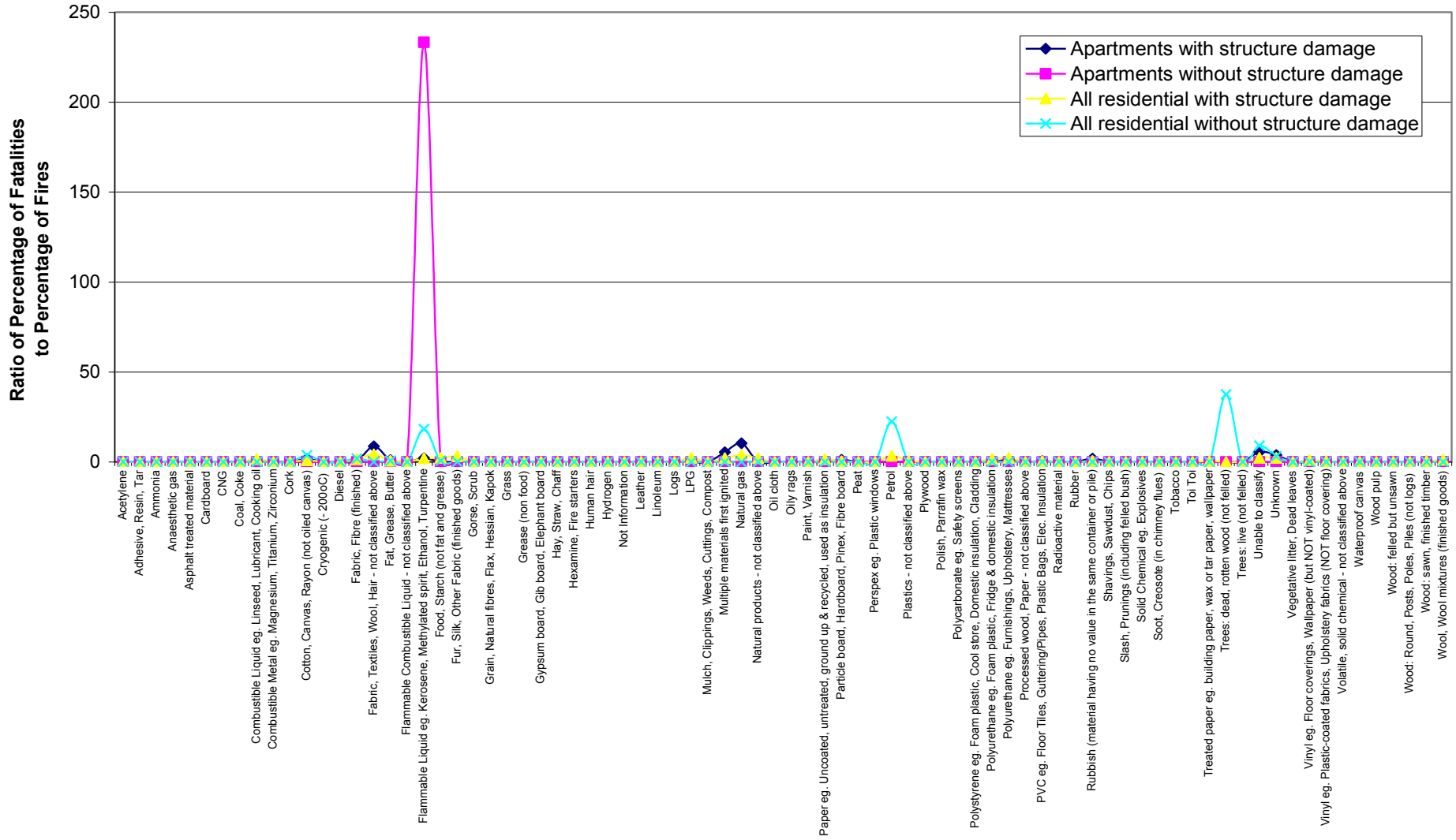


Figure 221: Ratio of percentage of total fatalities to percentage of total fires recorded according to material first ignited (1995-2005).

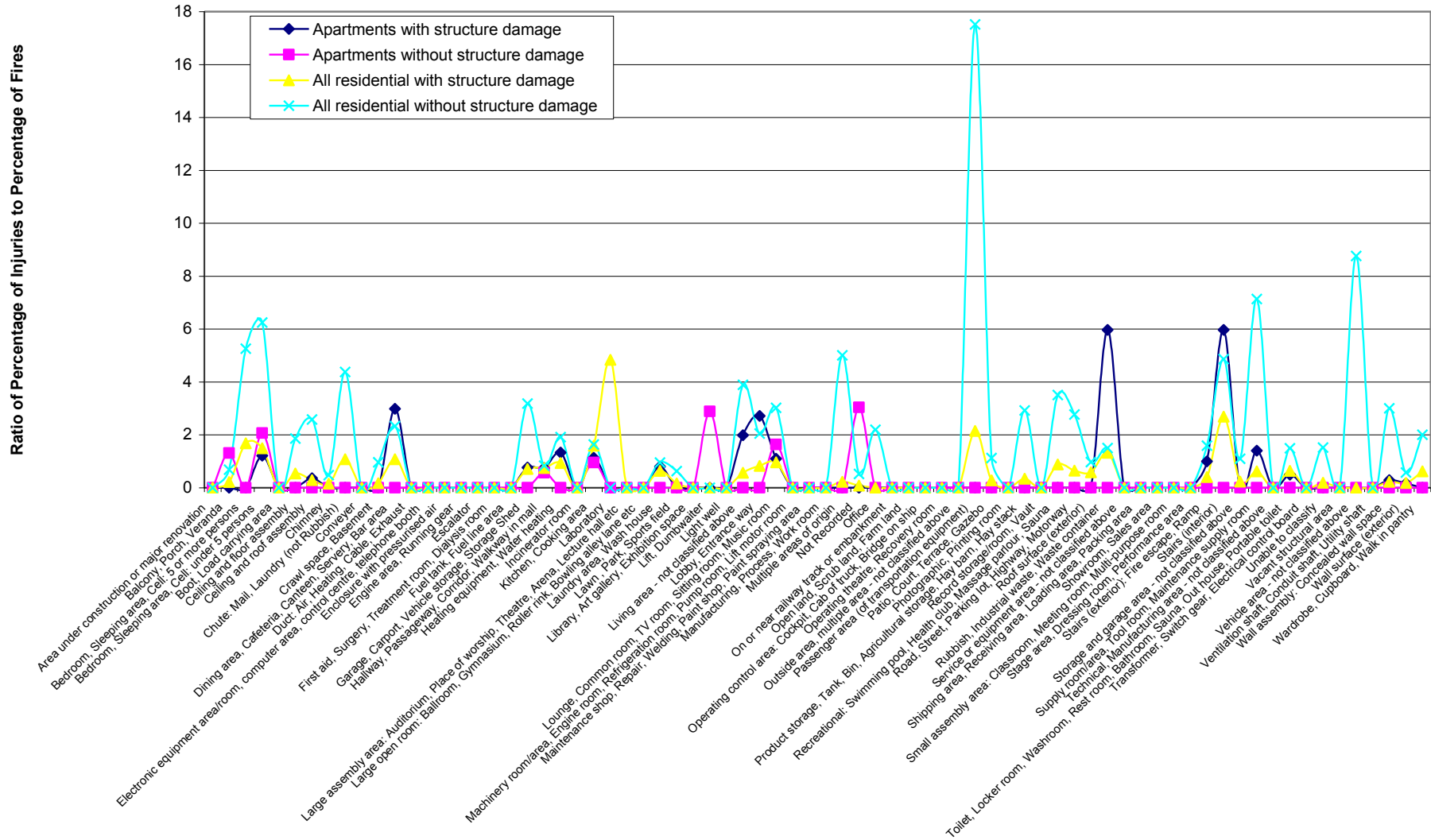


Figure 222: Ratio of percentage of total injuries to percentage of total fires recorded according to material first ignited (1995-2005).

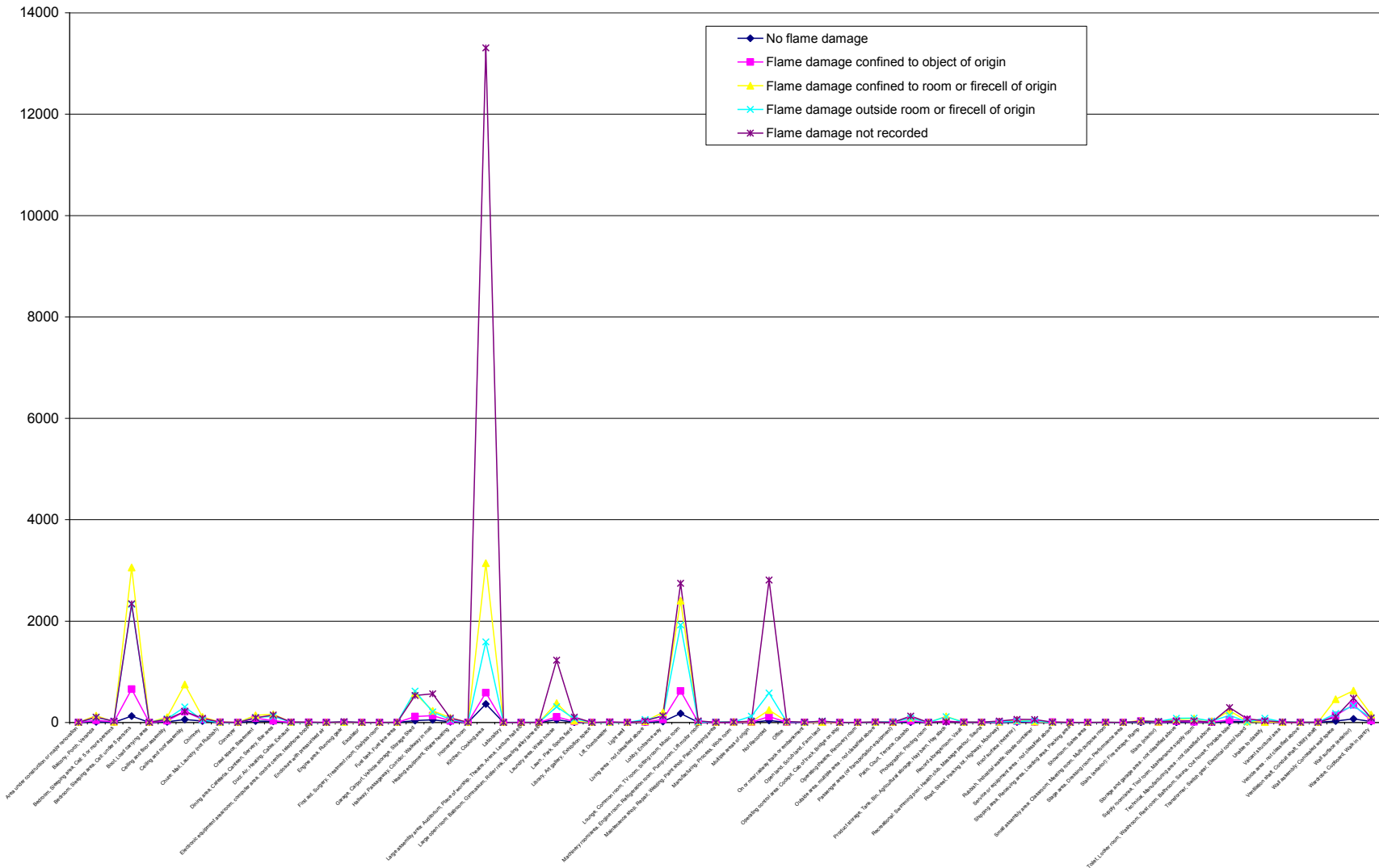


Figure 223: Number of residential fires according to extent of flame damage and material first ignited (1986-2005).

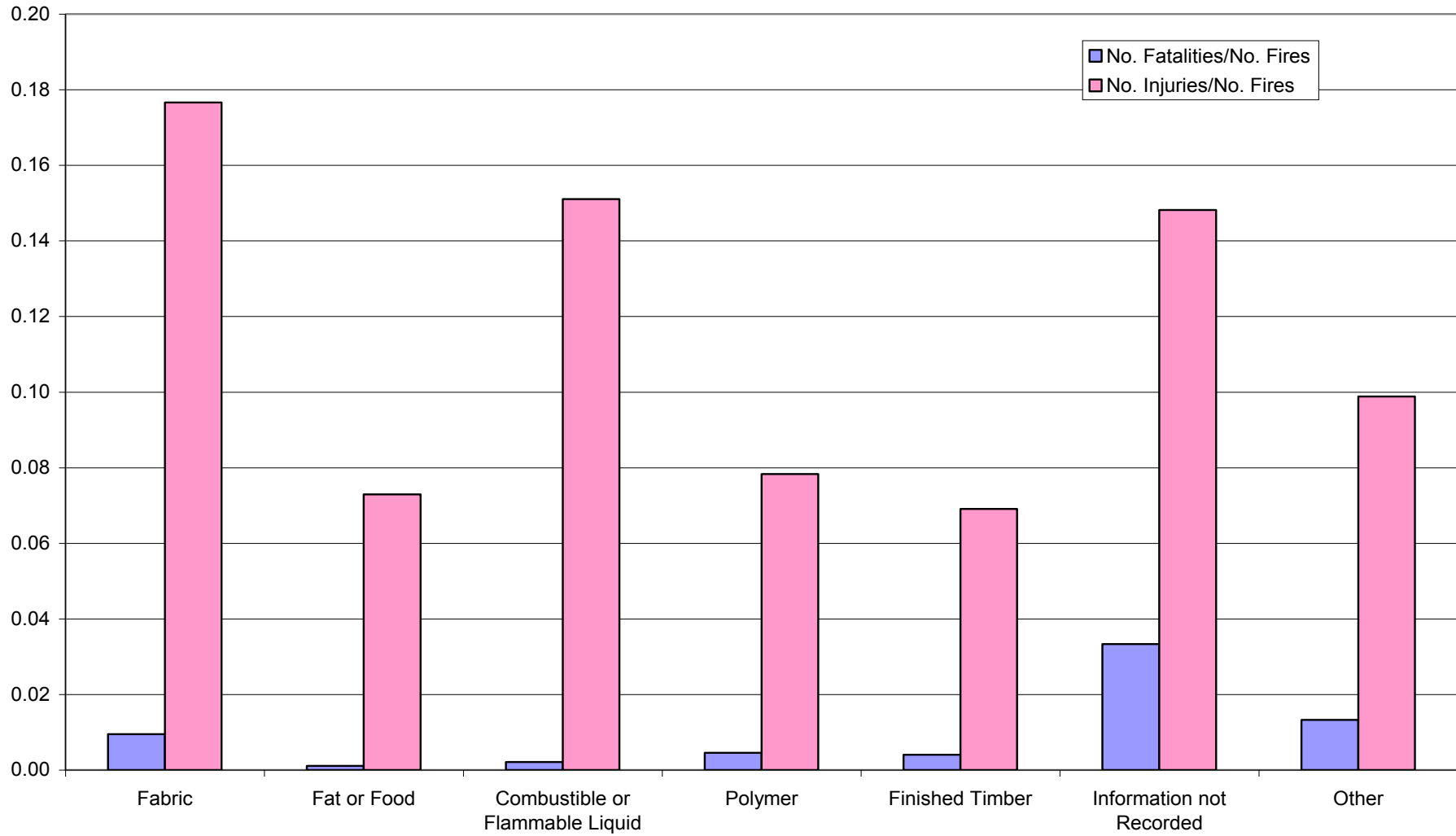


Figure 224: Number of fatalities and injuries per apartment fire as recorded for each material first ignited (1995-2005).

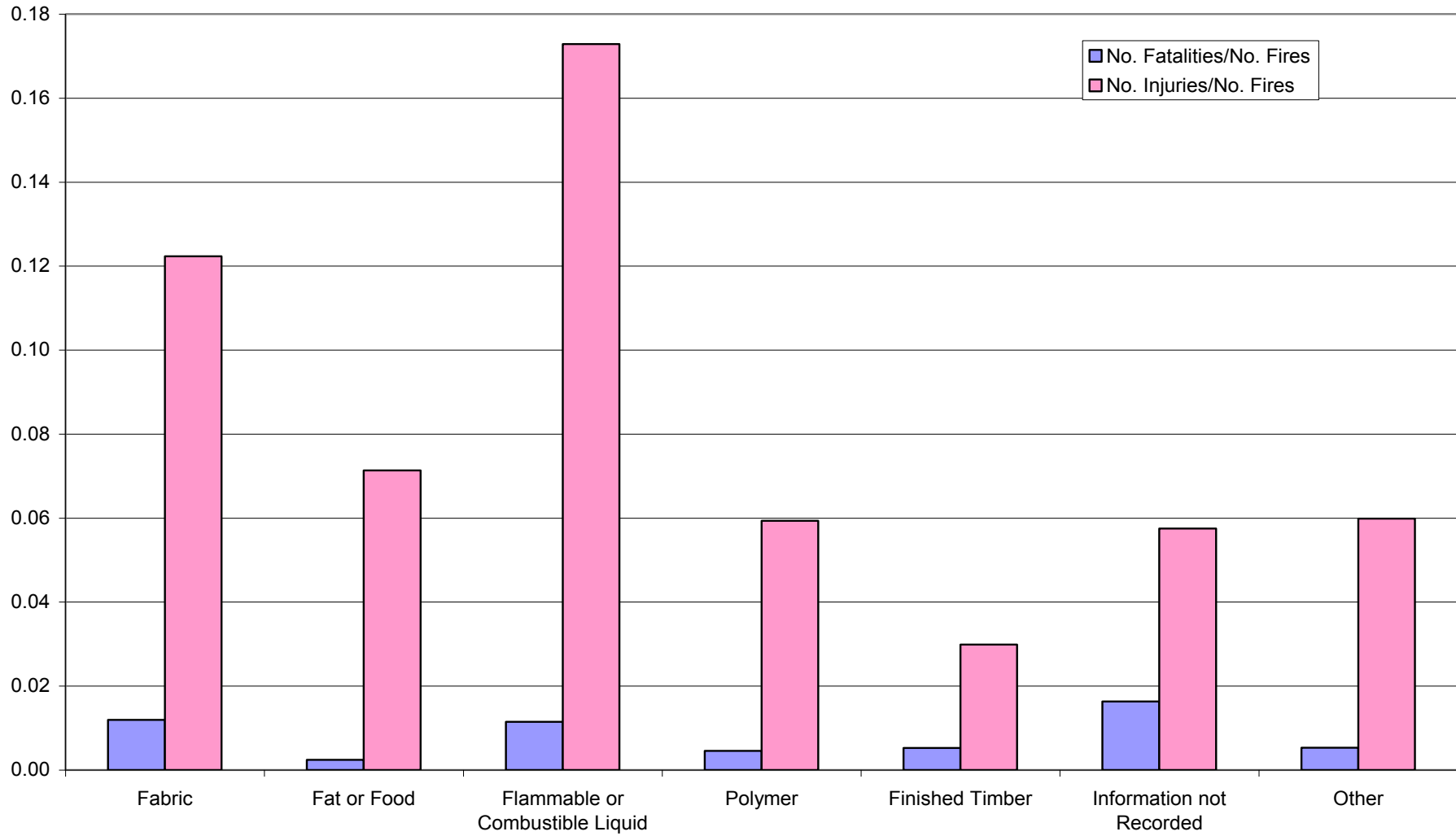


Figure 225: Number of fatalities and injuries per residential fire as recorded for each material first ignited with structure damage (1995-2005).

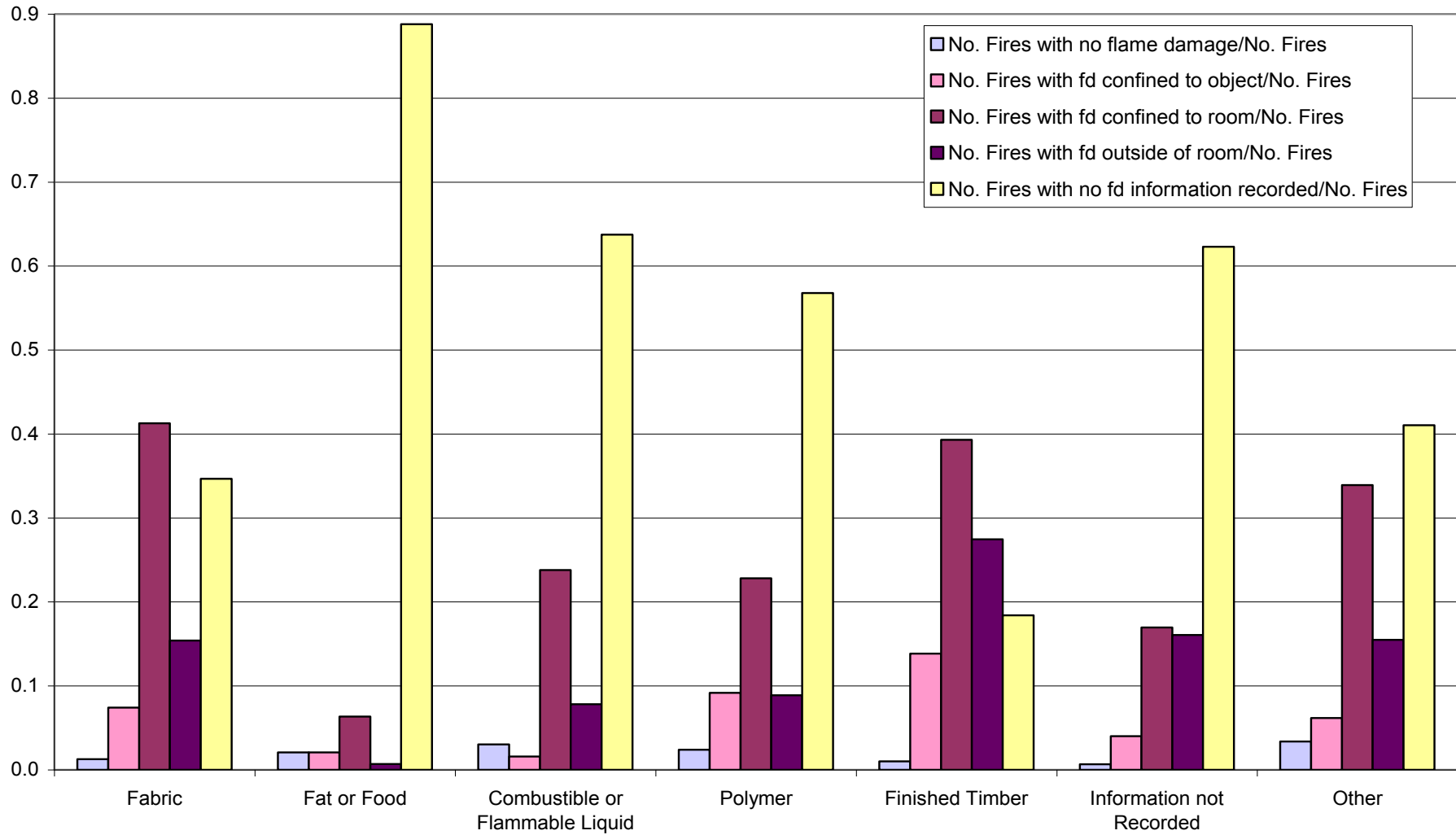


Figure 226: Number of fires according to the extent of flame damage recorded per number of apartment fires recorded for material first ignited (1985-2005).

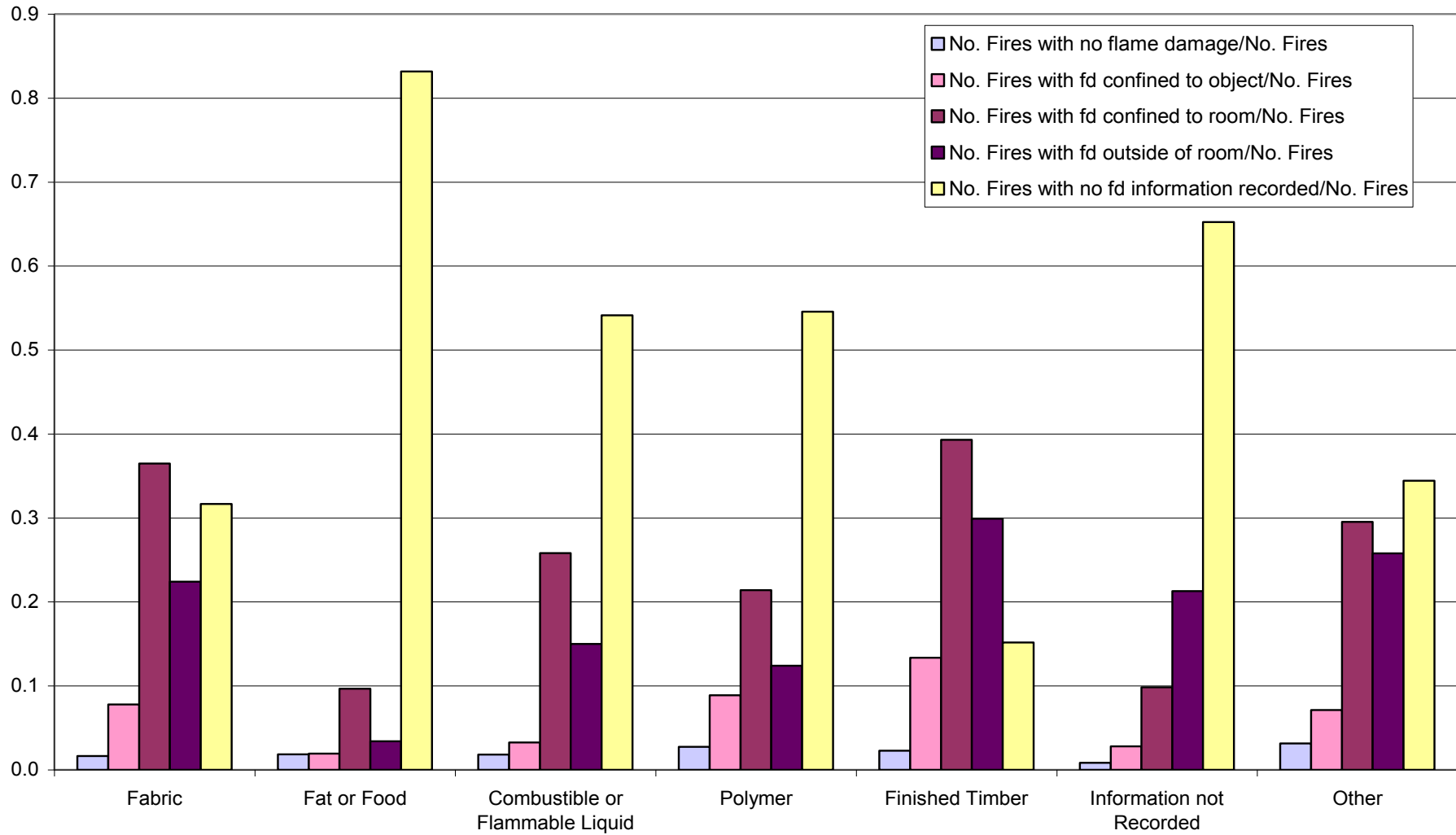


Figure 227: Number of fires according to the extent of flame damage recorded per number of residential fires recorded for material first ignited (1985-2005).

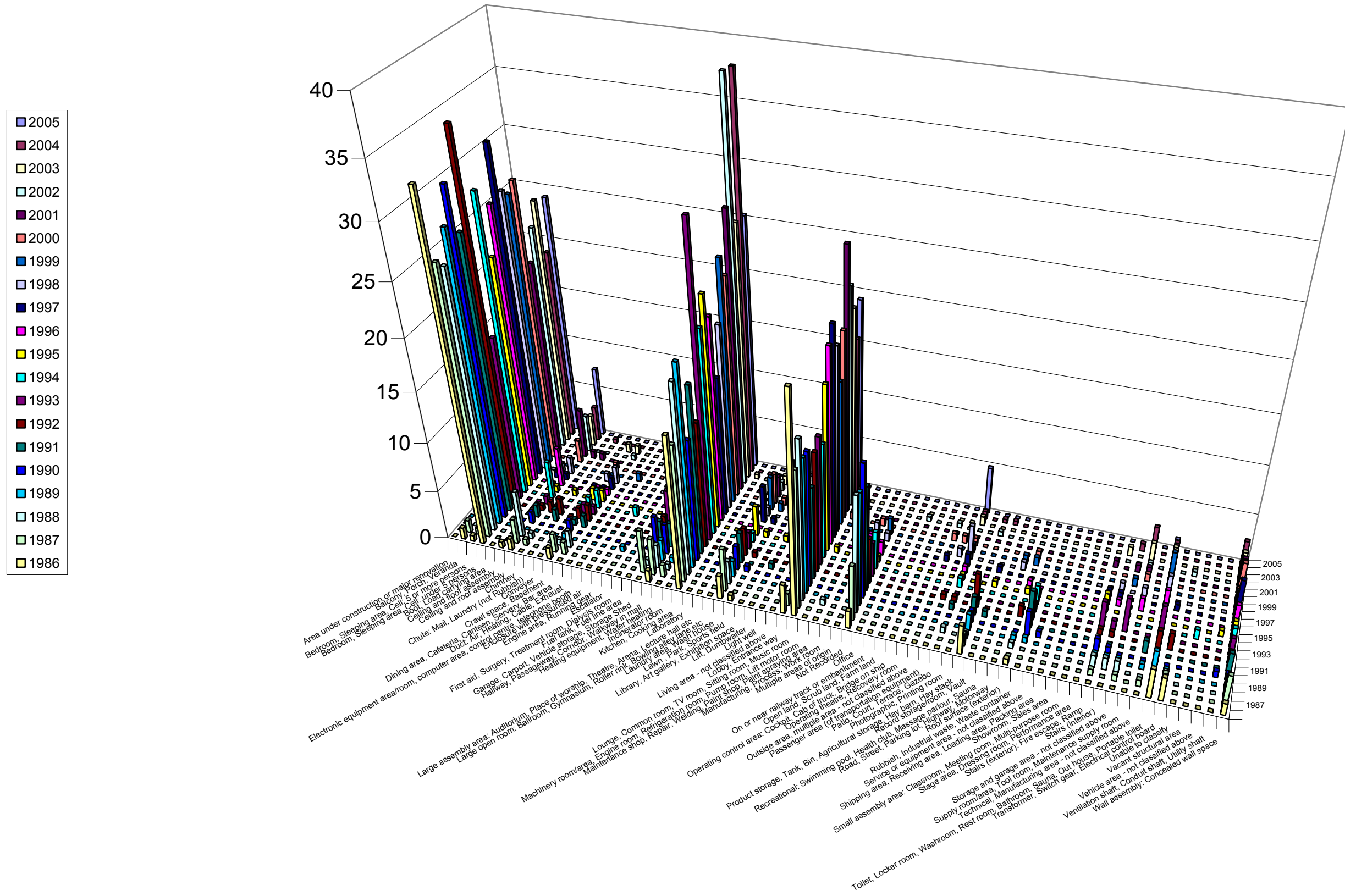


Figure 228: Total number of fire events per year for each material first ignited considered (1986 – 2005).

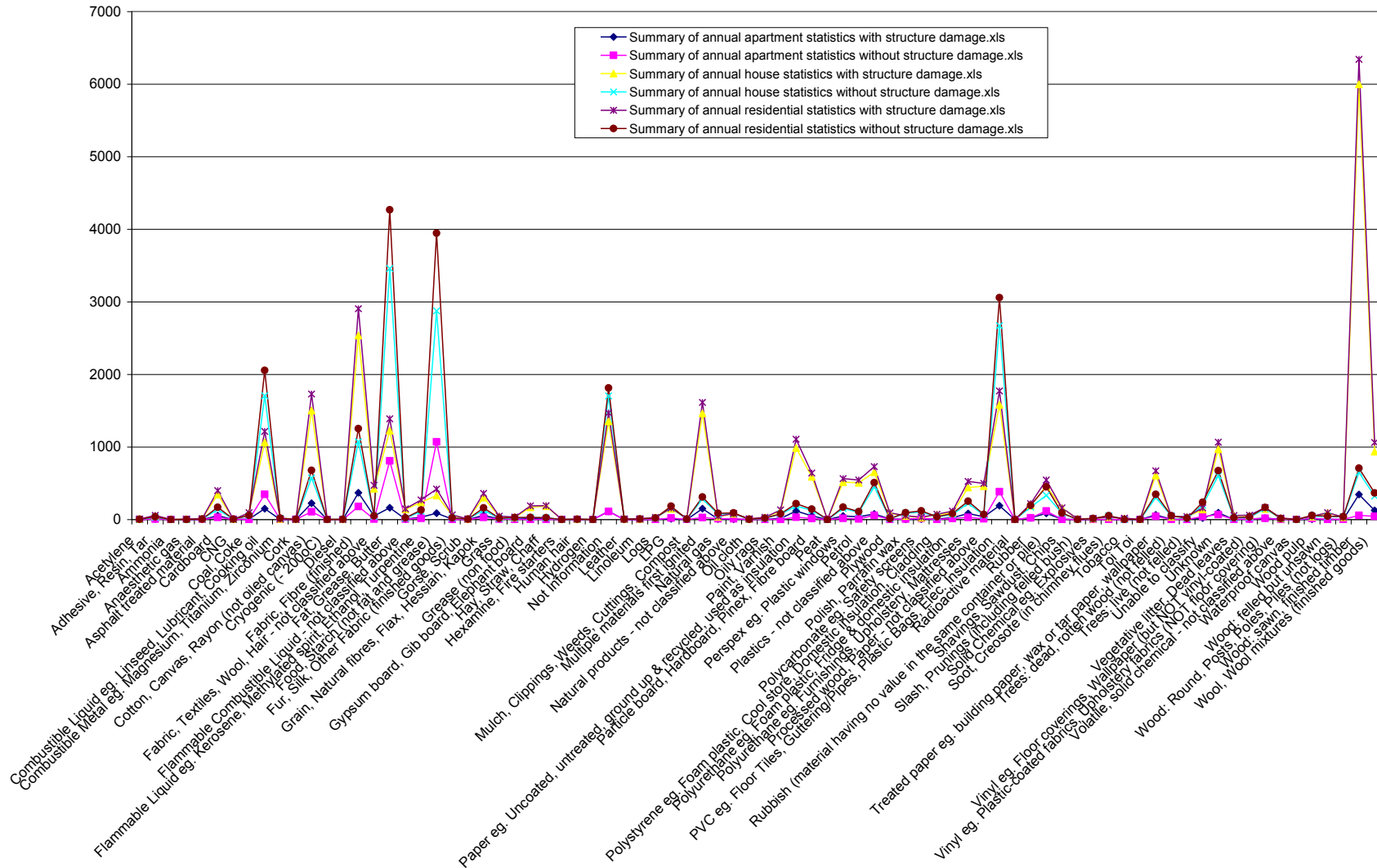


Figure 229: Number of residential fires according to the first material ignited (1986-2005).

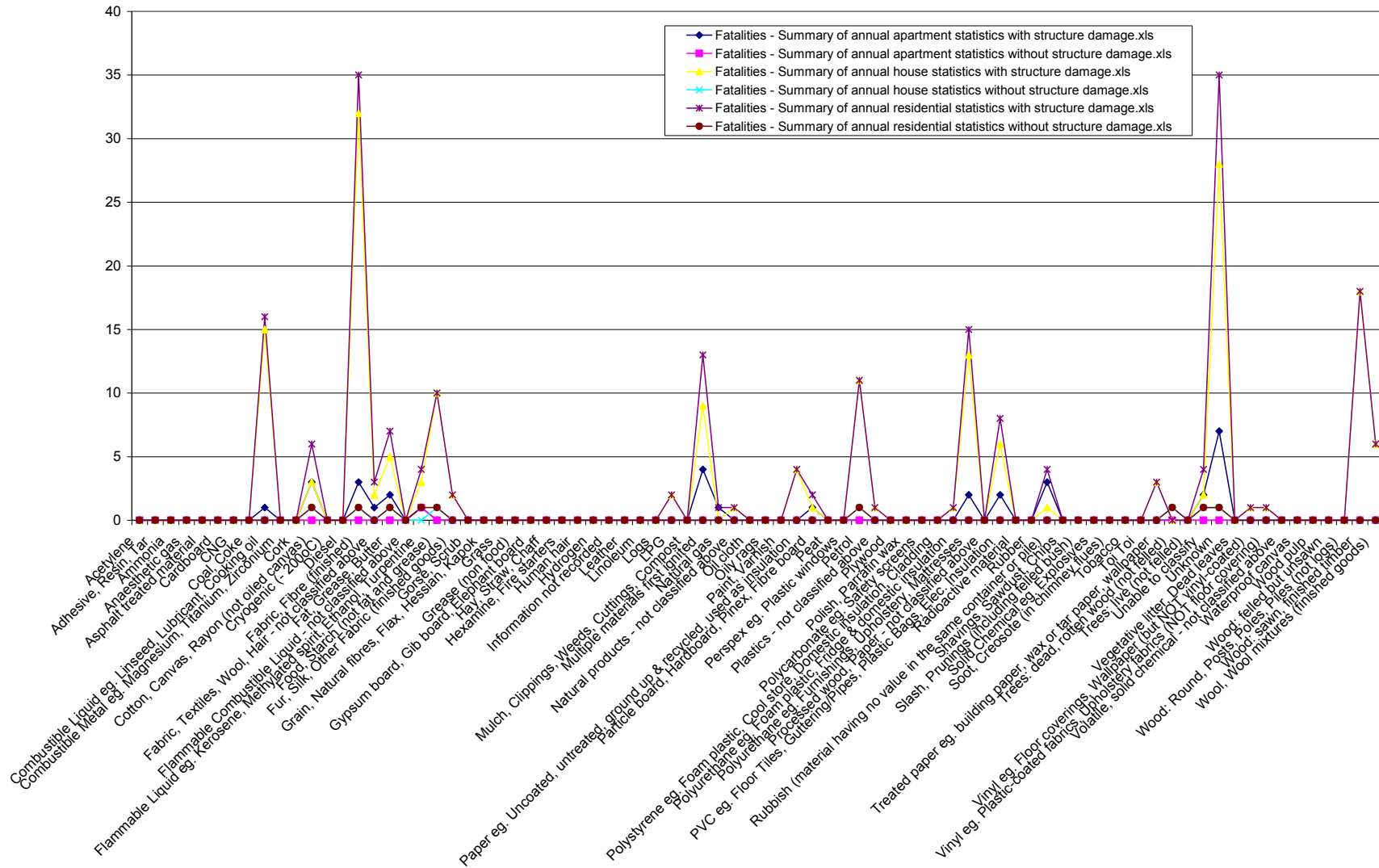


Figure 230: Number of fatalities from apartment and house fires according to the first material ignited (1995-2005).

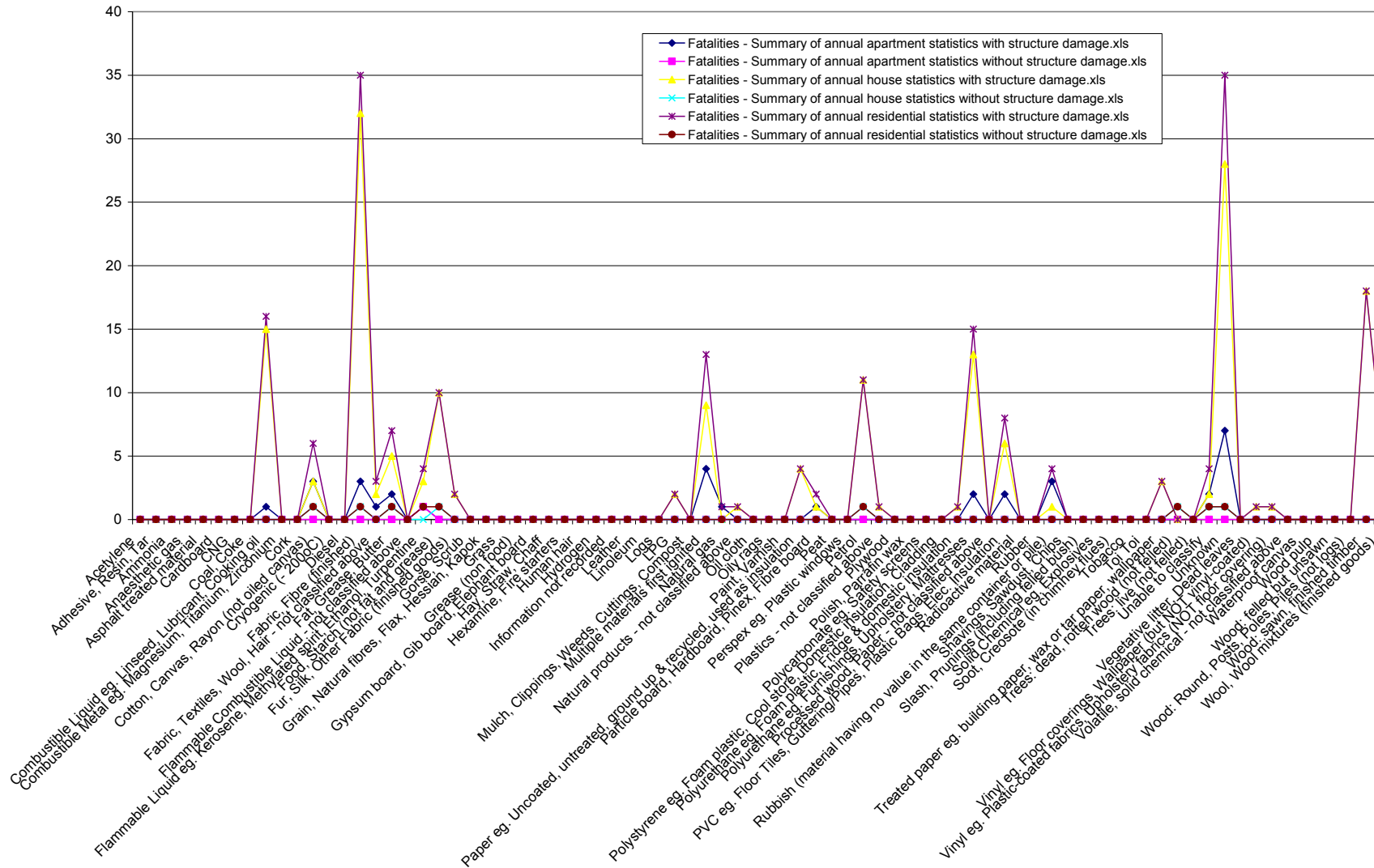


Figure 231: Number of injuries from apartment and house fires according to the first material ignited (1995-2005).

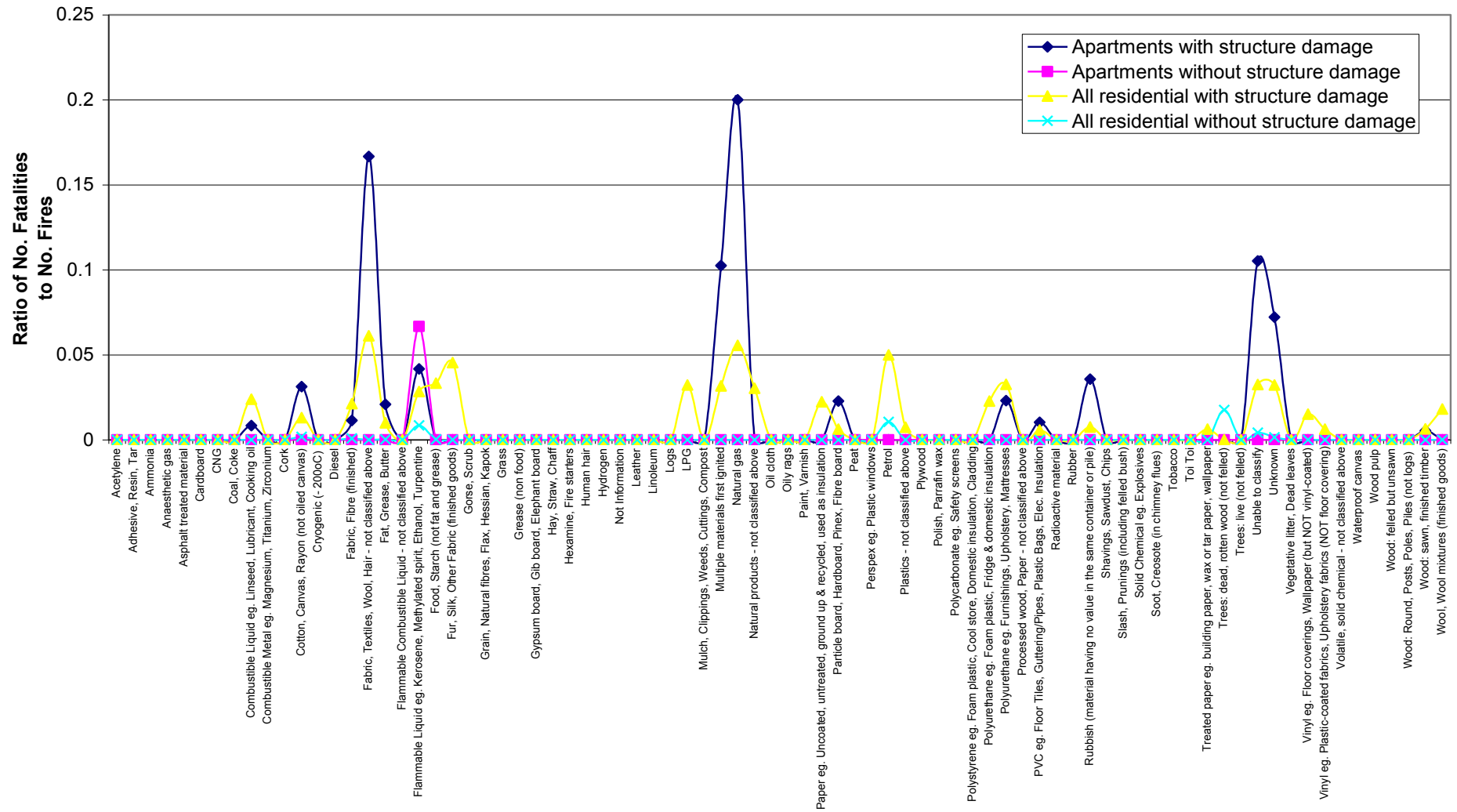


Figure 232: Ratio of numbers of fatalities to numbers of fires recorded according to material first ignited (1995-2005).

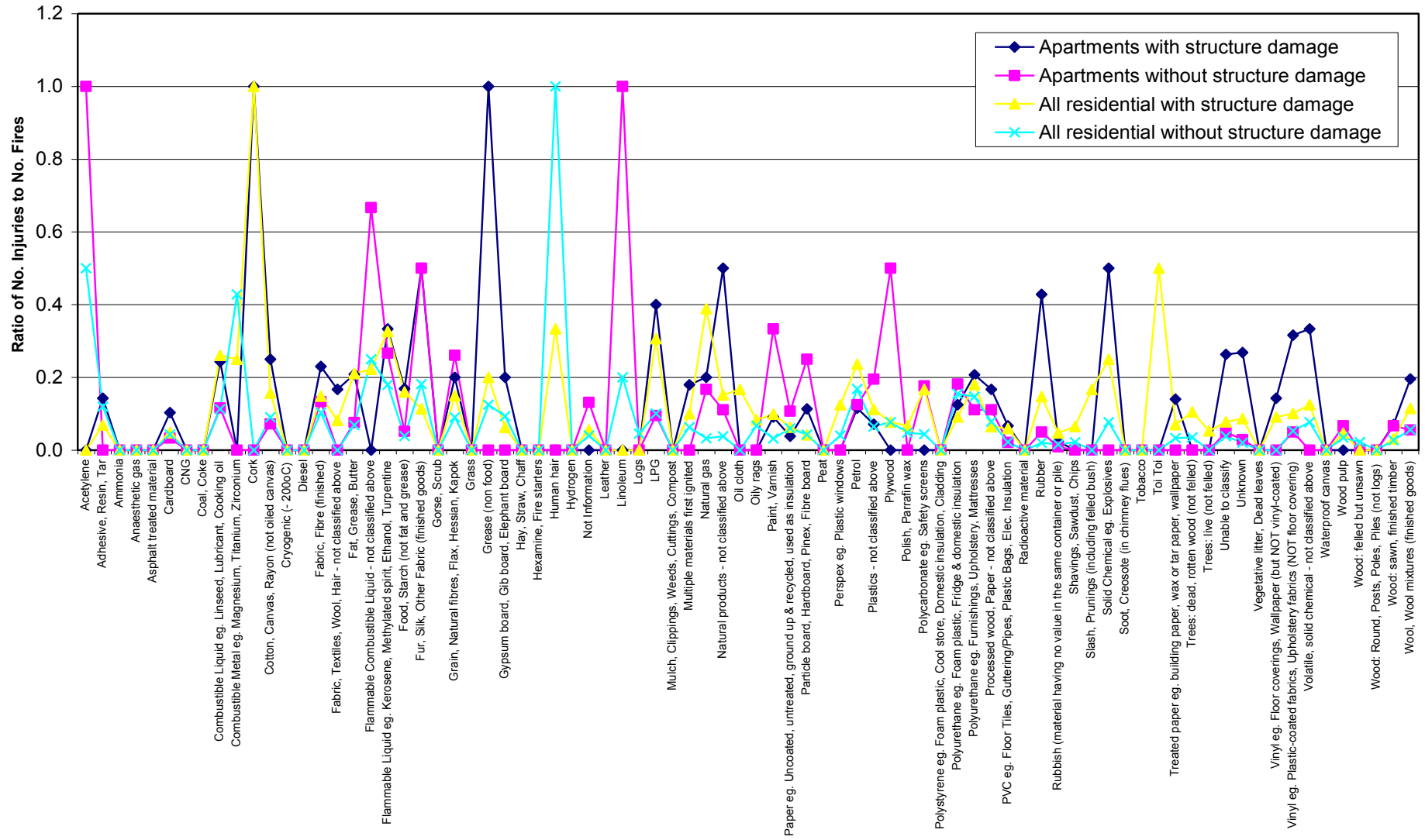


Figure 233: Ratio of numbers of injuries to numbers of fires recorded according to material first ignited (1995-2005).

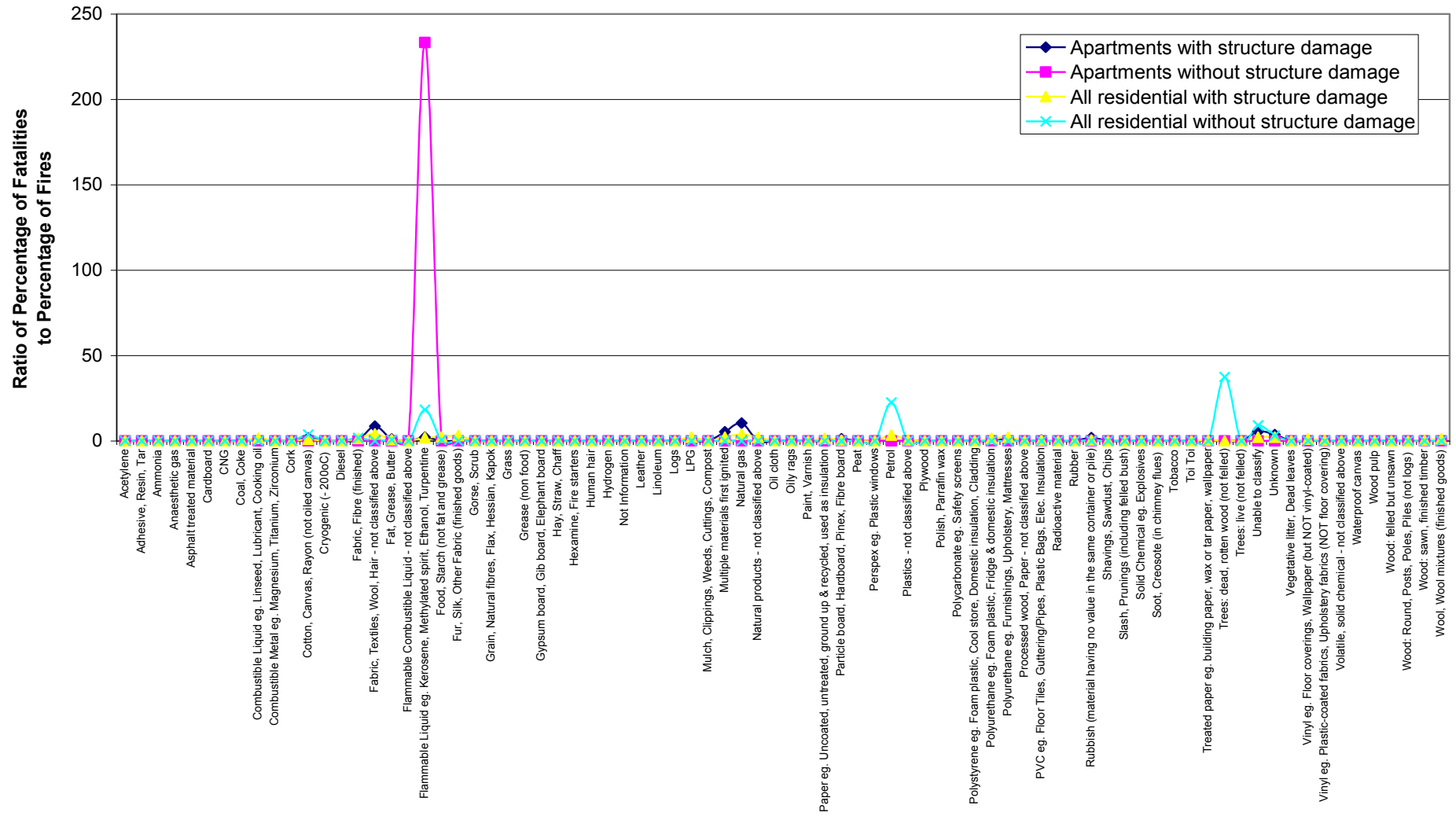


Figure 234: Ratio of percentage of total fatalities to percentage of total number of fires reported according to first material ignited (1995-2005).

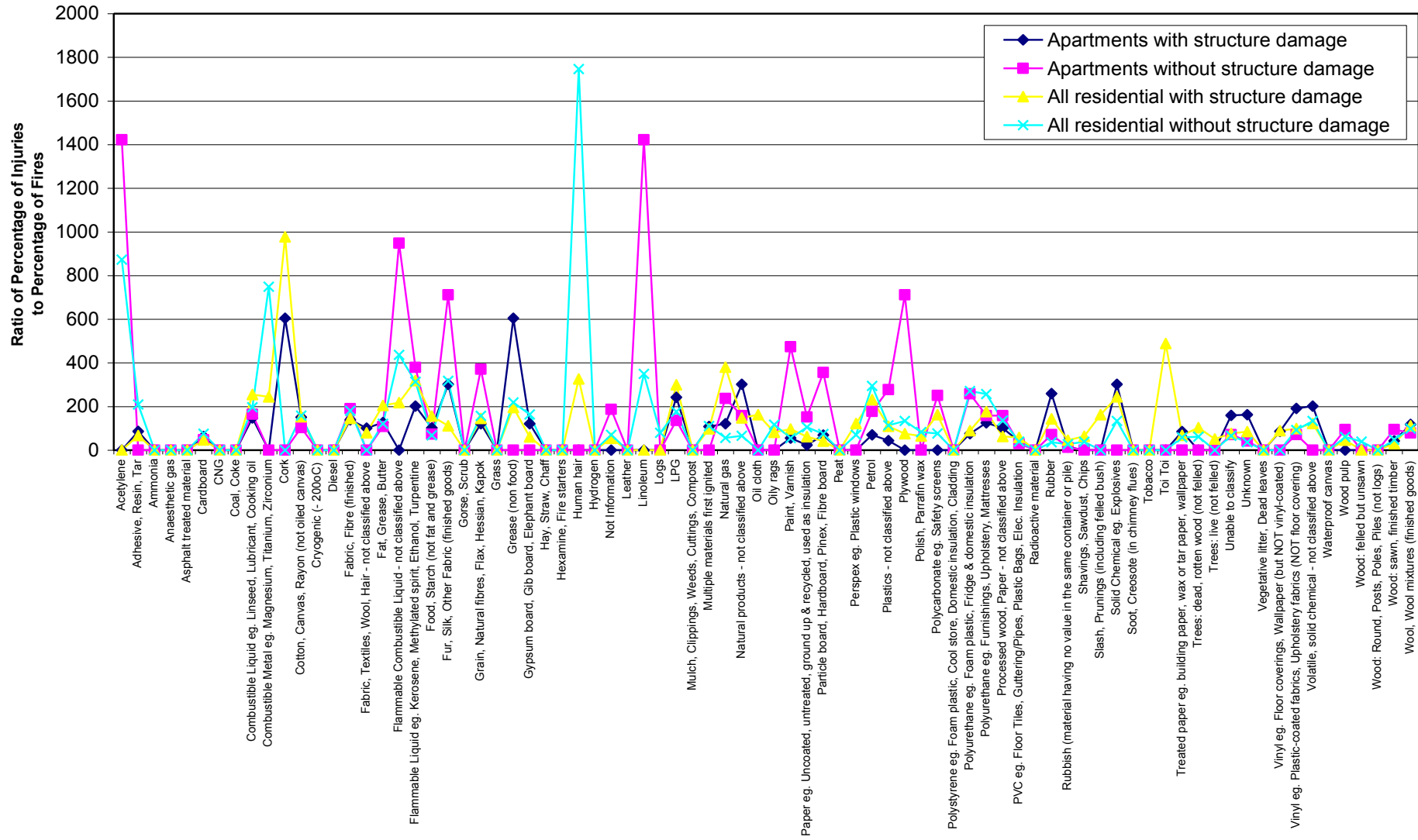


Figure 235: Ratio of percentage of total injuries to percentage of total number of fires reported according to first material ignited (1995-2005).

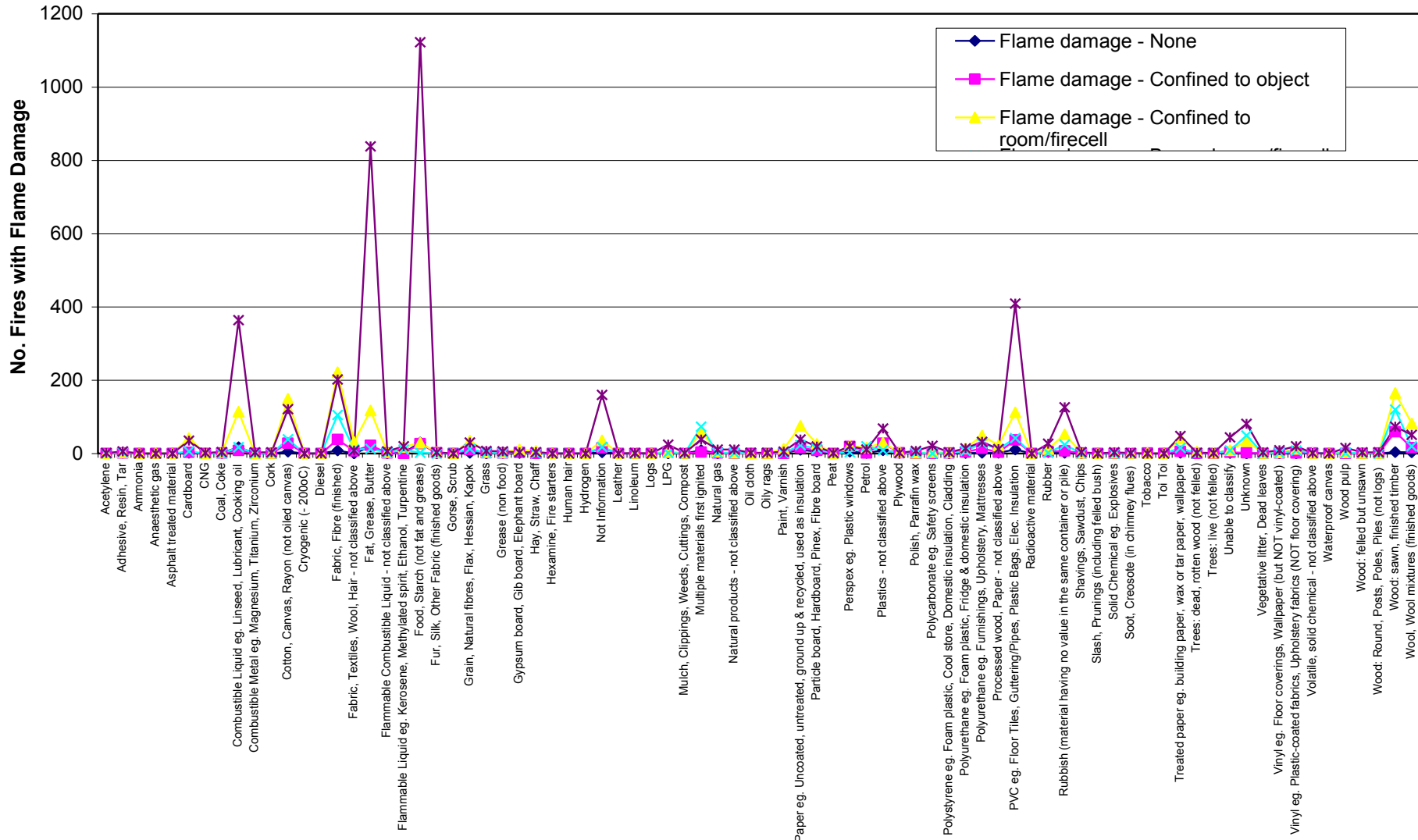


Figure 236: Number of apartment fires according to extent of flame damage and first material ignited (1986-2005).

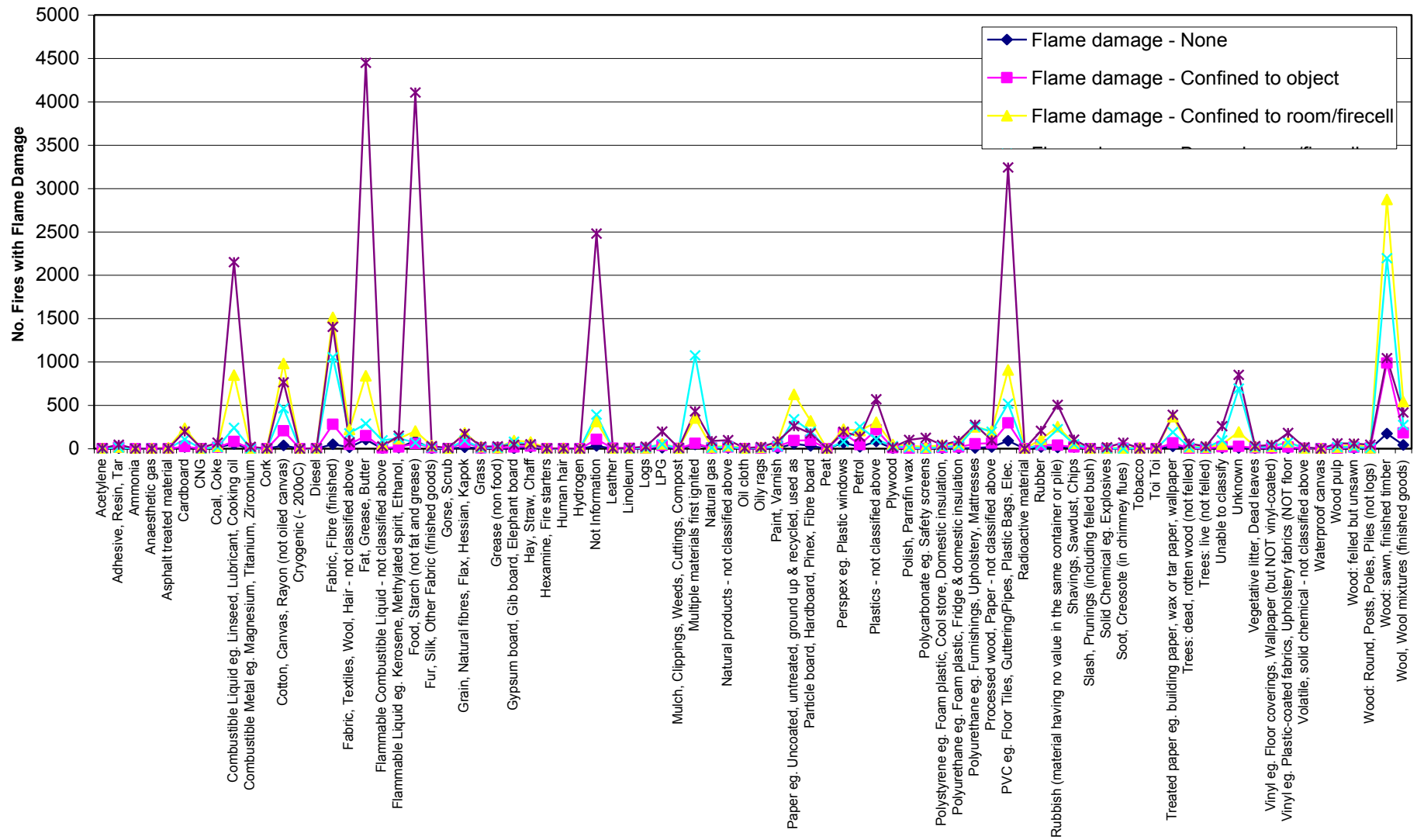


Figure 237: Number of all residential fires according to extent of flame damage and first material ignited (1986-2005).

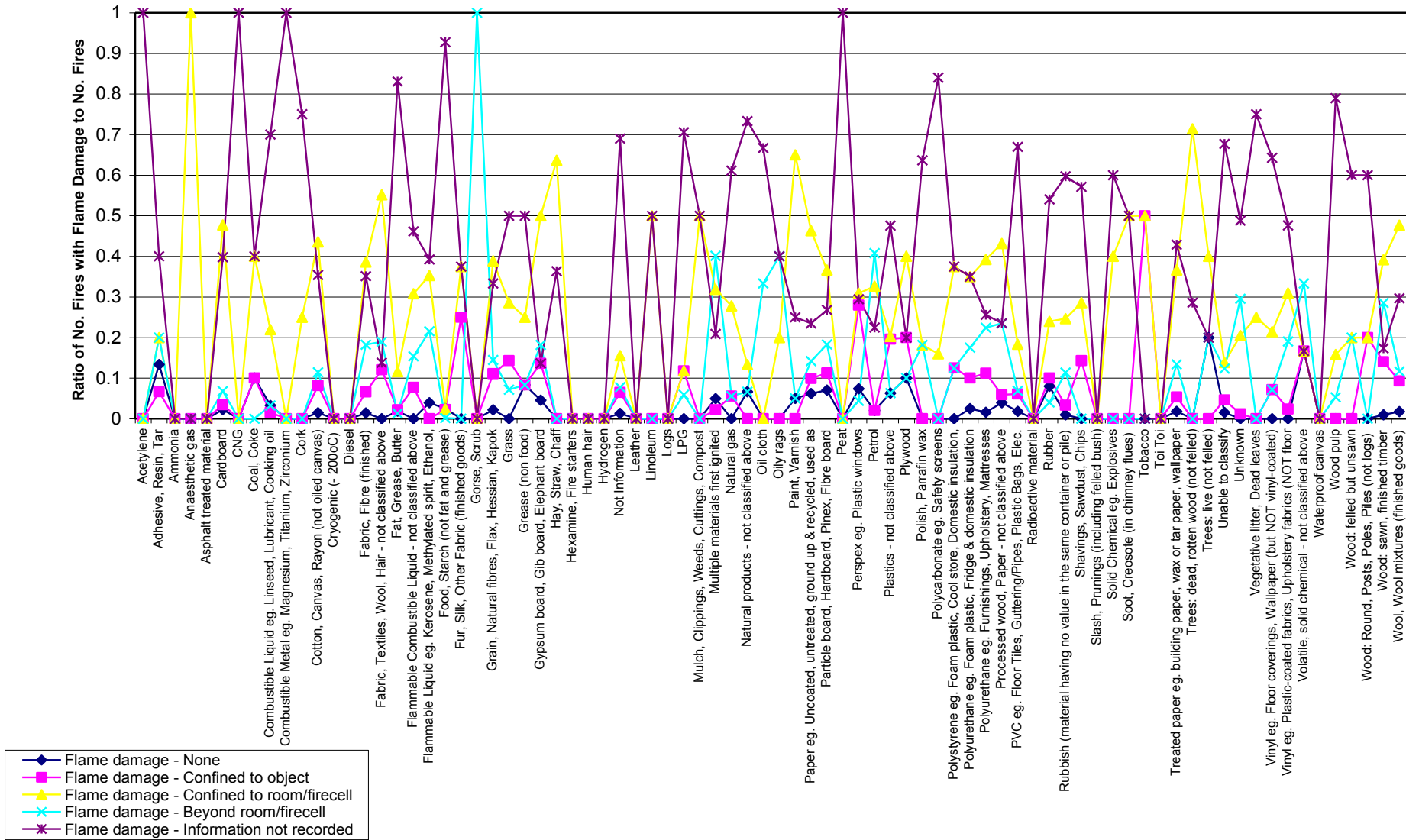


Figure 238: Ratio of the number of apartment fires according to extent of flame damage to the number of total fires attributed to each material first ignited (1986-2005).

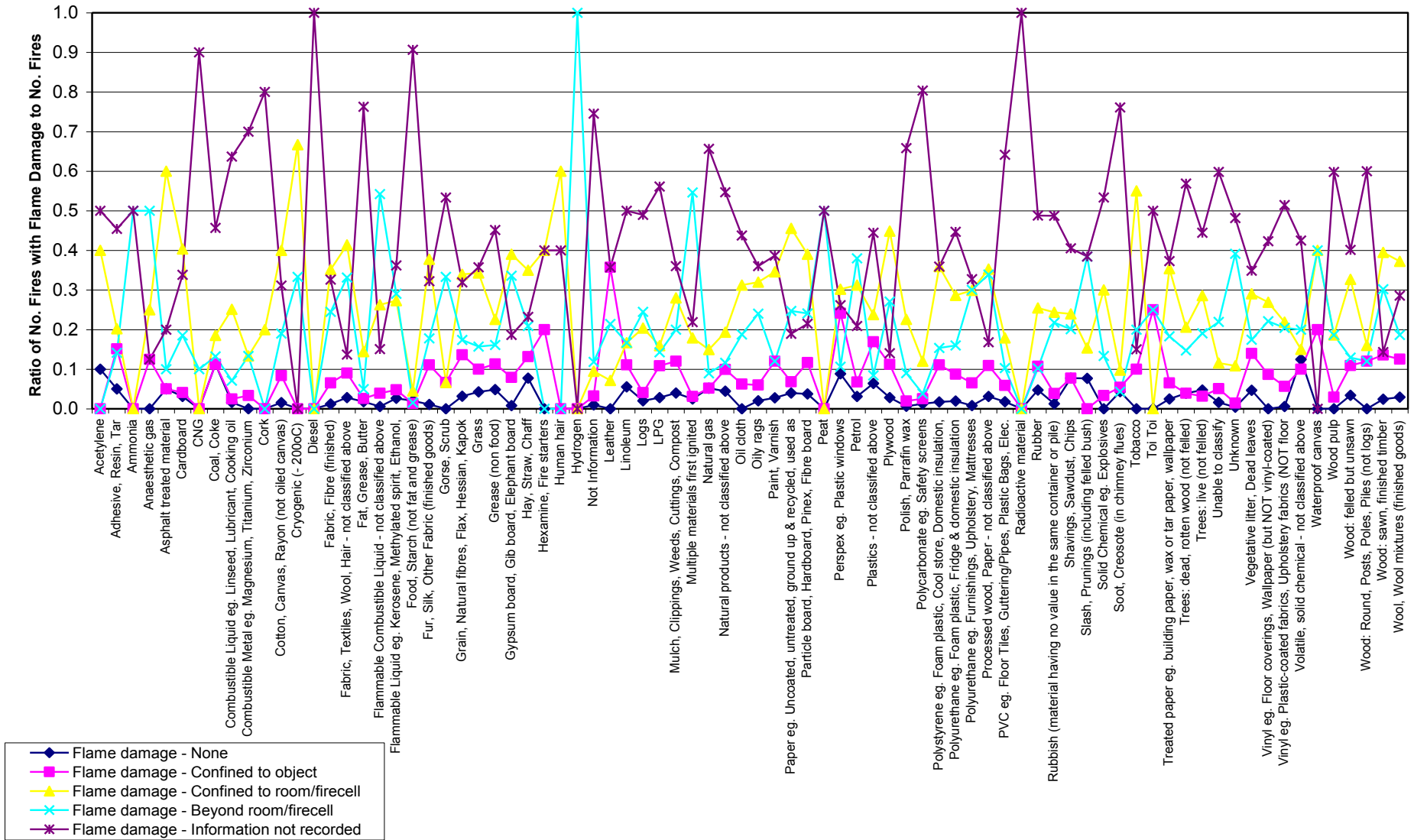


Figure 239: Ratio of the number of apartment fires according to extent of flame damage to the number of total fires attributed to each material first ignited (1986-2005).

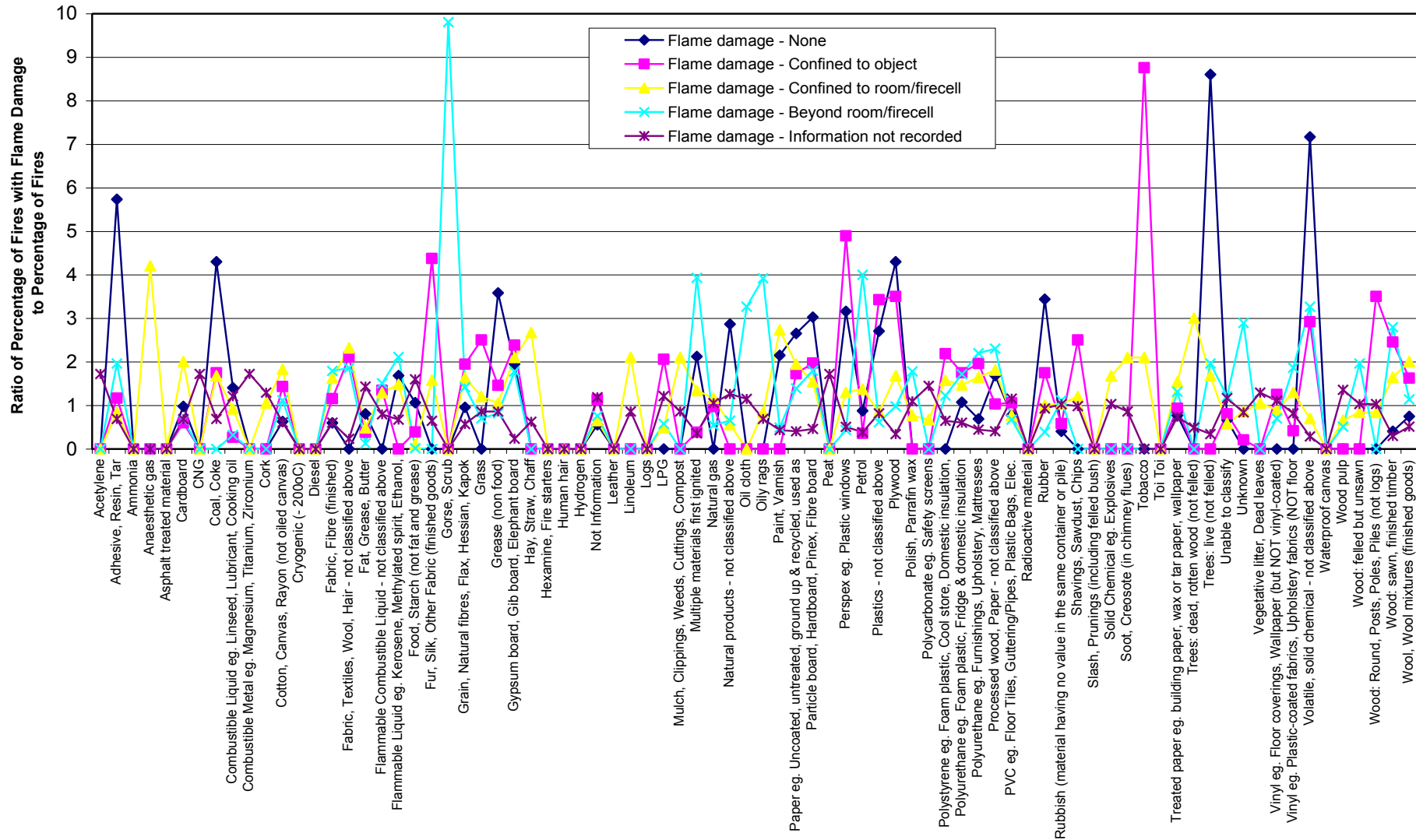


Figure 240: Ratio of the percentage of apartment fires according to extent of flame damage to the percentage of total fires attributed to each material first ignited (1986-2005).

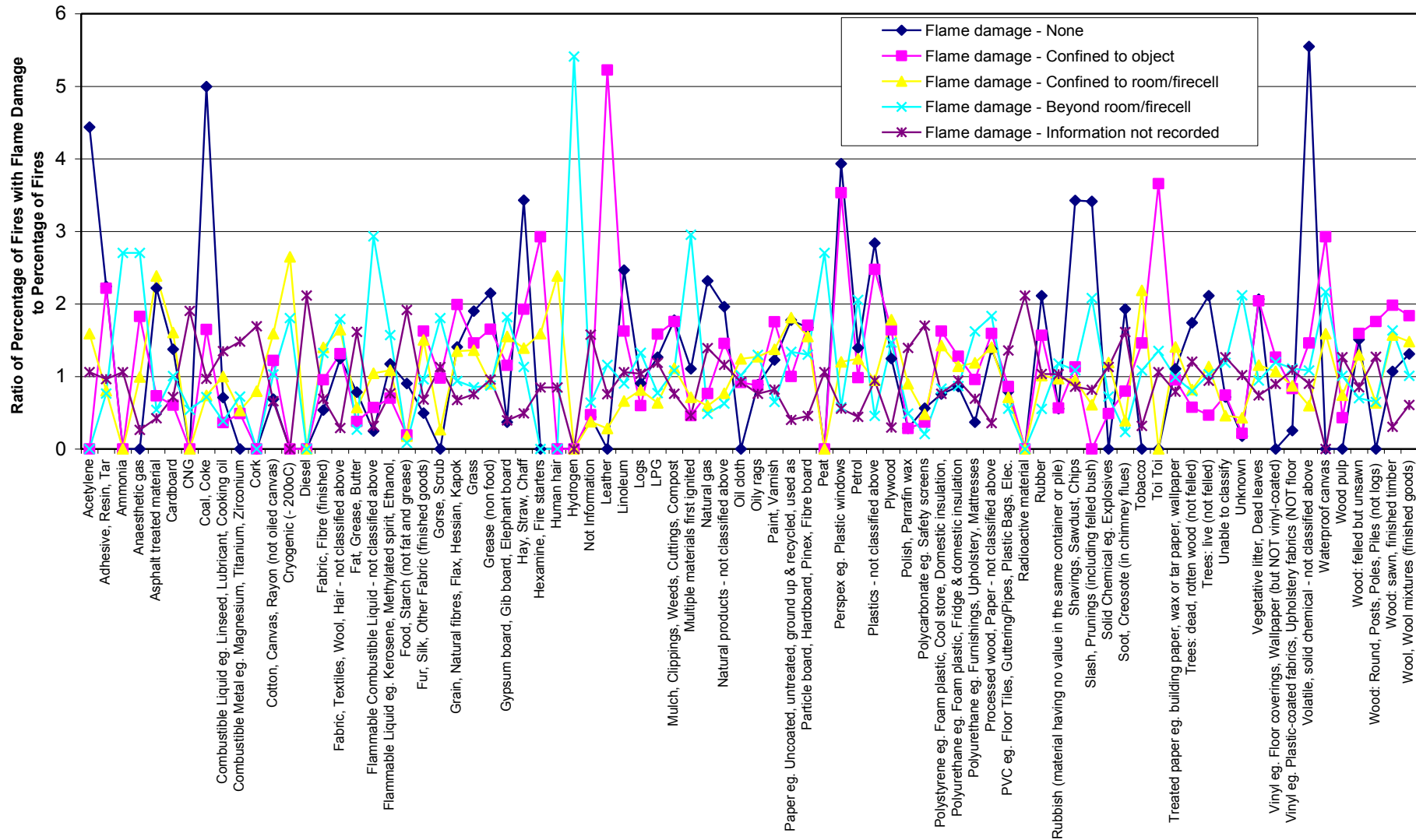


Figure 241: Ratio of the percentage of all residential fires according to extent of flame damage to the percentage of total fires attributed to each material first ignited (1986-2005).

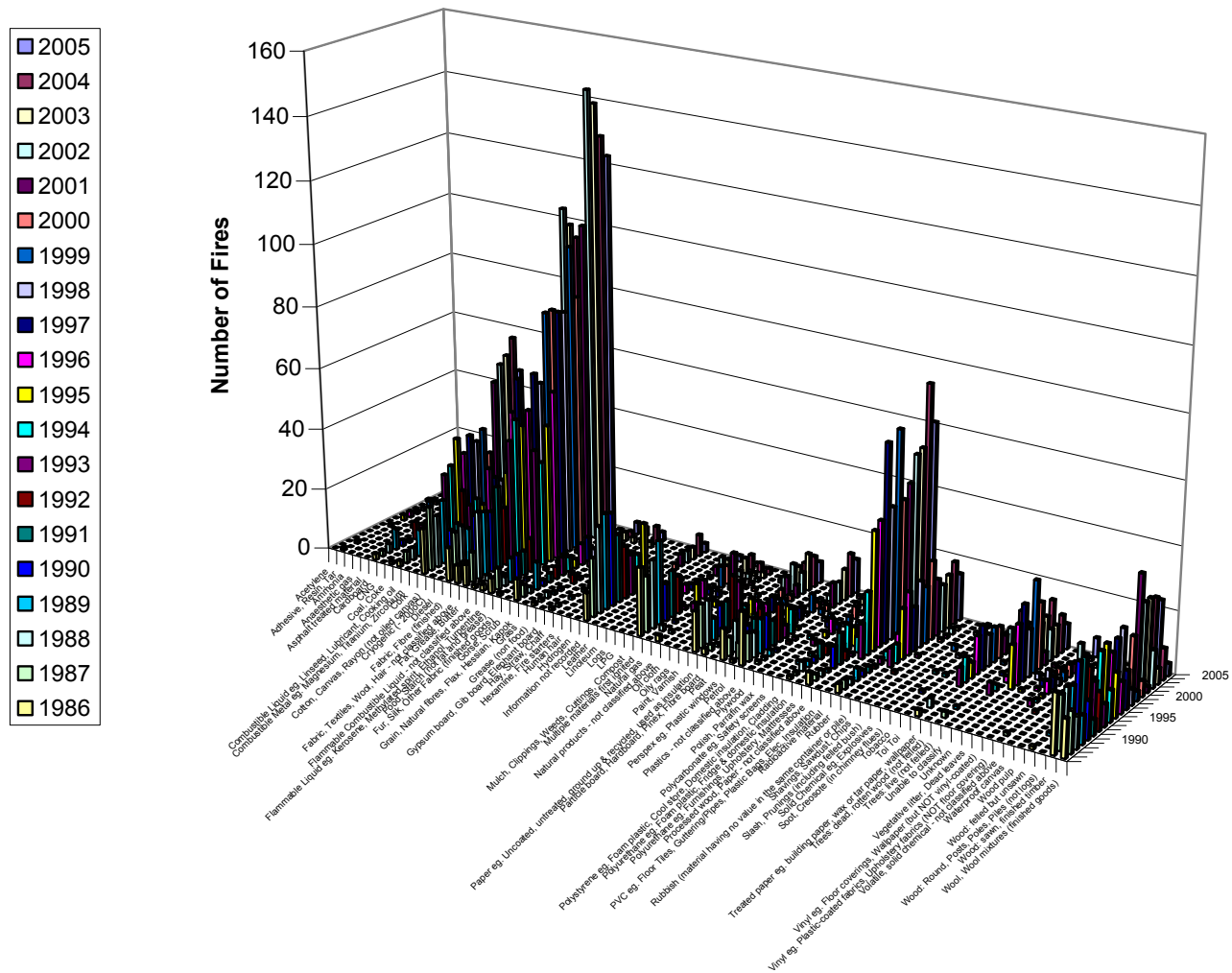


Figure 242: Number of fires that occurred in apartments each year for each material first ignited (1986 – 2005).

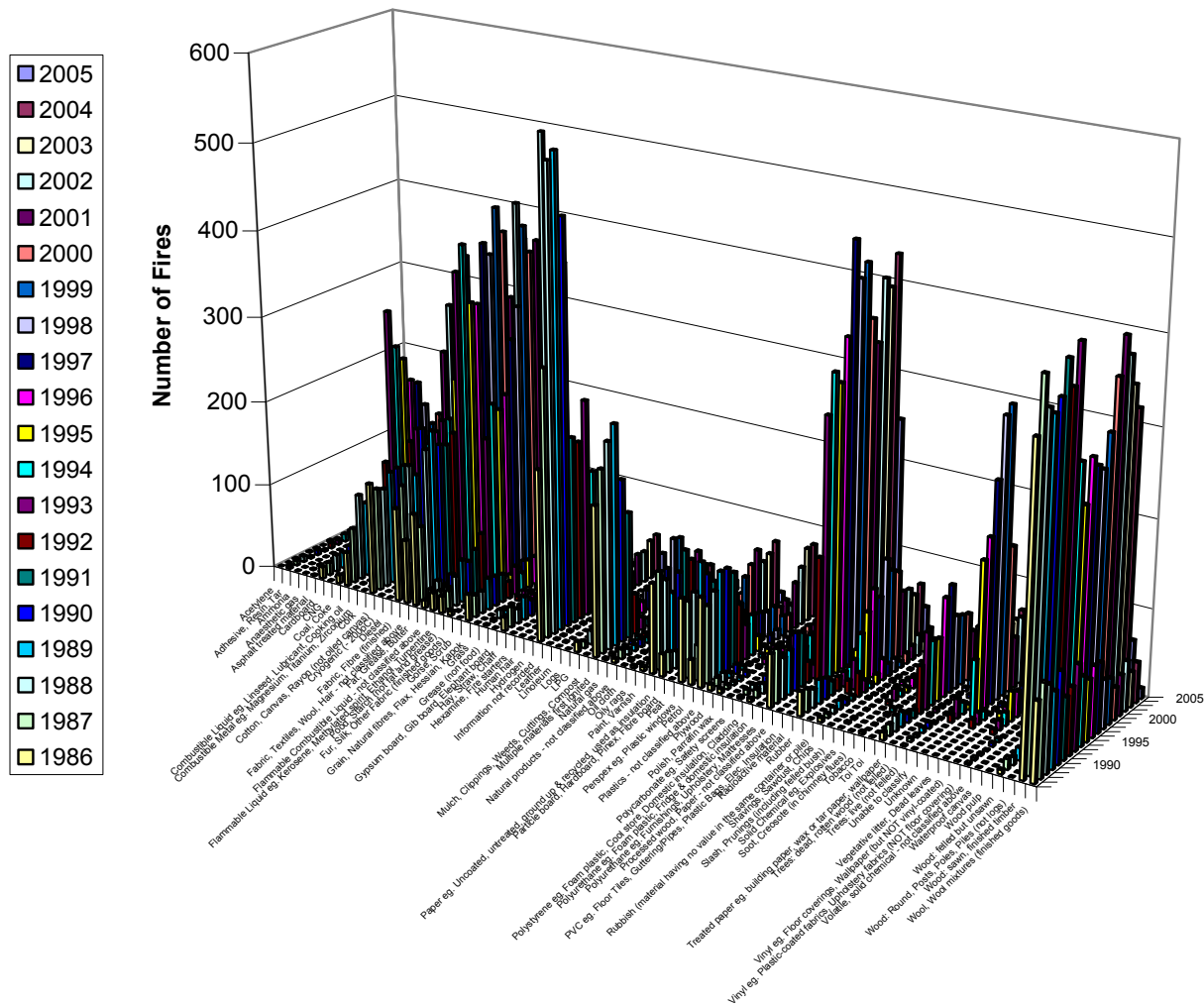


Figure 243: Number of fires that occurred in all residential structures each year for each material first ignited (1986 – 2005).

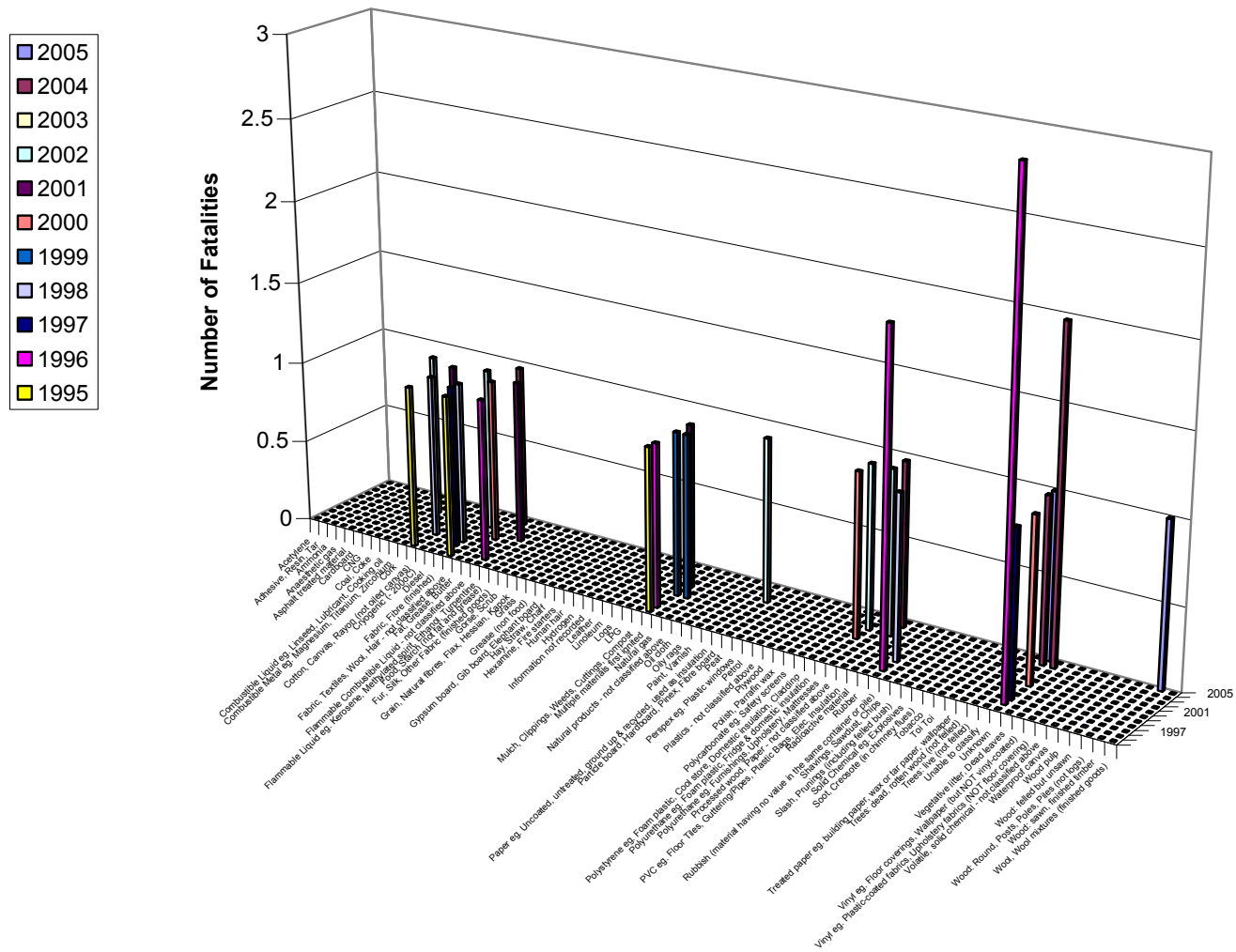


Figure 244: Number of fatalities from apartment fires each year for each material first ignited (1995-2005).

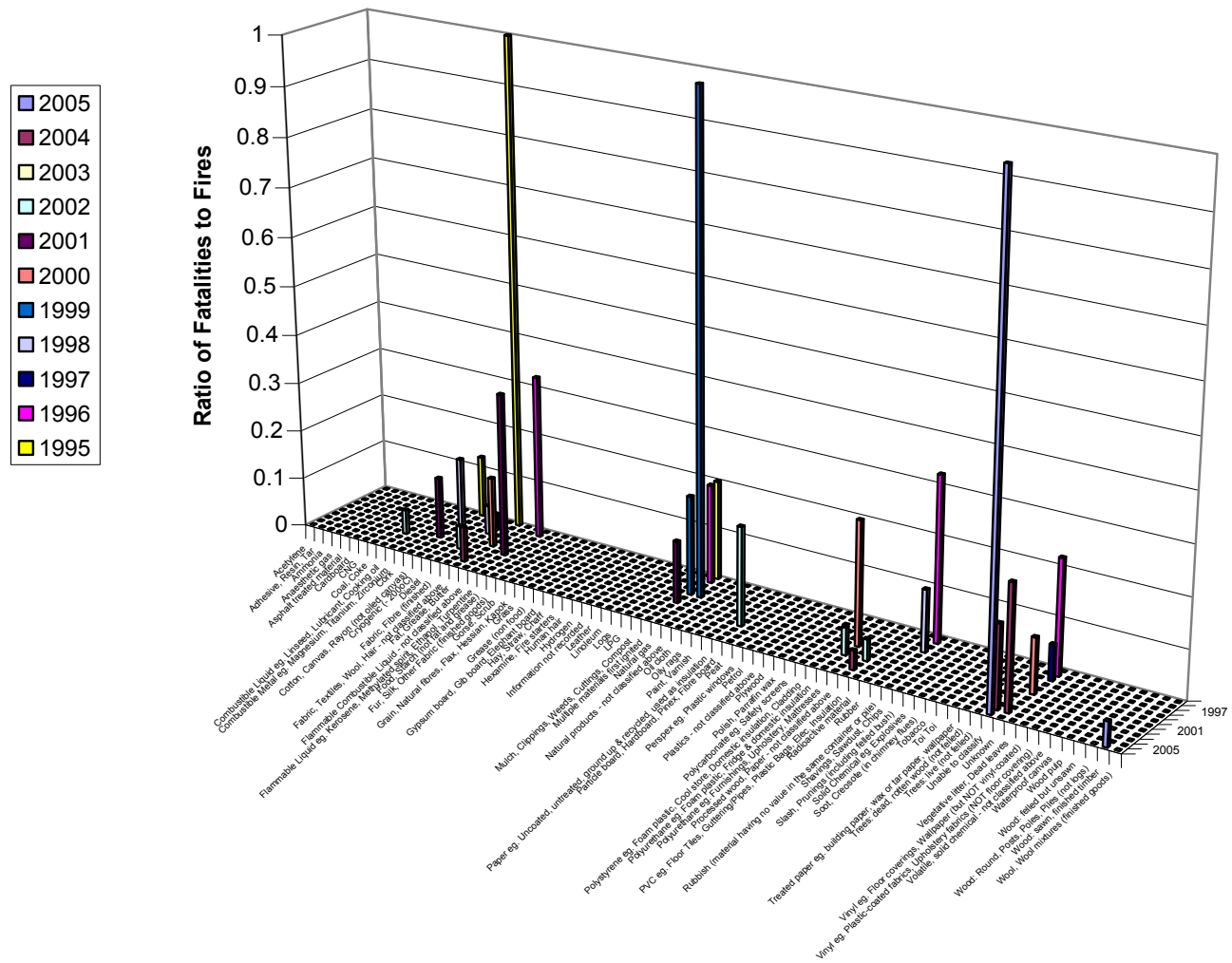


Figure 245: Ratio of number of fatalities to number of fires in apartments for each material first ignited (1995 – 2005).

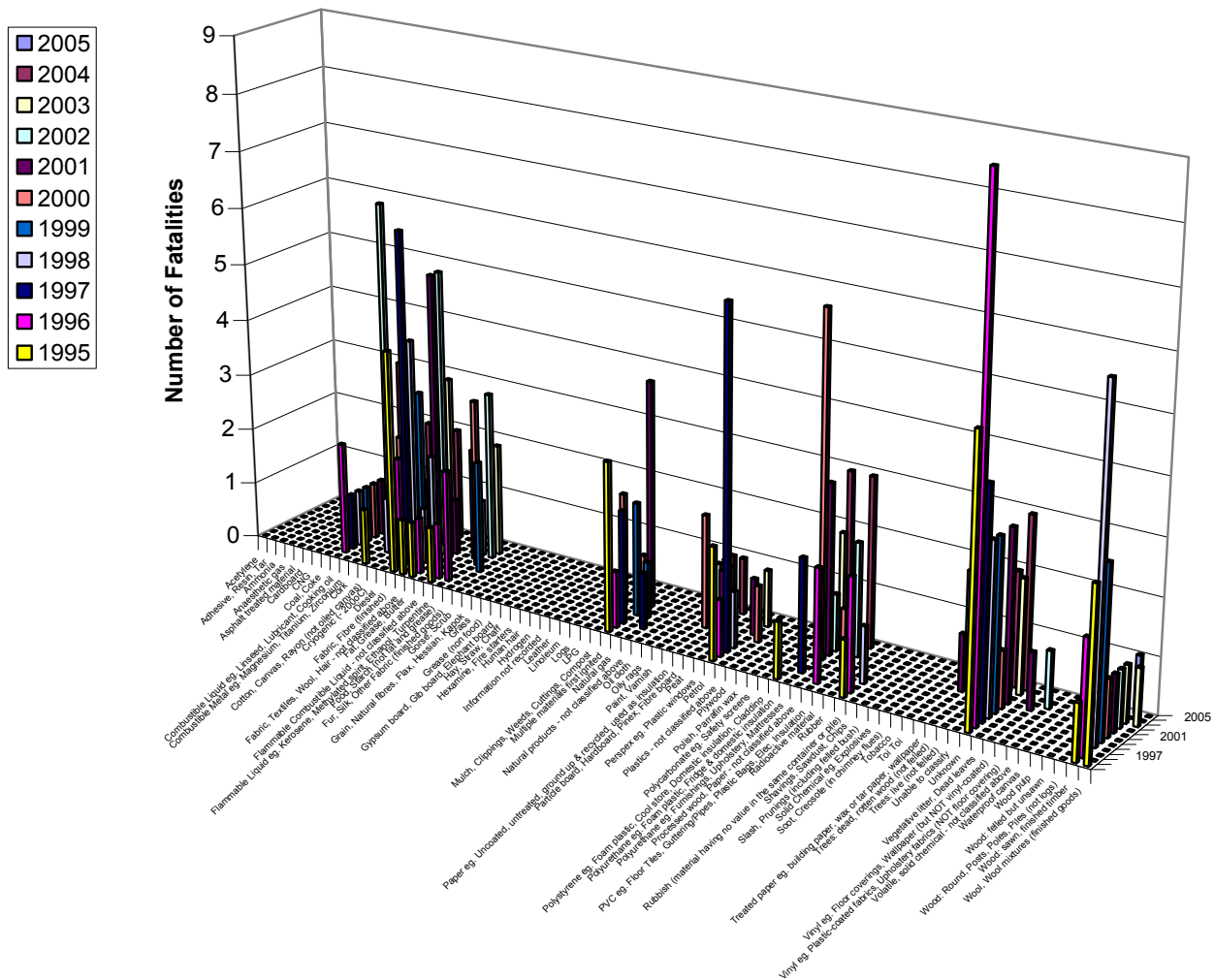


Figure 246: Number of fatalities from all residential structures each year for each material first ignited (1995 – 2005).

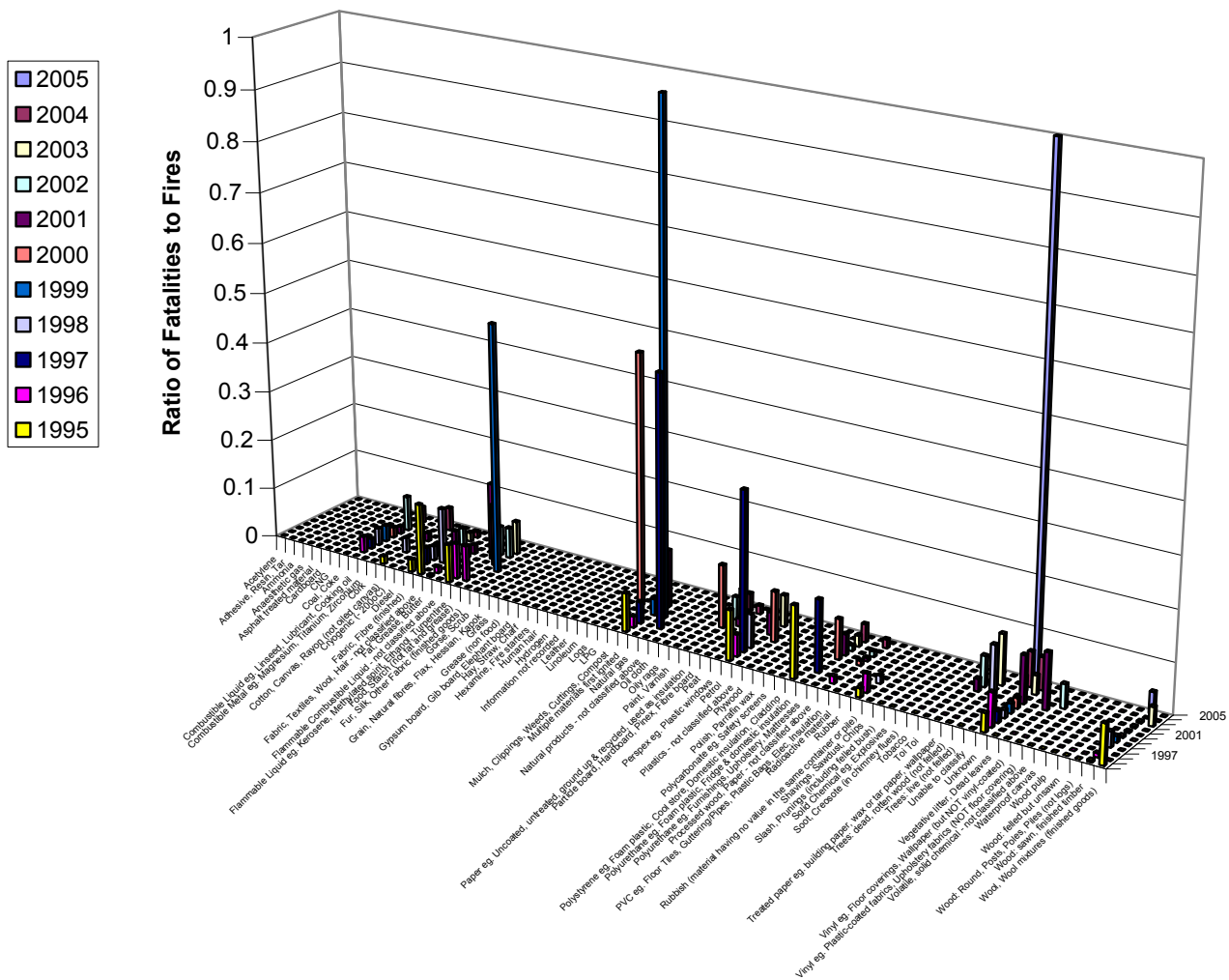


Figure 247: Ratio of number of fatalities to number of fires in all residential structures for each material first ignited (1995 – 2005).

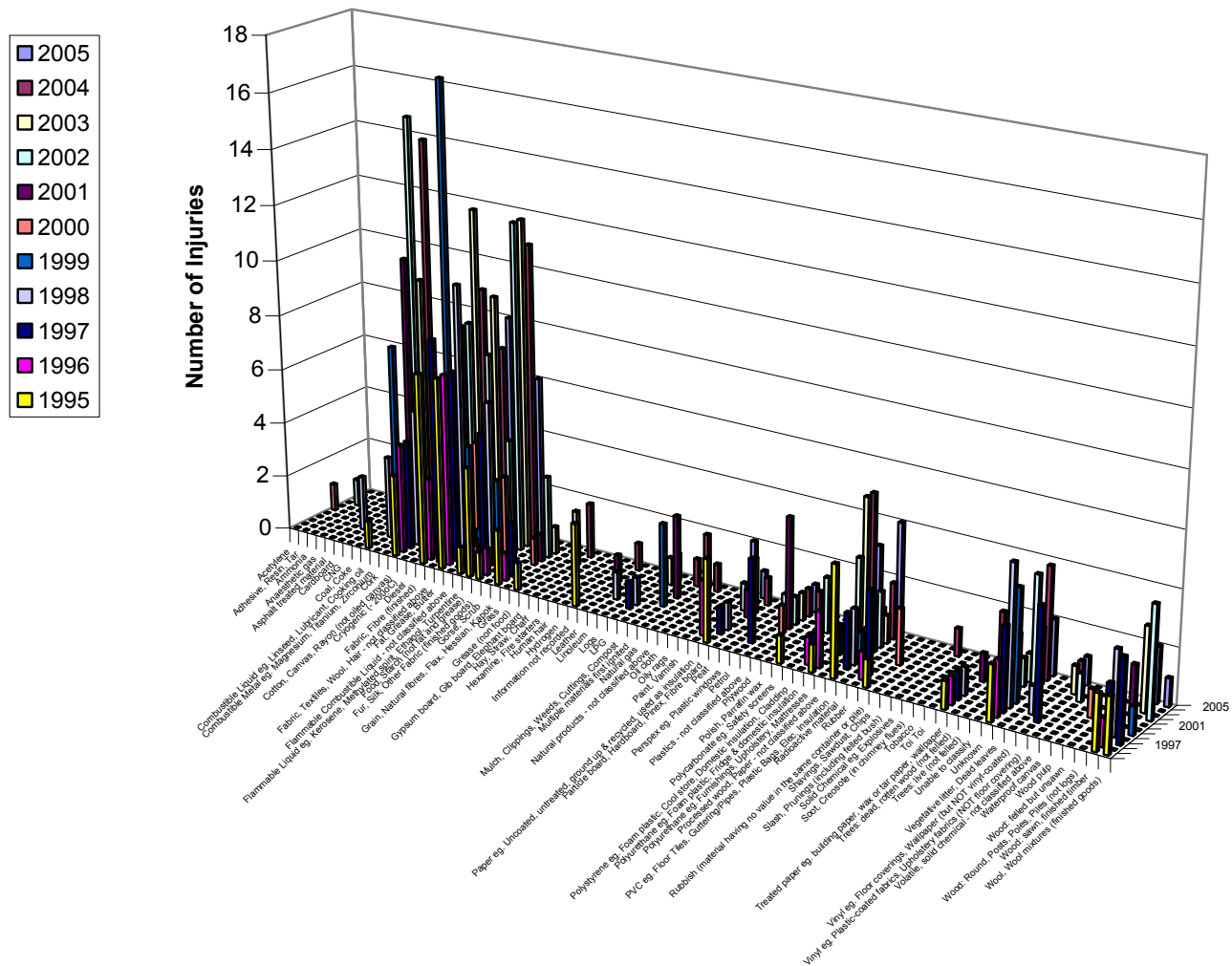


Figure 248: Number of injuries from fires in apartments each year for each material first ignited (1995 – 2005).

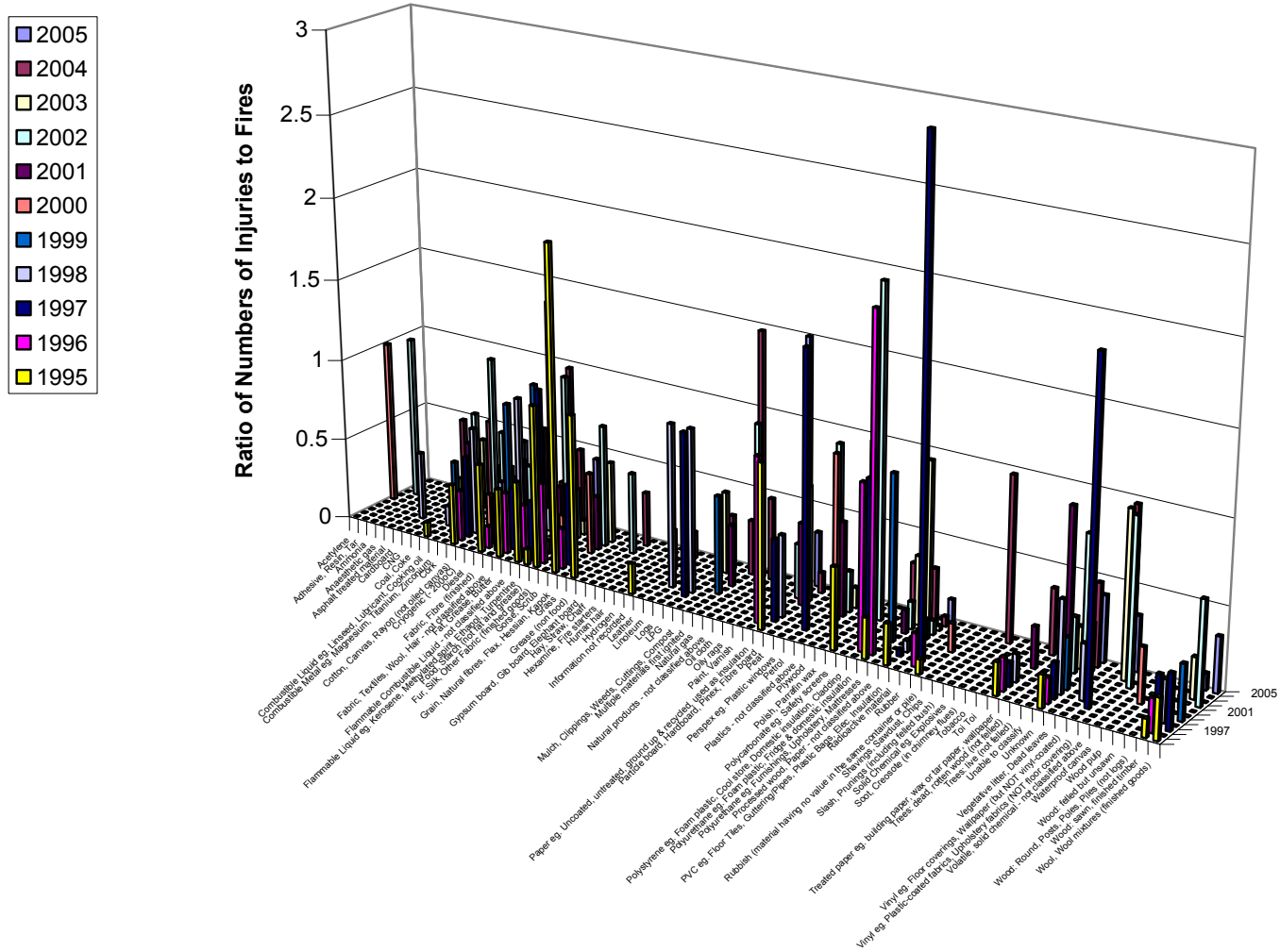


Figure 249: Ratio of the number of injuries to the number of fires in all residential structures for each year for each material first ignited (1995 – 2005).

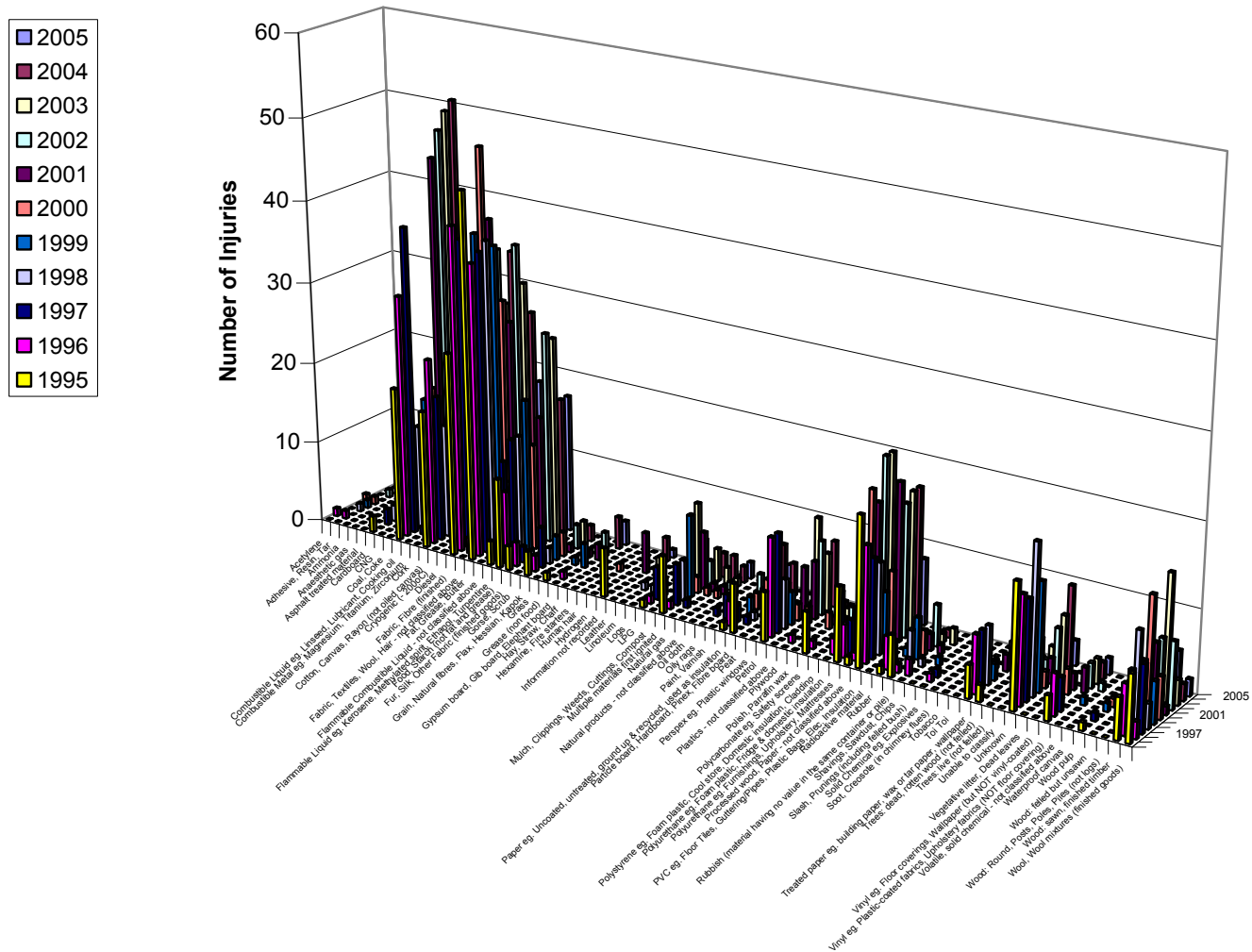


Figure 250: Number of injuries from fires in all residential structures each year for each material first ignited (1995 – 2005).

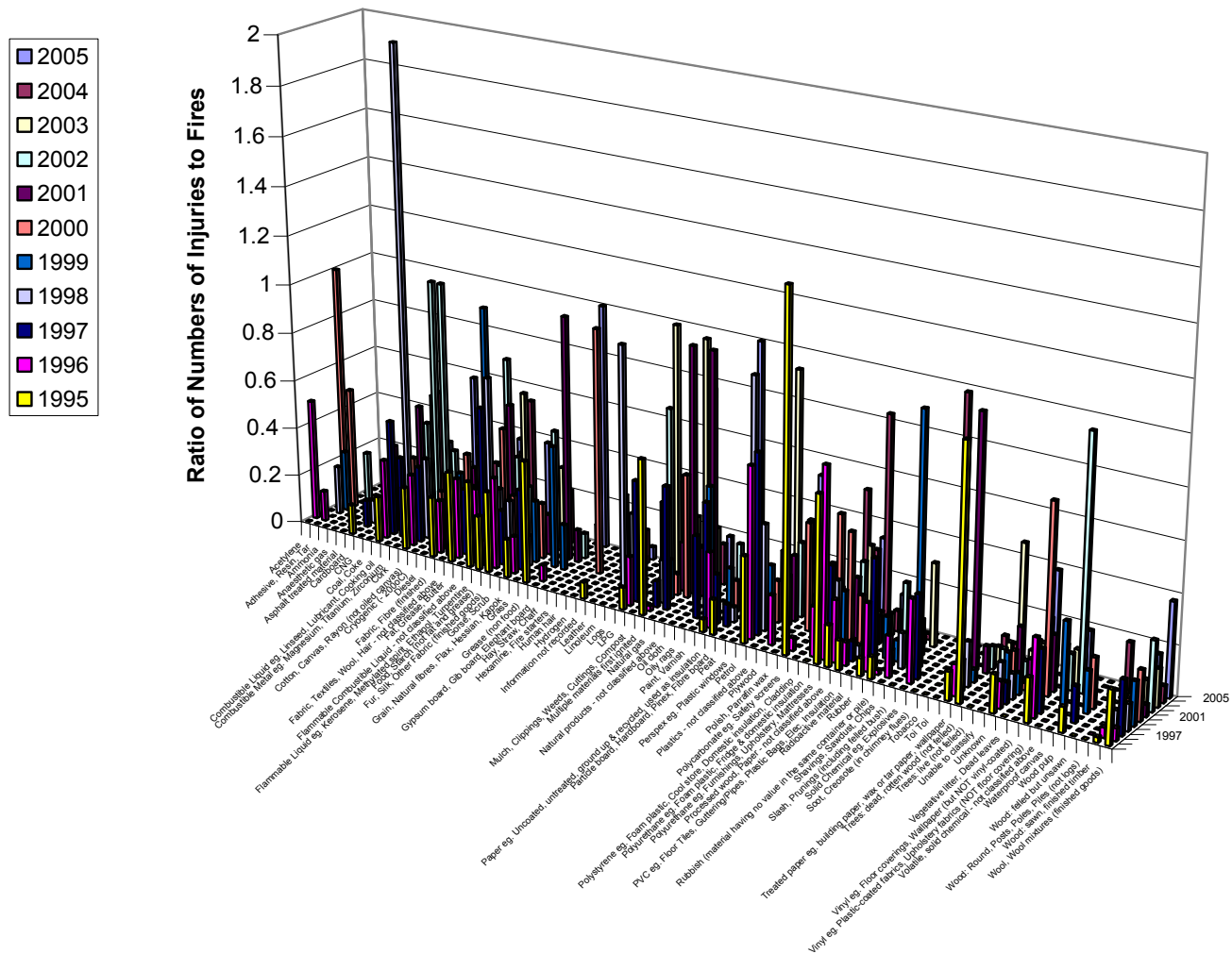


Figure 251: Ratio of the number of injuries to the number of fires that occurred in all residential structures for each year for each material first ignited (1995 – 2005).

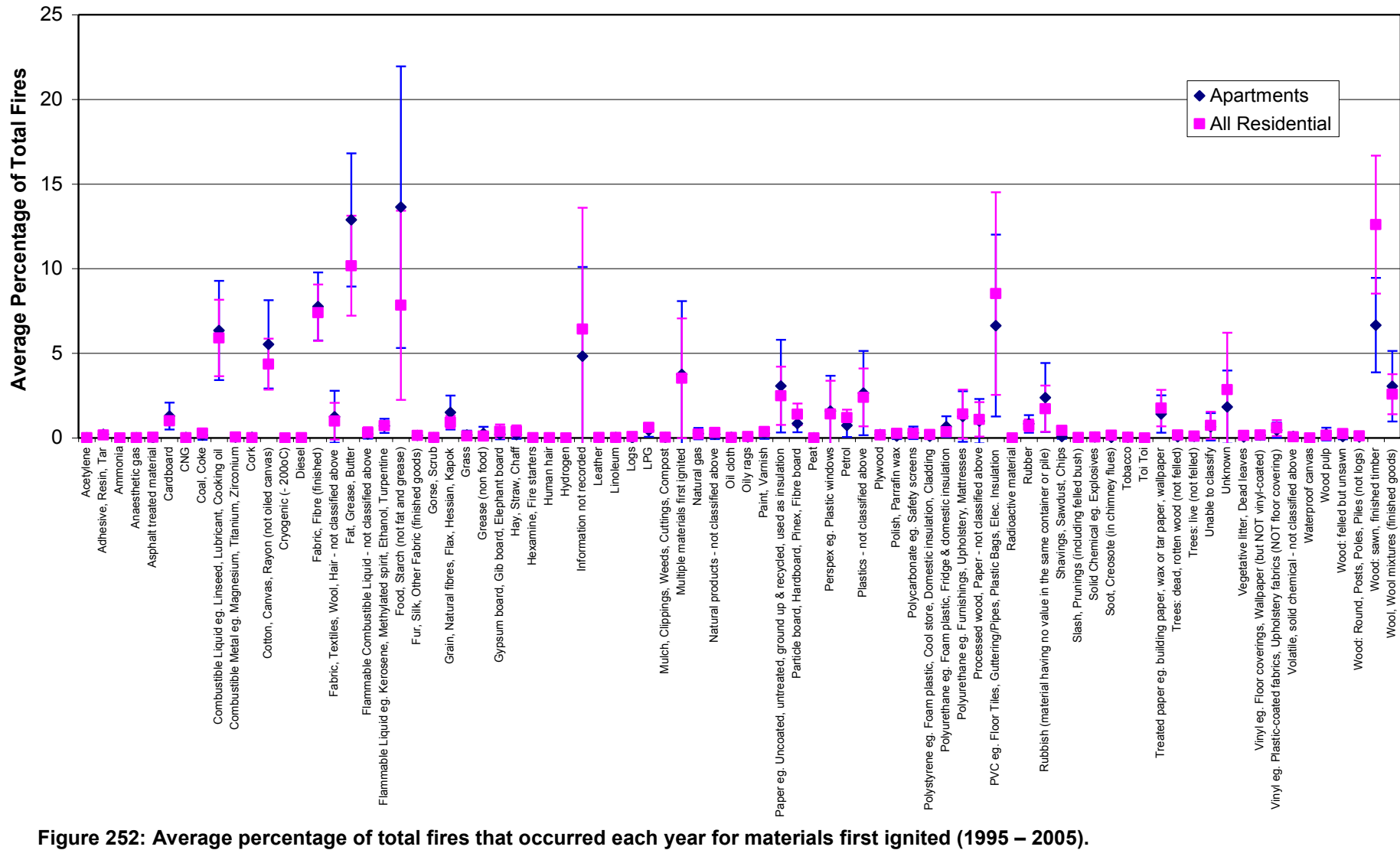


Figure 252: Average percentage of total fires that occurred each year for materials first ignited (1995 – 2005).

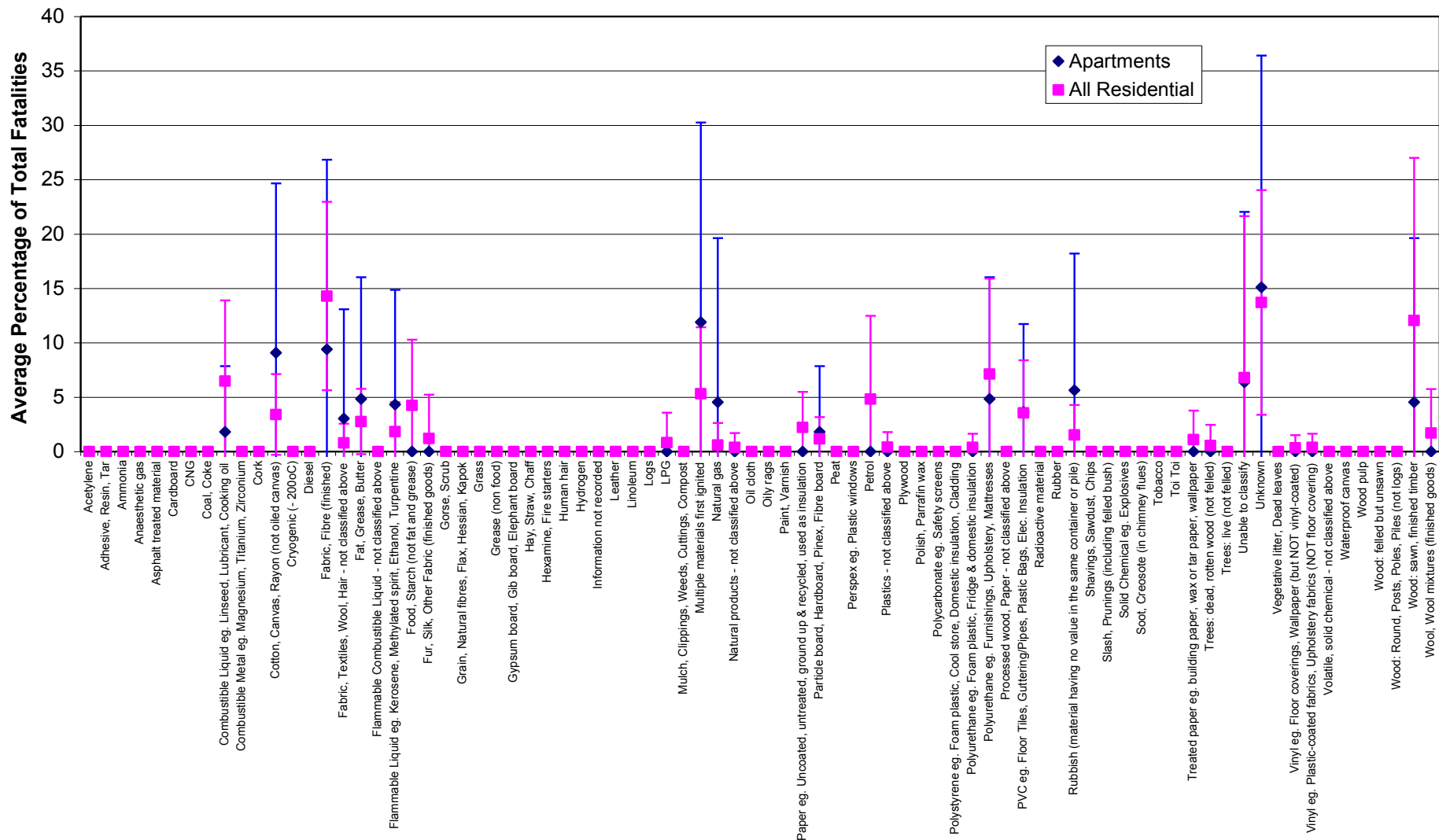


Figure 253: Average percentage of total fatalities that occurred each year for materials first ignited (1995 – 2005).

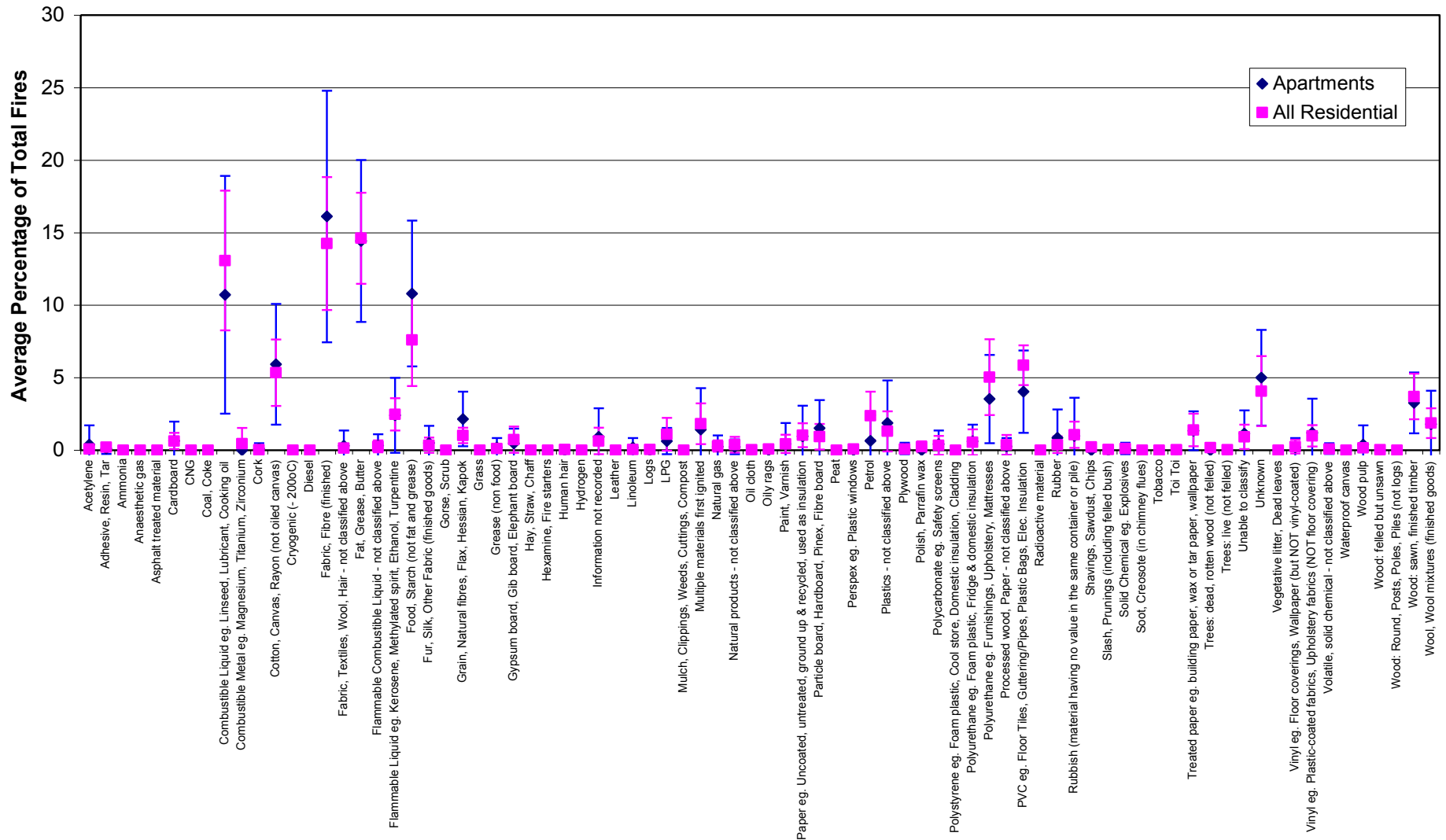


Figure 254: Average percentage of total injuries that occurred each year for each material first ignited (1995 – 2005).

APPENDIX I CAUSE OF IGNITION – DATA ANALYSIS OF ALL CLASSES

Table 70: Ranking of the most common cause of ignition by percentage of total fires (using NZFS from 1986 – 2005).

Apartments with damage		Apartments without damage		All residential with damage		All residential without damage	
Cause of Ignition	% Total Fires	Cause of Ignition	% Total Fires	Cause of Ignition	% Total Fires	Cause of Ignition	% Total Fires
Careless disposal: cigarettes, cigars, ashes, embers	10.5	Unattended/Asleep: kitchen, cooking fire	28.6	Careless disposal: cigarettes, cigars, ashes, embers	8.7	Equipment unattended	16.7
Suspicious	9.2	Equipment unattended	17.9	Suspicious	6.9	Unattended/Asleep: kitchen, cooking fire	15.8
Unattended/Asleep: kitchen, cooking fire	8.8	Other electrical failure	4.2	Unable to classify	6.4	Unable to classify	6.5
Unlawful	6.6	Heat source too close to combustibles: fires near trees, welding/cutting, debris	3.5	Equipment unattended	5.9	Short circuit, earth fault	5.3
Equipment unattended	5.6	Short circuit, earth fault	3.2	People playing with heat sources	5.4	Other electrical failure	5.0
Short circuit, earth fault	5.0	Careless disposal: cigarettes, cigars, ashes, embers	3.0	Short circuit, earth fault	5.3	Heat source too close to combustibles: fires near trees, welding/cutting, debris	3.6
People playing with heat sources	4.9	Failure to clean	2.9	Other electrical failure	4.9	Part failure, leak or break	3.3
Unable to classify	4.8	Accidentally turned on: not turned off	2.7	Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.5	Failure to clean	3.3
Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.7	Carelessness with heat source - not classified above	2.6	Unlawful	4.3	Combustible placed too close to heat source	3.2
Other electrical failure	4.7	Reckless act (involving fire)	2.4	Unattended/Asleep: kitchen, cooking fire	4.3	Carelessness with heat source - not classified above	3.0

Table 71: Ranking of the most common cause of ignition by percentage of total fires (using NZFS from 1986 – 2005).

Apartments		All residential	
Cause of Ignition	% Total Fires	Cause of Ignition	% Total Fires
Unattended/Asleep: kitchen, cooking fire	19.8	Equipment unattended	10.6
Equipment unattended	12.4	Unattended/Asleep: kitchen, cooking fire	9.3
Careless disposal: cigarettes, cigars, ashes, embers	6.3	Unable to classify	6.4
Suspicious	5.0	Careless disposal: cigarettes, cigars, ashes, embers	6.1
Other electrical failure	4.4	Short circuit, earth fault	5.3
Unlawful	4.2	Other electrical failure	4.9
Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.1	Suspicious	4.4
Short circuit, earth fault	4.0	Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.1
Unable to classify	3.3	People playing with heat sources	4.0
People playing with heat sources	2.9	Combustible placed too close to heat source	3.7

Table 72: Ranking of the most common cause of ignition by percentage of total civilian fatalities (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Cause of Ignition	% Total Fatalities	Cause of Ignition	% Total Fatalities	Cause of Ignition	% Total Fatalities	Cause of Ignition	% Total Fatalities
Unattended/Asleep: kitchen, cooking fire	20.6	Falling asleep: other (includes smoking in bed)	100.0	Unattended/Asleep: kitchen, cooking fire	16.9	Falling asleep: other (includes smoking in bed)	22.2
Careless disposal: cigarettes, cigars, ashes, embers	14.7			Unknown	15.1	Careless disposal: cigarettes, cigars, ashes, embers	11.1
Falling asleep: other (includes smoking in bed)	14.7			Falling asleep: other (includes smoking in bed)	10.2	Equipment unattended	11.1
Unknown	11.8			Careless disposal: cigarettes, cigars, ashes, embers	7.1	Failure to use ordinary care	11.1
Other electrical failure	5.9			People playing with heat sources	6.2	Lawful	11.1
People playing with heat sources	5.9			Suspicious	6.2	People otherwise impaired: unconscious, mental/physical impairment)	11.1
Suspicious	5.9			Unlawful	4.4	Reckless act (involving fire)	11.1
Unlawful	5.9			Other electrical failure	4.0	Unknown	11.1
Failure to use ordinary care	2.9			Short circuit, earth fault	4.0		
Flammable liquid/gas spilled or accidentally released	2.9			Equipment unattended	2.7		

Table 73: Ranking of the most common cause of ignition by percentage of total civilian fatalities (1995 – 2005).

Apartments		All Residential	
Cause of Ignition	% Total Fatalities	Cause of Ignition	% Total Fatalities
Unattended/Asleep: kitchen, cooking fire	20.0	Unattended/Asleep: kitchen, cooking fire	16.2
Falling asleep: other (includes smoking in bed)	17.1	Unknown	15.0
Careless disposal: cigarettes, cigars, ashes, embers	14.3	Falling asleep: other (includes smoking in bed)	10.7
Unknown	11.4	Careless disposal: cigarettes, cigars, ashes, embers	7.3
Other electrical failure	5.7	People playing with heat sources	6.0
People playing with heat sources	5.7	Suspicious	6.0
Suspicious	5.7	Unlawful	4.3
Unlawful	5.7	Other electrical failure	3.8
Failure to use ordinary care	2.9	Short circuit, earth fault	3.8
Flammable liquid/gas spilled or accidentally released	2.9	Equipment unattended	3.0

Table 74: Ranking of the most common cause of ignition by percentage of total civilian injuries (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Cause of Ignition	% Total Injuries	Cause of Ignition	% Total Injuries	Cause of Ignition	% Total Injuries	Cause of Ignition	% Total Injuries
Unattended/Asleep: kitchen, cooking fire	16.7	Unattended/Asleep: kitchen, cooking fire	39.0	Unattended/Asleep: kitchen, cooking fire	16.1	Unattended/Asleep: kitchen, cooking fire	27.5
Careless disposal: cigarettes, cigars, ashes, embers	11.0	Equipment unattended	11.0	People playing with heat sources	7.8	Equipment unattended	14.9
Unlawful	7.7	Heat source too close to combustibles: fires near trees, welding/cutting, debris	6.5	Equipment unattended	7.7	Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.9
People playing with heat sources	7.0	Falling asleep: other (includes smoking in bed)	4.9	Heat source too close to combustibles: fires near trees, welding/cutting, debris	7.3	People playing with heat sources	4.8
Falling asleep: other (includes smoking in bed)	6.7	People impaired by drugs or alcohol	3.3	Careless disposal: cigarettes, cigars, ashes, embers	7.1	Other electrical failure	4.0
Heat source too close to combustibles: fires near trees, welding/cutting, debris	6.0	Reckless act (involving fire)	3.3	Unknown	4.7	Falling asleep: other (includes smoking in bed)	3.9
Equipment unattended	4.7	Combustible placed too close to heat source	2.8	Unlawful	4.3	Reckless act (involving fire)	3.9
Suspicious	4.7	Suspicious	2.8	Short circuit, earth fault	4.0	Combustible placed too close to heat source	3.6
Unknown	4.0	Accidentally turned on: not turned off	2.4	Other electrical failure	3.6	Carelessness with heat source - not classified above	3.5
Other electrical failure	3.0	Carelessness with heat source - not classified above	2.4	Reckless act (involving fire)	3.6	Careless disposal: cigarettes, cigars, ashes, embers	2.2

Table 75: Ranking of the most common cause of ignition by percentage of total civilian injuries (1995 – 2005).

Apartments		All Residential	
Cause of Ignition	% Total Injuries	Cause of Ignition	% Total Injuries
Unattended/Asleep: kitchen, cooking fire	26.7	Unattended/Asleep: kitchen, cooking fire	20.8
Equipment unattended	7.5	Equipment unattended	10.7
Careless disposal: cigarettes, cigars, ashes, embers	6.2	People playing with heat sources	6.6
Heat source too close to combustibles: fires near trees, welding/cutting, debris	6.2	Heat source too close to combustibles: fires near trees, welding/cutting, debris	6.3
Falling asleep: other (includes smoking in bed)	5.9	Careless disposal: cigarettes, cigars, ashes, embers	5.1
People playing with heat sources	4.6	Other electrical failure	3.7
Unlawful	4.6	Reckless act (involving fire)	3.7
Suspicious	3.8	Falling asleep: other (includes smoking in bed)	3.7
Reckless act (involving fire)	2.9	Unknown	3.3
Unknown	2.6	Short circuit, earth fault	3.1

Table 76: Highest ratios of numbers of civilian fatalities to numbers of fires for each cause of ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Cause of Ignition	Ratio of Fatalities to Fires	Cause of Ignition	Ratio of Fatalities to Fires	Cause of Ignition	Ratio of Fatalities to Fires	Cause of Ignition	Ratio of Fatalities to Fires
Falling asleep: other (includes smoking in bed)	0.1190	Falling asleep: other (includes smoking in bed)	0.0208	Falling asleep: other (includes smoking in bed)	0.1456	Falling asleep: other (includes smoking in bed)	0.0148
Flammable liquid/gas spilled or accidentally released	0.0526			Unknown	0.0318	People otherwise impaired: unconscious, mental/physical impairment)	0.0112
Unknown	0.0494			Deliberately lit fire - not classified above	0.0317	Lawful	0.0064
Mechanical failure, malfunction - not classified above	0.0476			Unattended/Asleep: kitchen, cooking fire	0.0276	Reckless act (involving fire)	0.0017
Failure to use ordinary care	0.0323			People impaired by drugs or alcohol	0.0226	Failure to use ordinary care	0.0017
Unattended/Asleep: kitchen, cooking fire	0.0246			Mechanical failure, malfunction - not classified above	0.0169	Unknown	0.0016
Careless disposal: cigarettes, cigars, ashes, embers	0.0148			Automatic control failure	0.0168	Careless disposal: cigarettes, cigars, ashes, embers	0.0015
Reckless act (involving fire)	0.0147			Collision, overturn, knockdown (includes vehicle)	0.0109	Equipment unattended	0.0002
Other electrical failure	0.0131			Pyrophoric	0.0108		
People playing with heat sources	0.0126			Reckless act (involving fire)	0.0101		

Table 77: Highest average ratios of numbers of civilian fatalities to numbers of fires for each cause of ignition (1995 – 2005).

Apartments		All Residential	
Cause of Ignition	Ratio of Fatalities to Fires	Cause of Ignition	Ratio of Fatalities to Fires
Falling asleep: other (includes smoking in bed)	0.0667	Falling asleep: other (includes smoking in bed)	0.0853
Mechanical failure, malfunction - not classified above	0.0370	Deliberately lit fire - not classified above	0.0222
Unknown	0.0280	Unknown	0.0207
Flammable liquid/gas spilled or accidentally released	0.0278	Mechanical failure, malfunction - not classified above	0.0112
Careless disposal: cigarettes, cigars, ashes, embers	0.0109	People impaired by drugs or alcohol	0.0108
People playing with heat sources	0.0094	Pyrophoric	0.0088
Failure to use ordinary care	0.0081	People otherwise impaired: unconscious, mental/physical impairment)	0.0078
Unlawful	0.0066	Unattended/Asleep: kitchen, cooking fire	0.0071
Other electrical failure	0.0062	Collision, overturn, knockdown (includes vehicle)	0.0070
Reckless act (involving fire)	0.0061	Automatic control failure	0.0066

Table 78: Highest average ratios of numbers of civilian injuries to numbers of fires for each cause of ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Cause of Ignition	Ratio of Injuries to Fires	Cause of Ignition	Ratio of Injuries to Fires	Cause of Ignition	Ratio of Injuries to Fires	Cause of Ignition	Ratio of Injuries to Fires
Reckless (involving fire) - not classified above	1.0000	Solar, sun	0.6667	Falling asleep: other (includes smoking in bed)	0.3481	Falling asleep: other (includes smoking in bed)	0.3185
Falling asleep: other (includes smoking in bed)	0.4762	Deliberately lit fire - not classified above	0.3333	Unattended/Asleep: kitchen, cooking fire	0.1830	Improper fuelling techniques: vehicles, saws, petrol motors etc	0.2222
Flammable liquid/gas spilled or accidentally released	0.3684	Reckless (involving fire) - not classified above	0.3333	People otherwise impaired: unconscious, mental/physical impairment)	0.1750	Deliberately lit fire - not classified above	0.1852
Equipment not being operated properly	0.3529	Collision, overturn, knockdown (includes vehicle)	0.2857	Flammable liquid/gas spilled or accidentally released	0.1585	Extreme conditions - not classified above	0.1667
Equipment used for purpose not intended	0.3333	Falling asleep: other (includes smoking in bed)	0.2500	Solar, sun	0.1429	Friction (sparks etc.)	0.1111
People otherwise impaired: unconscious, mental/physical impairment)	0.3333	Flammable liquid used: kindle fire, washing, cleaning, painting	0.2000	Equipment not being operated properly	0.1259	People playing with heat sources	0.0945
Failure to clean	0.2500	Design deficiency	0.1429	Reckless act (involving fire)	0.1136	Equipment not being operated properly	0.0913
Pyrophoric	0.2500	Equipment used for purpose not intended	0.1429	People impaired by drugs or alcohol	0.1128	People otherwise impaired: unconscious, mental/physical impairment)	0.0899
Reckless with fireworks	0.2308	Installed too close to combustibles	0.1429	Failure to use ordinary care	0.1049	People impaired by drugs or alcohol	0.0890
Unattended/Asleep: kitchen, cooking fire	0.1761	Reckless with fireworks	0.1429	Reckless with fireworks	0.0980	Reckless (involving fire) - not classified above	0.0833

Table 79: Highest average ratios of numbers of civilian injuries to numbers of fires for each cause of ignition (1995 – 2005).

Apartments		All Residential	
Cause of Ignition	Ratio of Injuries to Fires	Cause of Ignition	Ratio of Injuries to Fires
Reckless (involving fire) - not classified above	0.5000	Falling asleep: other (includes smoking in bed)	0.3345
Solar, sun	0.4000	Deliberately lit fire - not classified above	0.1222
Falling asleep: other (includes smoking in bed)	0.3556	People otherwise impaired: unconscious, mental/physical impairment)	0.1163
Pyrophoric	0.2500	Solar, sun	0.1111
Flammable liquid/gas spilled or accidentally released	0.2222	Equipment not being operated properly	0.1050
Equipment used for purpose not intended	0.2000	Unattended/Asleep: kitchen, cooking fire	0.1043
Reckless with fireworks	0.2000	People impaired by drugs or alcohol	0.1004
Equipment not being operated properly	0.1600	Flammable liquid/gas spilled or accidentally released	0.0984
Installed too close to combustibles	0.1515	Reckless act (involving fire)	0.0904
Collision, overturn, knockdown (includes vehicle)	0.1250	Reckless with fireworks	0.0875

Table 80: Highest average ratio of percentage of civilian fatalities to percentage of fires each year for each cause of ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Cause of Ignition	Ratio of %Fatalities to %Fires	Cause of Ignition	Ratio of %Fatalities to %Fires	Cause of Ignition	Ratio of %Fatalities to %Fires	Cause of Ignition	Ratio of %Fatalities to %Fires
Falling asleep: other (includes smoking in bed)	11.29	Falling asleep: other (includes smoking in bed)	84.27	Falling asleep: other (includes smoking in bed)	20.89	Falling asleep: other (includes smoking in bed)	41.00
Flammable liquid/gas spilled or accidentally released	4.99			Unknown	4.57	People otherwise impaired: unconscious, mental/physical impairment)	31.09
Unknown	4.68			Deliberately lit fire - not classified above	4.56	Lawful	17.74
Mechanical failure, malfunction - not classified above	4.51			Unattended/Asleep: kitchen, cooking fire	3.96	Reckless act (involving fire)	4.60
Failure to use ordinary care	3.06			People impaired by drugs or alcohol	3.24	Failure to use ordinary care	4.58
Unattended/Asleep: kitchen, cooking fire	2.34			Mechanical failure, malfunction - not classified above	2.43	Unknown	4.43
Careless disposal: cigarettes, cigars, ashes, embers	1.40			Automatic control failure	2.41	Careless disposal: cigarettes, cigars, ashes, embers	4.06
Reckless act (involving fire)	1.39			Collision, overturn, knockdown (includes vehicle)	1.56	Equipment unattended	0.67
Other electrical failure	1.24			Pyrophoric	1.54		
People playing with heat sources	1.19			Reckless act (involving fire)	1.46		

Table 81: Highest average ratio of percentage of civilian fatalities to percentage of fires each year for each cause of ignition (1995 – 2005).

Apartments		All Residential	
Cause of Ignition	Ratio of %Fatalities to %Fires	Cause of Ignition	Ratio of %Fatalities to %Fires
Falling asleep: other (includes smoking in bed)	13.84	Falling asleep: other (includes smoking in bed)	20.86
Mechanical failure, malfunction - not classified above	7.69	Deliberately lit fire - not classified above	5.43
Unknown	5.81	Unknown	5.05
Flammable liquid/gas spilled or accidentally released	5.77	Mechanical failure, malfunction - not classified above	2.73
Careless disposal: cigarettes, cigars, ashes, embers	2.27	People impaired by drugs or alcohol	2.63
People playing with heat sources	1.95	Pyrophoric	2.14
Failure to use ordinary care	1.67	People otherwise impaired: unconscious, mental/physical impairment)	1.89
Unlawful	1.37	Unattended/Asleep: kitchen, cooking fire	1.75
Other electrical failure	1.29	Collision, overturn, knockdown (includes vehicle)	1.72
Reckless act (involving fire)	1.27	Automatic control failure	1.62

Table 82: Highest average ratio of percentage of civilian injuries to percentage of fires each year for each cause of ignition (1995 – 2005).

Apartments with Damage		Apartments without Damage		All Residential with Damage		All Residential without Damage	
Cause of Ignition	Ratio of %Injuries to %Fires	Cause of Ignition	Ratio of %Injuries to %Fires	Cause of Ignition	Ratio of %Injuries to %Fires	Cause of Ignition	Ratio of %Injuries to %Fires
Reckless (involving fire) - not classified above	10.74	Solar, sun	10.96	Falling asleep: other (includes smoking in bed)	7.17	Falling asleep: other (includes smoking in bed)	7.21
Falling asleep: other (includes smoking in bed)	5.12	Deliberately lit fire - not classified above	5.48	Unattended/Asleep: kitchen, cooking fire	3.77	Improper fuelling techniques: vehicles, saws, petrol motors etc	5.03
Flammable liquid/gas spilled or accidentally released	3.96	Reckless (involving fire) - not classified above	5.48	People otherwise impaired: unconscious, mental/physical impairment)	3.60	Deliberately lit fire - not classified above	4.19
Equipment not being operated properly	3.79	Collision, overturn, knockdown (includes vehicle)	4.70	Flammable liquid/gas spilled or accidentally released	3.26	Extreme conditions - not classified above	3.77
Equipment used for purpose not intended	3.58	Falling asleep: other (includes smoking in bed)	4.11	Solar, sun	2.94	Friction (sparks etc.)	2.52
People otherwise impaired: unconscious, mental/physical impairment)	3.58	Flammable liquid used: kindle fire, washing, cleaning, painting	3.29	Equipment not being operated properly	2.59	People playing with heat sources	2.14
Failure to clean	2.69	Design deficiency	2.35	Reckless act (involving fire)	2.34	Equipment not being operated properly	2.07
Pyrophoric	2.69	Equipment used for purpose not intended	2.35	People impaired by drugs or alcohol	2.32	People otherwise impaired: unconscious, mental/physical impairment)	2.04
Reckless with fireworks	2.48	Installed too close to combustibles	2.35	Failure to use ordinary care	2.16	People impaired by drugs or alcohol	2.02
Unattended/Asleep: kitchen, cooking fire	1.89	Reckless with fireworks	2.35	Reckless with fireworks	2.02	Reckless (involving fire) - not classified above	1.89

Table 83: Highest average ratio of percentage of civilian injuries to percentage of fires each year for each cause of ignition (1995 – 2005).

Apartments		All Residential	
Cause of Ignition	Ratio of %Injuries to %Fires	Cause of Ignition	Ratio of %Injuries to %Fires
Reckless (involving fire) - not classified above	6.66	Falling asleep: other (includes smoking in bed)	7.17
Solar, sun	5.32	Deliberately lit fire - not classified above	2.62
Falling asleep: other (includes smoking in bed)	4.73	People otherwise impaired: unconscious, mental/physical impairment)	2.49
Pyrophoric	3.33	Solar, sun	2.38
Flammable liquid/gas spilled or accidentally released	2.96	Equipment not being operated properly	2.25
Equipment used for purpose not intended	2.66	Unattended/Asleep: kitchen, cooking fire	2.24
Reckless with fireworks	2.66	People impaired by drugs or alcohol	2.15
Equipment not being operated properly	2.13	Flammable liquid/gas spilled or accidentally released	2.11
Installed too close to combustibles	2.02	Reckless act (involving fire)	1.94
Collision, overturn, knockdown (includes vehicle)	1.66	Reckless with fireworks	1.88

Table 84: Ranking of reported cause of ignition by percentage of fire incidents (1986 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Cause of Ignition	% Total Fires	Cause of Ignition	% Total Fires	Cause of Ignition	% Total Fires	Cause of Ignition	% Total Fires
Careless disposal: cigarettes, cigars, ashes, embers	10.6	Unattended/Asleep: kitchen, cooking fire	27.7	Careless disposal: cigarettes, cigars, ashes, embers	8.4	Equipment unattended	16.8
Suspicious	9.4	Equipment unattended	18.6	Unable to classify	6.6	Unattended/Asleep: kitchen, cooking fire	12.8
Unattended/Asleep: kitchen, cooking fire	8.5	Other electrical failure	4.2	Suspicious	6.6	Unable to classify	7.5
Unlawful	6.4	Heat source too close to combustibles: fires near trees, welding/cutting, debris	3.5	Equipment unattended	6.1	Short circuit, earth fault	5.7
Equipment unattended	5.7	Short circuit, earth fault	3.2	People playing with heat sources	5.6	Other electrical failure	5.1
People playing with heat sources	5.1	Careless disposal: cigarettes, cigars, ashes, embers	3.0	Short circuit, earth fault	5.3	Heat source too close to combustibles: fires near trees, welding/cutting, debris	3.6
Short circuit, earth fault	5.0	Failure to clean	2.9	Other electrical failure	4.8	Part failure, leak or break	3.5
Unable to classify	4.9	Accidentally turned on: not turned off	2.7	Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.5	Combustible placed too close to heat source	3.5
Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.6	Carelessness with heat source - not classified above	2.6	Combustible placed too close to heat source	4.2	Failure to clean	3.4
Other electrical failure	4.5	Reckless act (involving fire)	2.5	Unlawful	4.0	Carelessness with heat source - not classified above	3.1

Table 85: Ranking of reported cause of ignition by percentage of fatalities in fires (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Cause of Ignition	% Total Fatalities	Cause of Ignition	% Total Fatalities	Cause of Ignition	% Total Fatalities	Cause of Ignition	% Total Fatalities
Unattended/Asleep: kitchen, cooking fire	18.2	Falling asleep: other (includes smoking in bed)	100.0	Unattended/Asleep: kitchen, cooking fire	19.9	Falling asleep: other (includes smoking in bed)	25.0
Careless disposal: cigarettes, cigars, ashes, embers	15.2			Unknown	17.7	Careless disposal: cigarettes, cigars, ashes, embers	12.5
Falling asleep: other (includes smoking in bed)	15.2			Falling asleep: other (includes smoking in bed)	12.7	Equipment unattended	12.5
Unknown	12.1			Careless disposal: cigarettes, cigars, ashes, embers	8.8	Failure to use ordinary care	12.5
Other electrical failure	6.1			Suspicious	7.2	Lawful	12.5
People playing with heat sources	6.1			People playing with heat sources	6.6	People otherwise impaired: unconscious, mental/physical impairment)	12.5
Suspicious	6.1			Unlawful	5.5	Reckless act (involving fire)	12.5
Unlawful	6.1			Other electrical failure	5.0	Unknown	12.5
Failure to use ordinary care	3.0			Short circuit, earth fault	5.0		
Flammable liquid/gas spilled or accidentally released	3.0			Heat source too close to combustibles: fires near trees, welding/cutting, debris	3.3		
Mechanical failure, malfunction - not classified above	3.0			Equipment unattended	2.8		
Reckless act (involving fire)	3.0			Part failure, leak or break	2.8		
Short circuit, earth fault	3.0			Reckless act (involving fire)	2.8		

Table 86: Ranking of reported cause of ignition by percentage of injuries (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Cause of Ignition	% Total Injuries	Cause of Ignition	% Total Injuries	Cause of Ignition	% Total Injuries	Cause of Ignition	% Total Injuries
Unattended/Asleep: kitchen, cooking fire	16.4	Unattended/Asleep: kitchen, cooking fire	38.4	Unattended/Asleep: kitchen, cooking fire	15.6	Unattended/Asleep: kitchen, cooking fire	26.9
Careless disposal: cigarettes, cigars, ashes, embers	11.2	Equipment unattended	11.6	Equipment unattended	8.3	Equipment unattended	15.5
Unlawful	7.7	Heat source too close to combustibles: fires near trees, welding/cutting, debris	6.0	People playing with heat sources	8.2	People playing with heat sources	4.7
People playing with heat sources	7.3	Falling asleep: other (includes smoking in bed)	4.7	Heat source too close to combustibles: fires near trees, welding/cutting, debris	7.3	Heat source too close to combustibles: fires near trees, welding/cutting, debris	4.6
Heat source too close to combustibles: fires near trees, welding/cutting, debris	5.9	Reckless act (involving fire)	3.4	Careless disposal: cigarettes, cigars, ashes, embers	7.1	Other electrical failure	4.0
Falling asleep: other (includes smoking in bed)	5.6	Combustible placed too close to heat source	3.0	Unknown	4.8	Reckless act (involving fire)	4.0
Equipment unattended	5.2	People impaired by drugs or alcohol	3.0	Unlawful	4.5	Falling asleep: other (includes smoking in bed)	3.9
Suspicious	4.9	Suspicious	3.0	Short circuit, earth fault	4.1	Combustible placed too close to heat source	3.8
Unknown	4.2	Accidentally turned on: not turned off	2.6	Reckless act (involving fire)	3.6	Carelessness with heat source - not classified above	3.4
Other electrical failure	2.8	Carelessness with heat source - not classified above	2.6	Other electrical failure	3.5	Careless disposal: cigarettes, cigars, ashes, embers	2.3

Table 87: Highest ratios of numbers of fatalities to numbers of fires for reported cause of ignition (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Cause of Ignition	Ratio of Fatalities to Fires	Cause of Ignition	Ratio of Fatalities to Fires	Cause of Ignition	Ratio of Fatalities to Fires	Cause of Ignition	Ratio of Fatalities to Fires
Mechanical failure, malfunction - not classified above	0.143	Falling asleep: other (includes smoking in bed)	0.022	Falling asleep: other (includes smoking in bed)	0.163	Falling asleep: other (includes smoking in bed)	0.016
Falling asleep: other (includes smoking in bed)	0.139			Mechanical failure, malfunction - not classified above	0.068	People otherwise impaired: unconscious, mental/physical impairment)	0.014
Flammable liquid/gas spilled or accidentally released	0.091			People impaired by drugs or alcohol	0.056	Lawful	0.007
Unknown	0.051			Legality not known	0.044	Failure to use ordinary care	0.002
Careless disposal: cigarettes, cigars, ashes, embers	0.036			Unattended/Asleep: kitchen, cooking fire	0.037	Reckless act (involving fire)	0.002
Failure to use ordinary care	0.036			Automatic control failure	0.035	Careless disposal: cigarettes, cigars, ashes, embers	0.002
Unattended/Asleep: kitchen, cooking fire	0.030			Deliberately lit fire - not classified above	0.033	Unknown	0.002
People playing with heat sources	0.029			Unknown	0.031	Equipment unattended	< 0.001
Other electrical failure	0.024			Collision, overturn, knockdown (includes vehicle)	0.029		
Reckless act (involving fire)	0.016			Carelessness with material ignited - not classified above	0.024		

Table 88: Highest ratios of numbers of injuries to numbers of fires for each reported cause of ignition (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Cause of Ignition	Ratio of Injuries to Fires	Cause of Ignition	Ratio of Injuries to Fires	Cause of Ignition	Ratio of Injuries to Fires	Cause of Ignition	Ratio of Injuries to Fires
Reckless (involving fire) - not classified above	1.000	Solar, sun	0.667	Flammable liquid used: kindle fire, washing, cleaning, painting	0.444	Improper fuelling techniques: vehicles, saws, petrol motors etc	0.400
Flammable liquid/gas spilled or accidentally released	0.636	Unable to classify	0.462	Flammable liquid/gas spilled or accidentally released	0.422	Falling asleep: other (includes smoking in bed)	0.318
People otherwise impaired: unconscious, mental/physical impairment)	0.500	Collision, overturn, knockdown (includes vehicle)	0.333	Falling asleep: other (includes smoking in bed)	0.340	Deliberately lit fire - not classified above	0.185
Equipment not being operated properly	0.462	Deliberately lit fire - not classified above	0.333	Improper fuelling techniques: vehicles, saws, petrol motors etc	0.333	Friction (sparks etc.)	0.115
Falling asleep: other (includes smoking in bed)	0.444	Reckless (involving fire) - not classified above	0.333	People impaired by drugs or alcohol	0.278	People impaired by drugs or alcohol	0.115
Unable to classify	0.364	Information not recorded	0.286	People otherwise impaired: unconscious, mental/physical impairment)	0.269	Equipment not being operated properly	0.113
Equipment used for purpose not intended	0.333	Flammable liquid used: kindle fire, washing, cleaning, painting	0.250	Unattended/Asleep: kitchen, cooking fire	0.240	People otherwise impaired: unconscious, mental/physical impairment)	0.113
People playing with heat sources	0.300	Falling asleep: other (includes smoking in bed)	0.239	Carelessness with material ignited - not classified above	0.220	People playing with heat sources	0.108
Reckless with fireworks	0.300	People impaired by drugs or alcohol	0.171	People playing with heat sources	0.192	Extreme conditions - not classified above	0.100
Failure to clean	0.286	Equipment used for purpose not intended	0.167	Equipment not being operated properly	0.177	Equipment used for purpose not intended	0.095

Table 89: Ratio of percentage of total fatalities to percentage of total fires for each reported cause of ignition (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Cause of Ignition	Ratio of %Fatalities to %Fires	Cause of Ignition	Ratio of %Fatalities to %Fires	Cause of Ignition	Ratio of %Fatalities to %Fires	Cause of Ignition	Ratio of %Fatalities to %Fires
Mechanical failure, malfunction - not classified above	7.4	Falling asleep: other (includes smoking in bed)	72.8	Falling asleep: other (includes smoking in bed)	13.1	Falling asleep: other (includes smoking in bed)	35.8
Falling asleep: other (includes smoking in bed)	7.2	Accidentally turned on: not turned off	0.0	Mechanical failure, malfunction - not classified above	5.4	People otherwise impaired: unconscious, mental/physical impairment)	32.5
Flammable liquid/gas spilled or accidentally released	4.7	Animal	0.0	People impaired by drugs or alcohol	4.5	Lawful	16.7
Unknown	2.6	Automatic control failure	0.0	Legality not known	3.5	Failure to use ordinary care	4.3
Careless disposal: cigarettes, cigars, ashes, embers	1.9	Backfire	0.0	Unattended/Asleep: kitchen, cooking fire	3.0	Reckless act (involving fire)	4.2
Failure to use ordinary care	1.8	Careless disposal: cigarettes, cigars, ashes, embers	0.0	Automatic control failure	2.8	Careless disposal: cigarettes, cigars, ashes, embers	4.0
Unattended/Asleep: kitchen, cooking fire	1.6	Carelessness with heat source - not classified above	0.0	Deliberately lit fire - not classified above	2.6	Unknown	3.8
People playing with heat sources	1.5	Carelessness with material ignited - not classified above	0.0	Unknown	2.5	Equipment unattended	0.8
Other electrical failure	1.2	Collision, overturn, knockdown (includes vehicle)	0.0	Collision, overturn, knockdown (includes vehicle)	2.4	Accidentally turned on: not turned off	0.0
Reckless act (involving fire)	0.8	Combustible placed too close to heat source	0.0	Carelessness with material ignited - not classified above	2.0	Animal	0.0

Table 90: Ratio of percentage of total injuries to percentage of total fires for each reported fire cause (1995 – 2005).

Apartments with Structure Damage		Apartments without Structure Damage		All Residential with Structure Damage		All Residential without Structure Damage	
Cause of Ignition	Ratio of %Injuries to %Fires	Cause of Ignition	Ratio of %Injuries to %Fires	Cause of Ignition	Ratio of %Injuries to %Fires	Cause of Ignition	Ratio of %Injuries to %Fires
Reckless (involving fire) - not classified above	6.0	Solar, sun	9.6	Flammable liquid used: kindle fire, washing, cleaning, painting	4.3	Improper fuelling techniques: vehicles, saws, petrol motors etc	7.0
Flammable liquid/gas spilled or accidentally released	3.8	Unable to classify	6.7	Flammable liquid/gas spilled or accidentally released	4.1	Falling asleep: other (includes smoking in bed)	5.6
People otherwise impaired: unconscious, mental/physical impairment)	3.0	Collision, overturn, knockdown (includes vehicle)	4.8	Falling asleep: other (includes smoking in bed)	3.3	Deliberately lit fire - not classified above	3.2
Equipment not being operated properly	2.8	Deliberately lit fire - not classified above	4.8	Improper fuelling techniques: vehicles, saws, petrol motors etc	3.2	Friction (sparks etc.)	2.0
Falling asleep: other (includes smoking in bed)	2.7	Reckless (involving fire) - not classified above	4.8	People impaired by drugs or alcohol	2.7	People impaired by drugs or alcohol	2.0
Unable to classify	2.2	Information not recorded	4.1	People otherwise impaired: unconscious, mental/physical impairment)	2.6	Equipment not being operated properly	2.0
Equipment used for purpose not intended	2.0	Flammable liquid used: kindle fire, washing, cleaning, painting	3.6	Unattended/Asleep: kitchen, cooking fire	2.3	People otherwise impaired: unconscious, mental/physical impairment)	2.0
People playing with heat sources	1.8	Falling asleep: other (includes smoking in bed)	3.5	Carelessness with material ignited - not classified above	2.1	People playing with heat sources	1.9
Reckless with fireworks	1.8	People impaired by drugs or alcohol	2.5	People playing with heat sources	1.9	Extreme conditions - not classified above	1.8
Failure to clean	1.7	Equipment used for purpose not intended	2.4	Equipment not being operated properly	1.7	Equipment used for purpose not intended	1.7

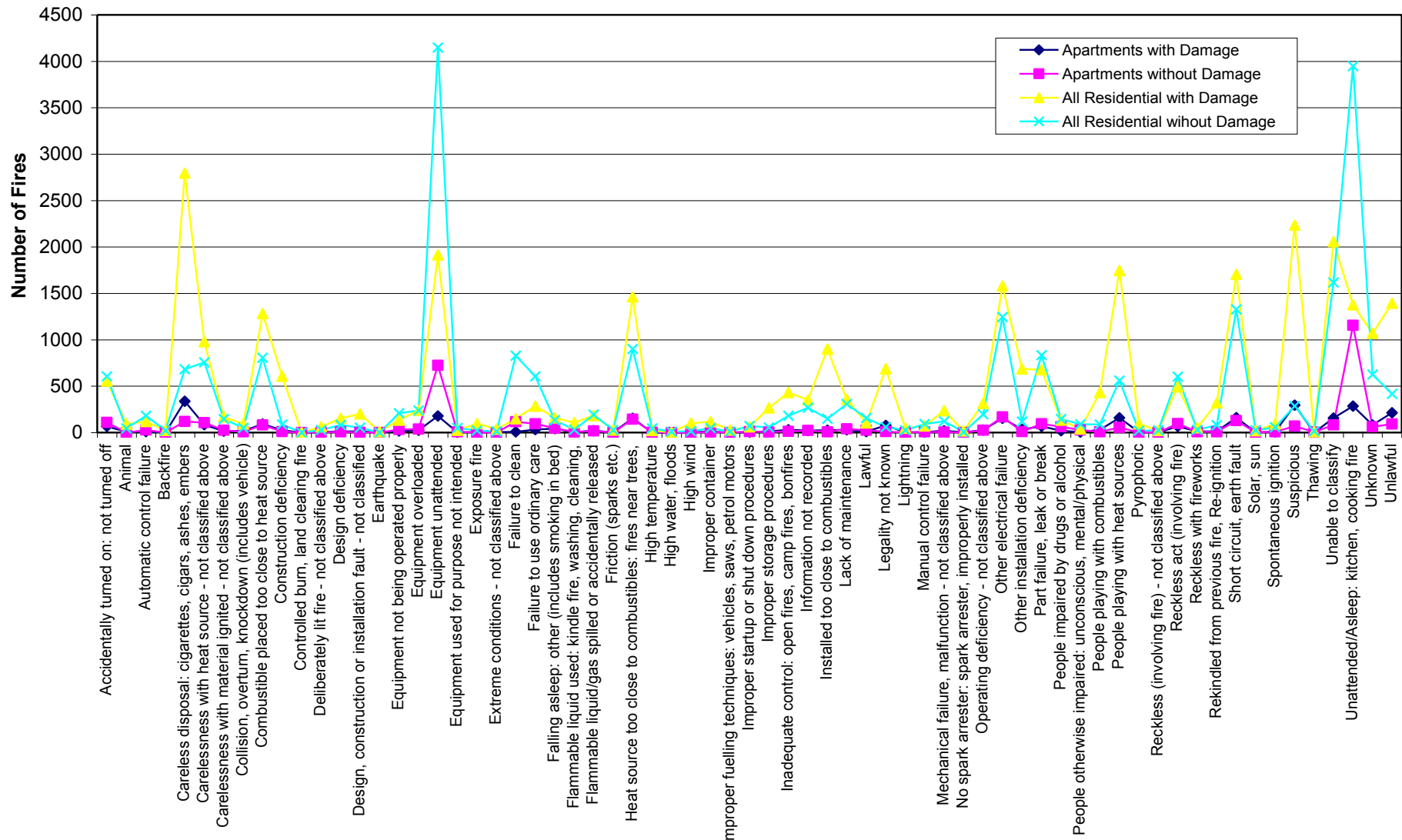


Figure 255: Number of fires in residential structures, with and without damage, according to the cause of ignition (1986-2005).

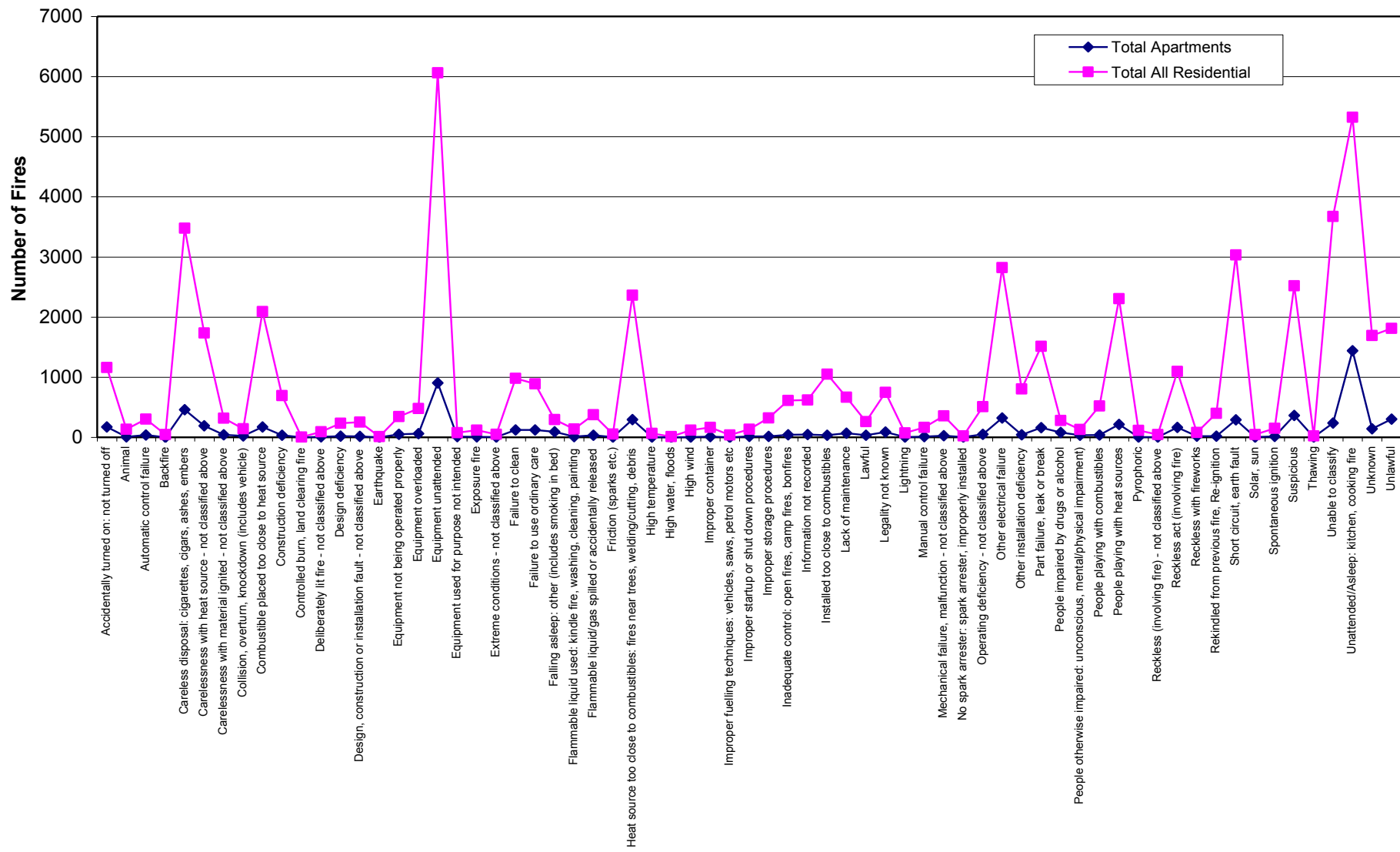


Figure 256: Number of fires in all apartments and all residential structures according to the cause of ignition (1986-2005).

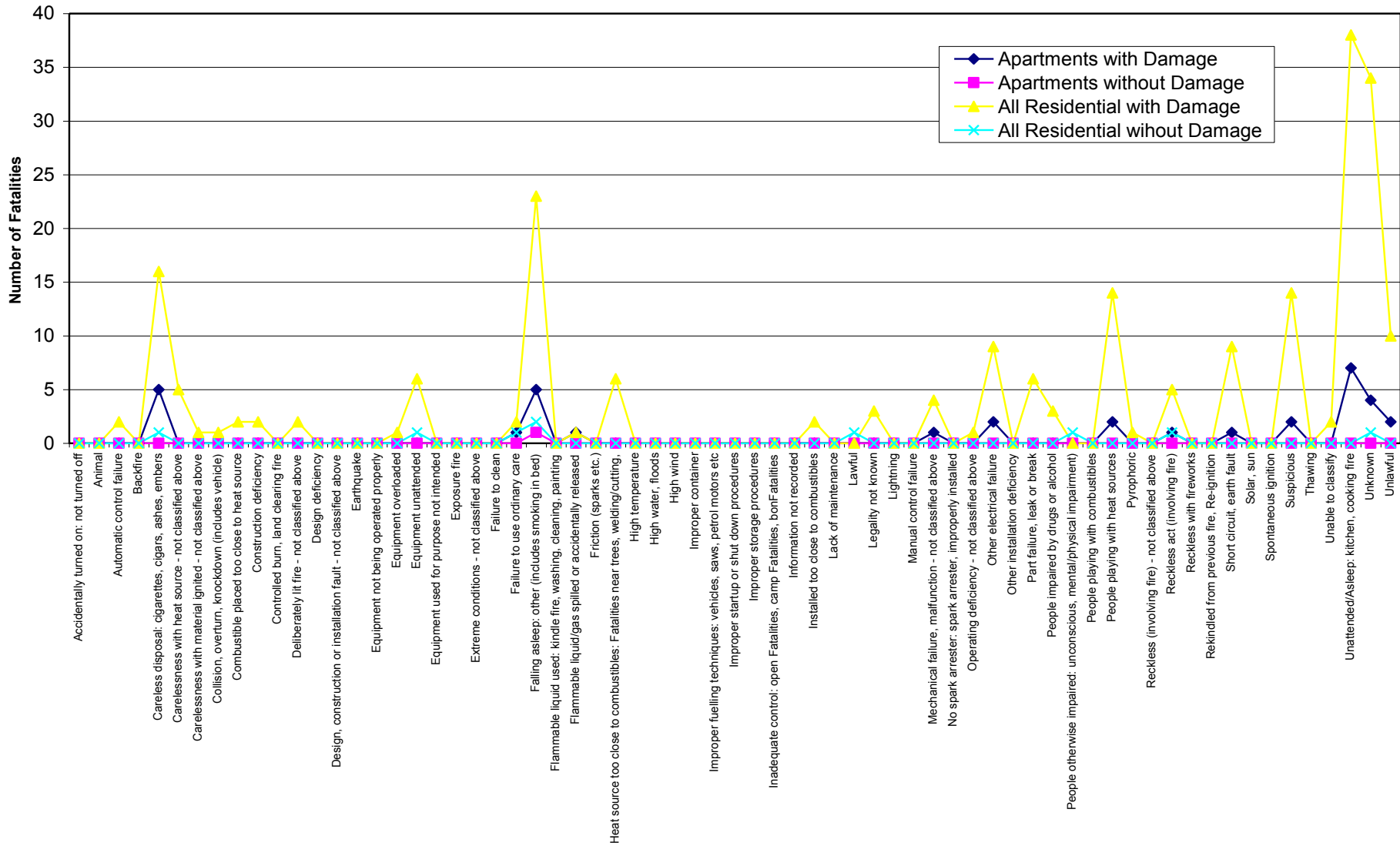


Figure 257: Number of fatalities from residential property fires, with and without damage, according to the cause of ignition (1995-2005).

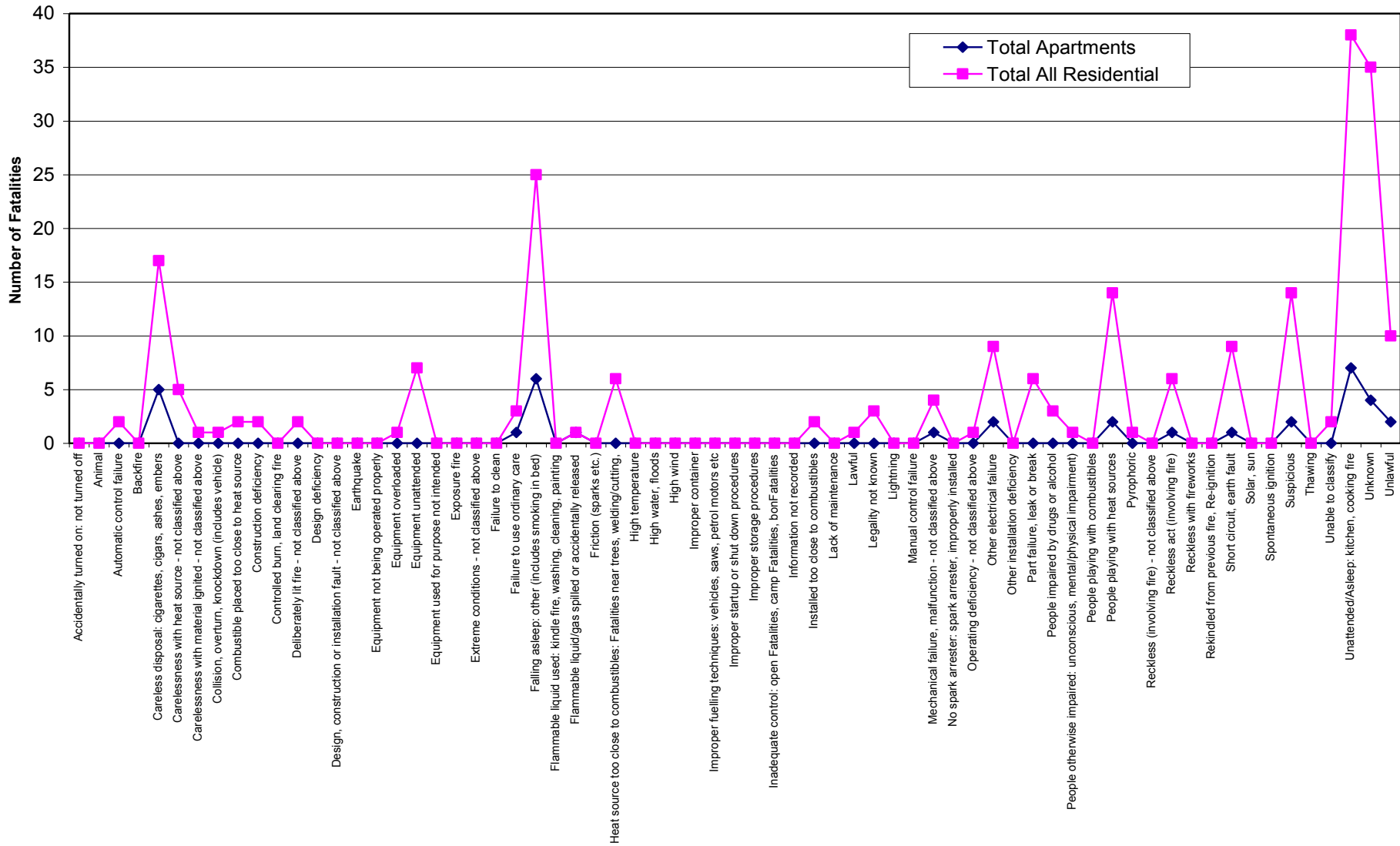


Figure 258: Number of fatalities from all apartment and all residential property fires according to the cause of ignition (1995-2005).

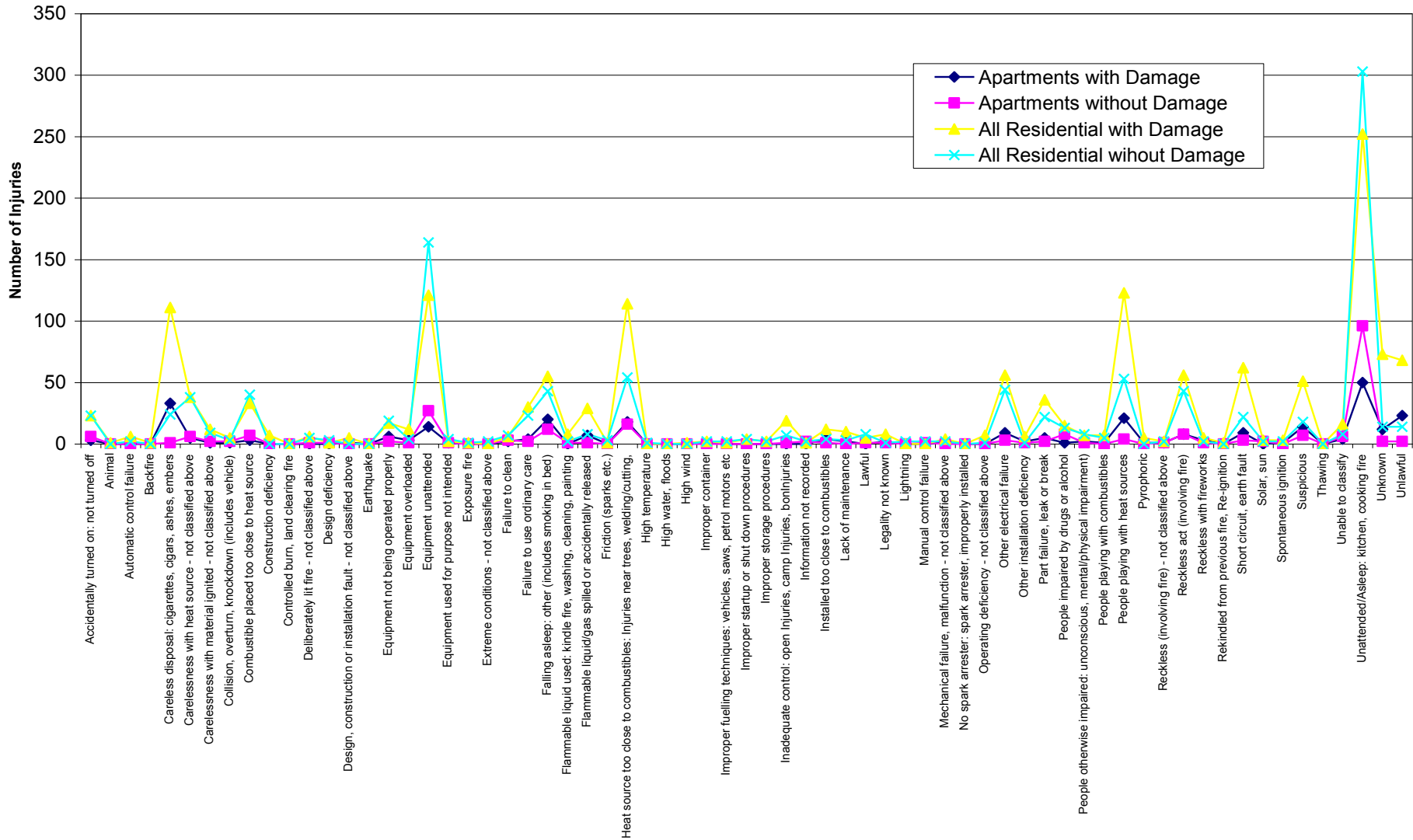


Figure 259: Number of injuries from apartment and house fires, with and without damage, according to the cause of ignition (1995-2005).

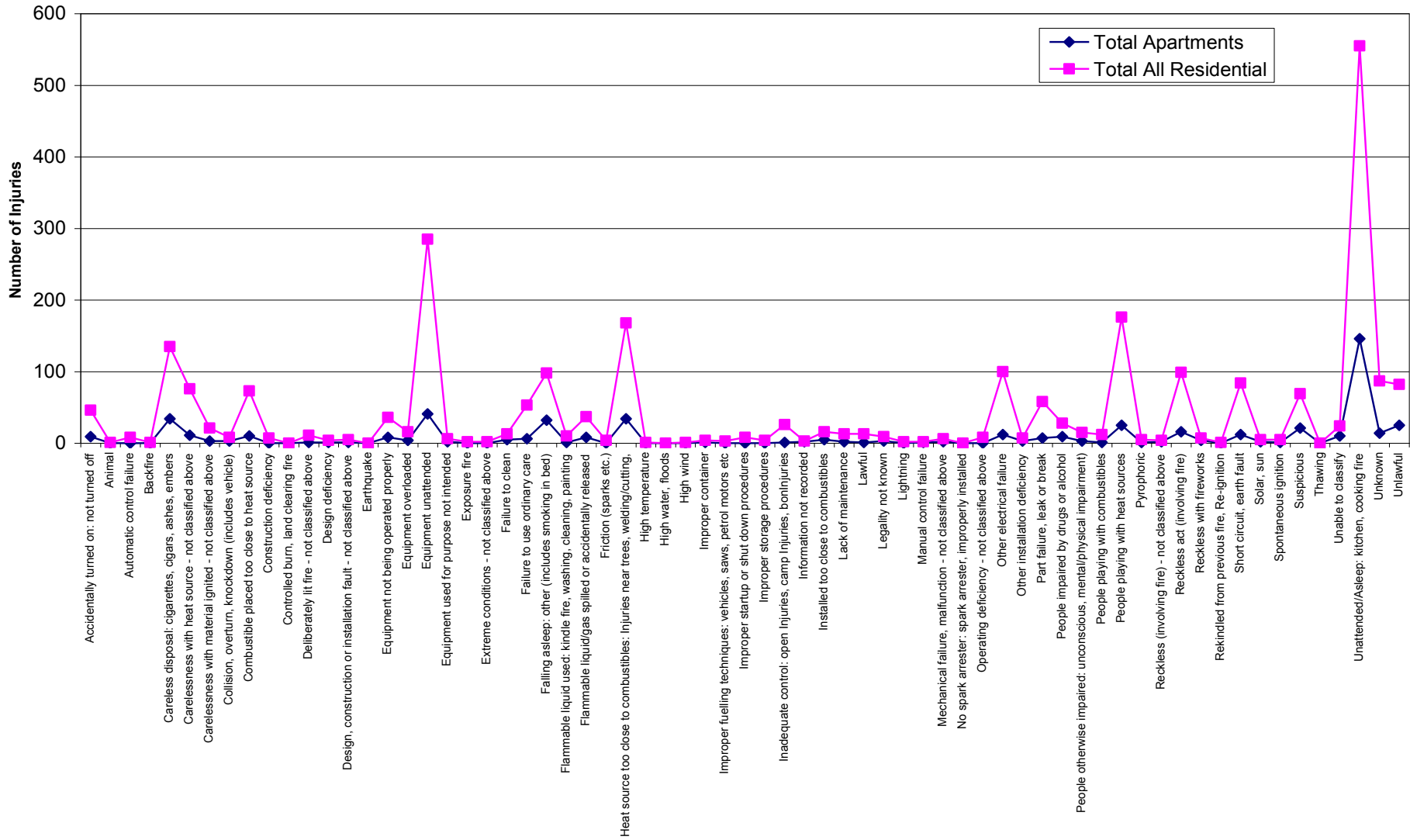


Figure 260: Number of injuries from all apartments and all residential fires according to the cause of ignition (1995-2005).

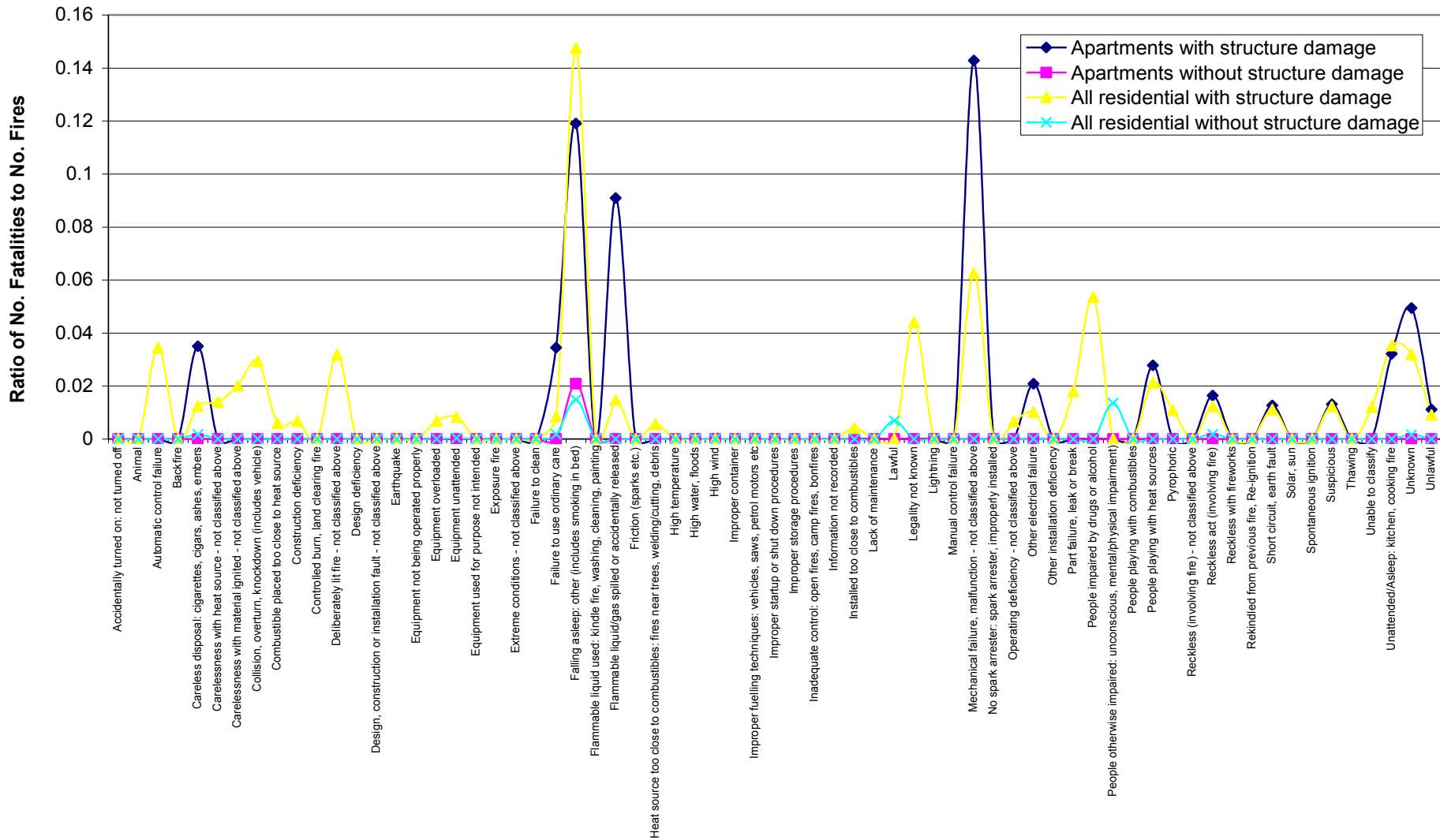


Figure 261: Ratio of numbers of fatalities to numbers of fires recorded according to cause of ignition (1995-2005).

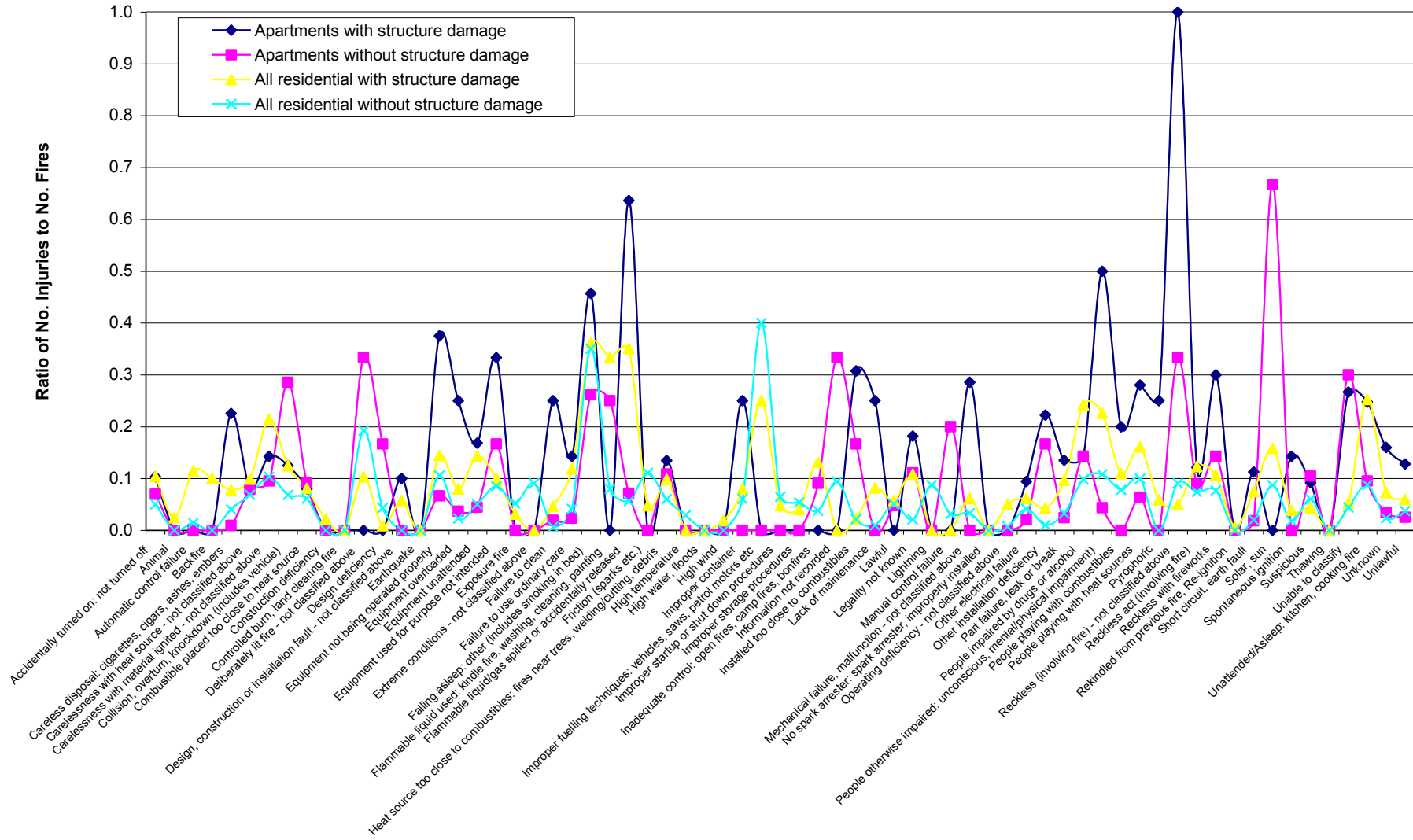


Figure 262: Ratio of numbers of injuries to numbers of fires recorded according to cause of ignition (1995-2005).

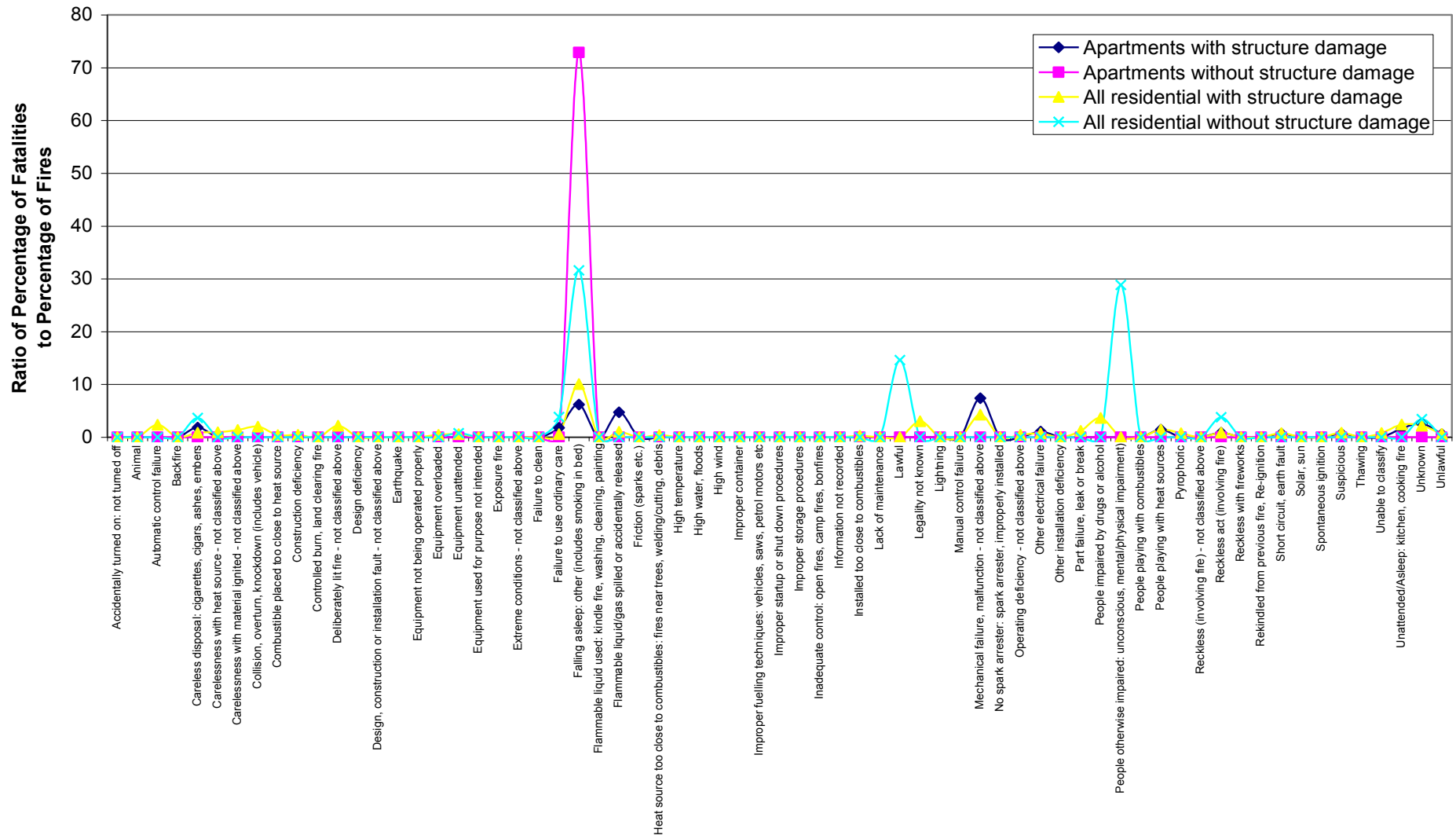


Figure 263: Ratio of percentage of total fatalities to percentage of total fires recorded according to cause of ignition (1995-2005).

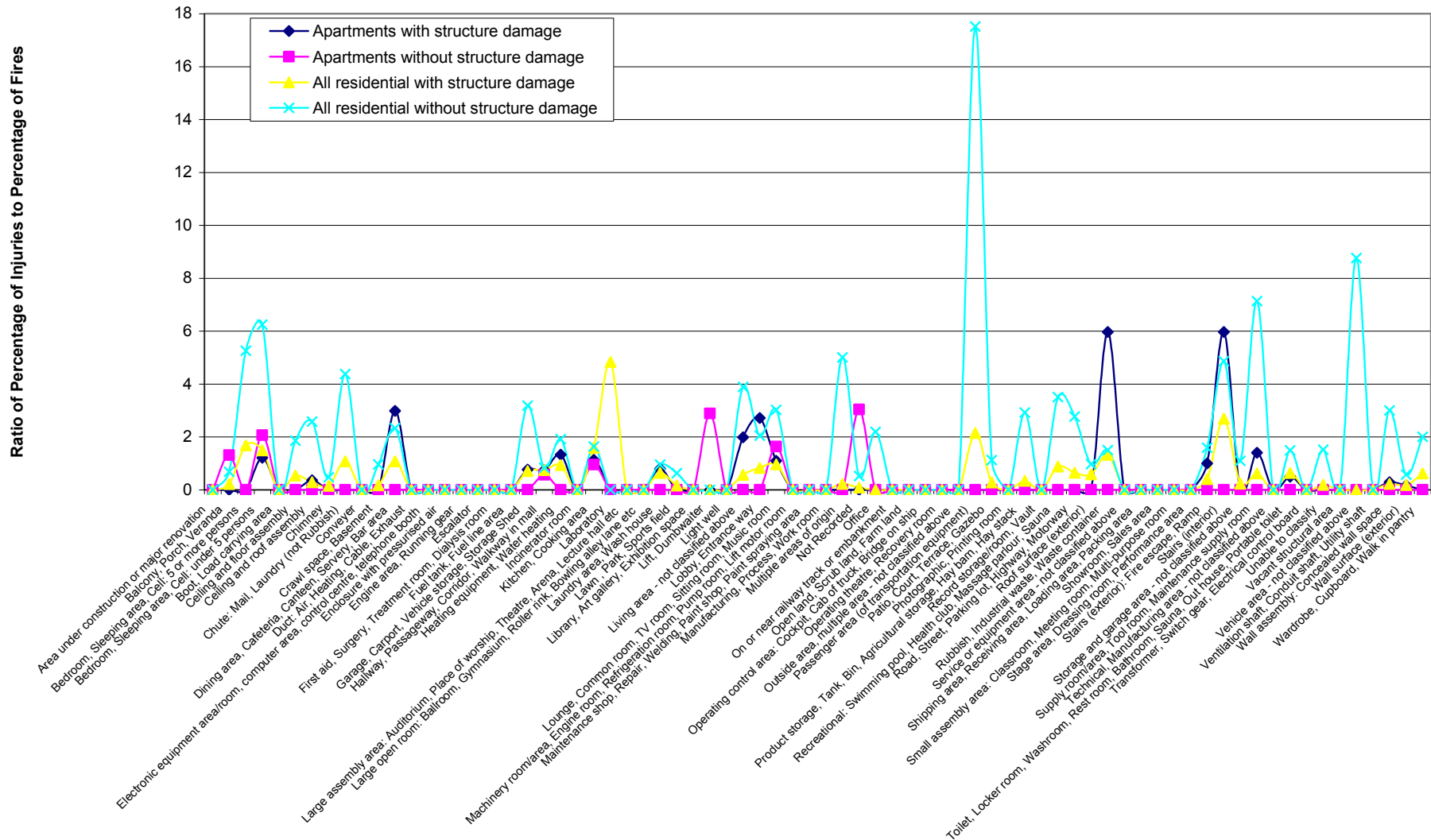


Figure 264: Ratio of percentage of total injuries to percentage of total fires recorded according to cause of ignition (1995-2005).

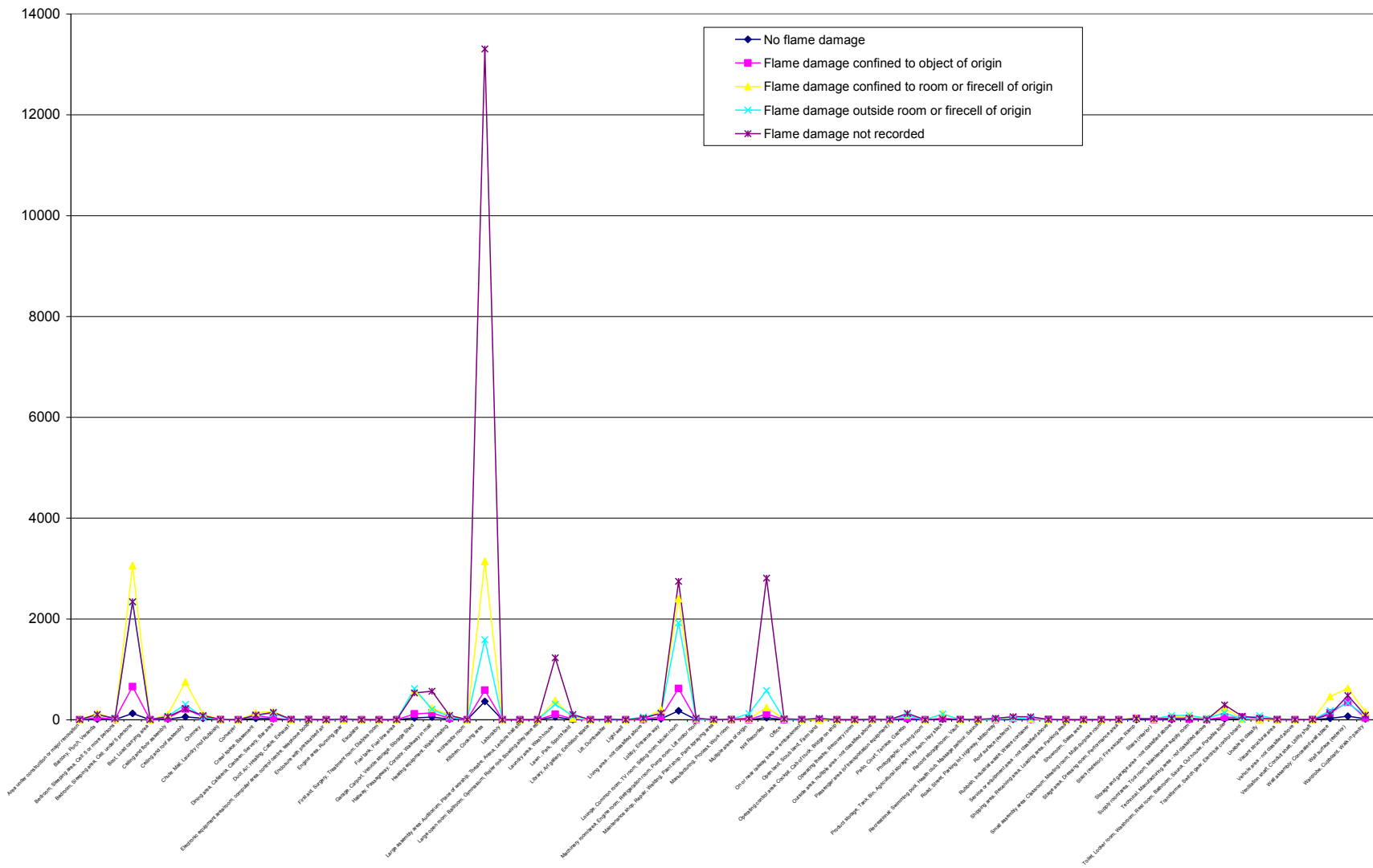


Figure 265: Number of residential fires according to extent of flame damage and cause of ignition (1986-2005).

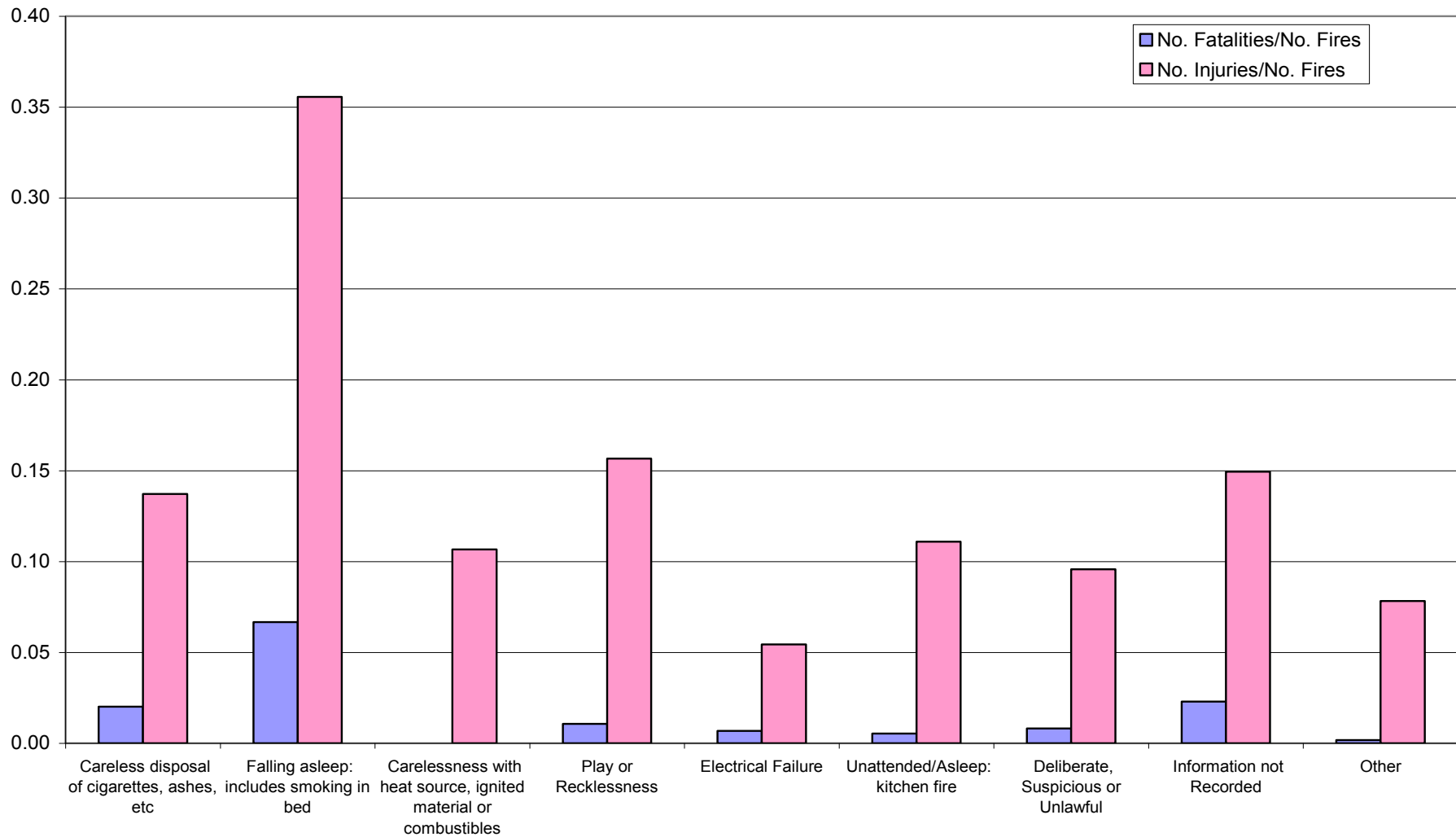


Figure 266: Number of fatalities and injuries per apartment fire as recorded for each reported cause of ignition (1995-2005).

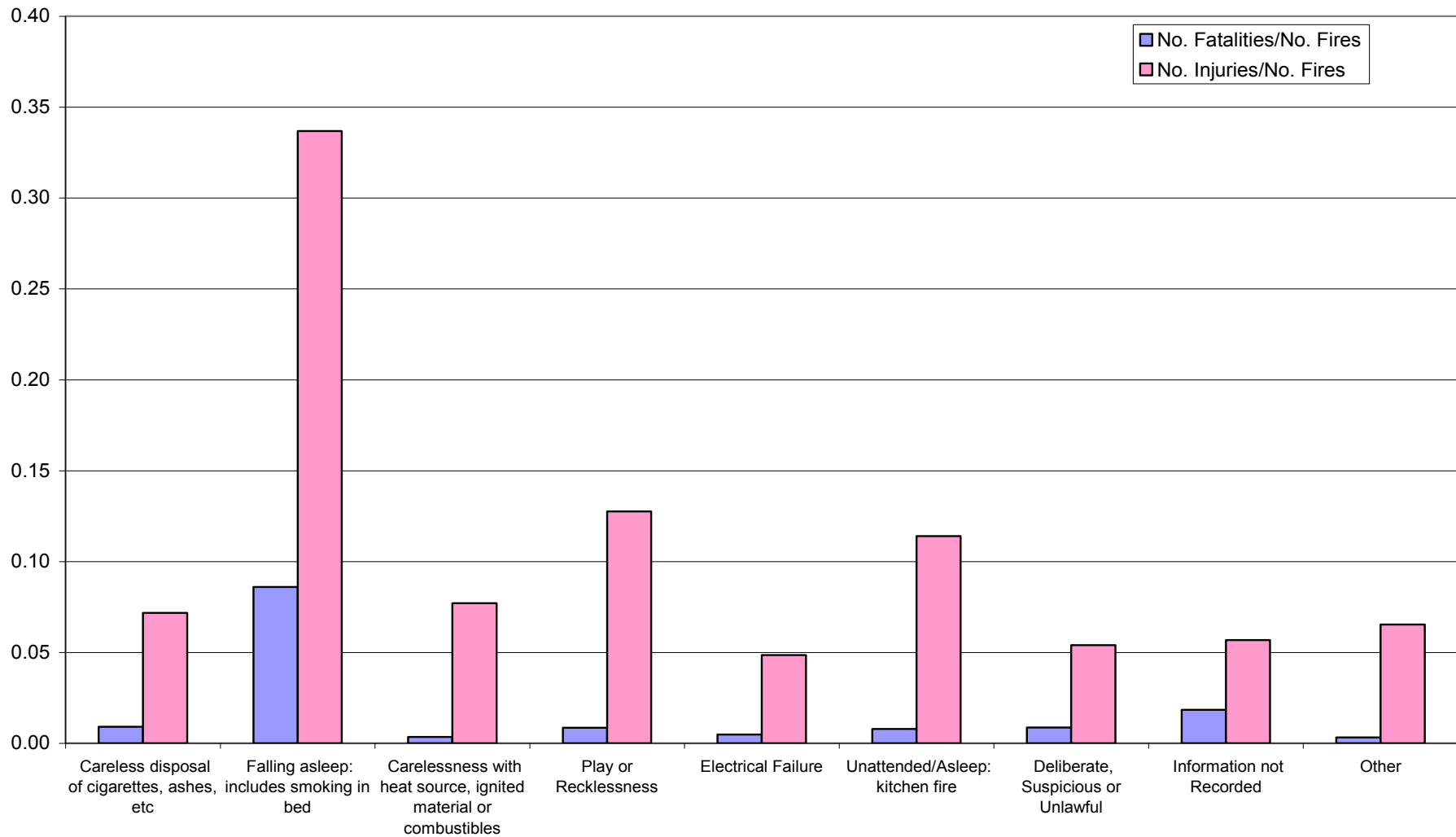


Figure 267: Number of fatalities and injuries per residential fire as recorded for each reported cause of ignition with structure damage (1995-2005).

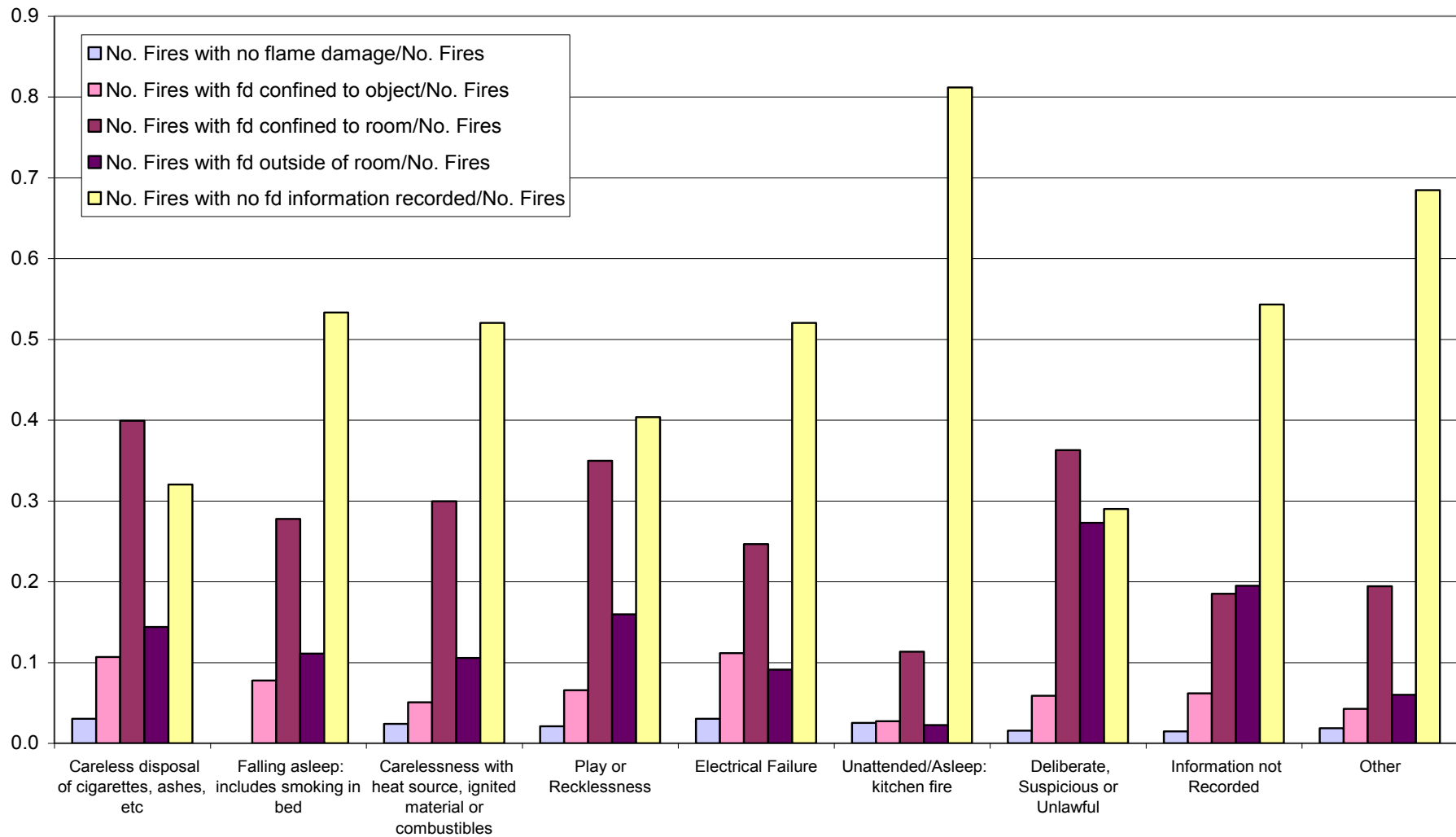


Figure 268: Number of fires according to the extent of flame damage recorded per number of apartment fires recorded for each reported cause of ignition (1985-2005).

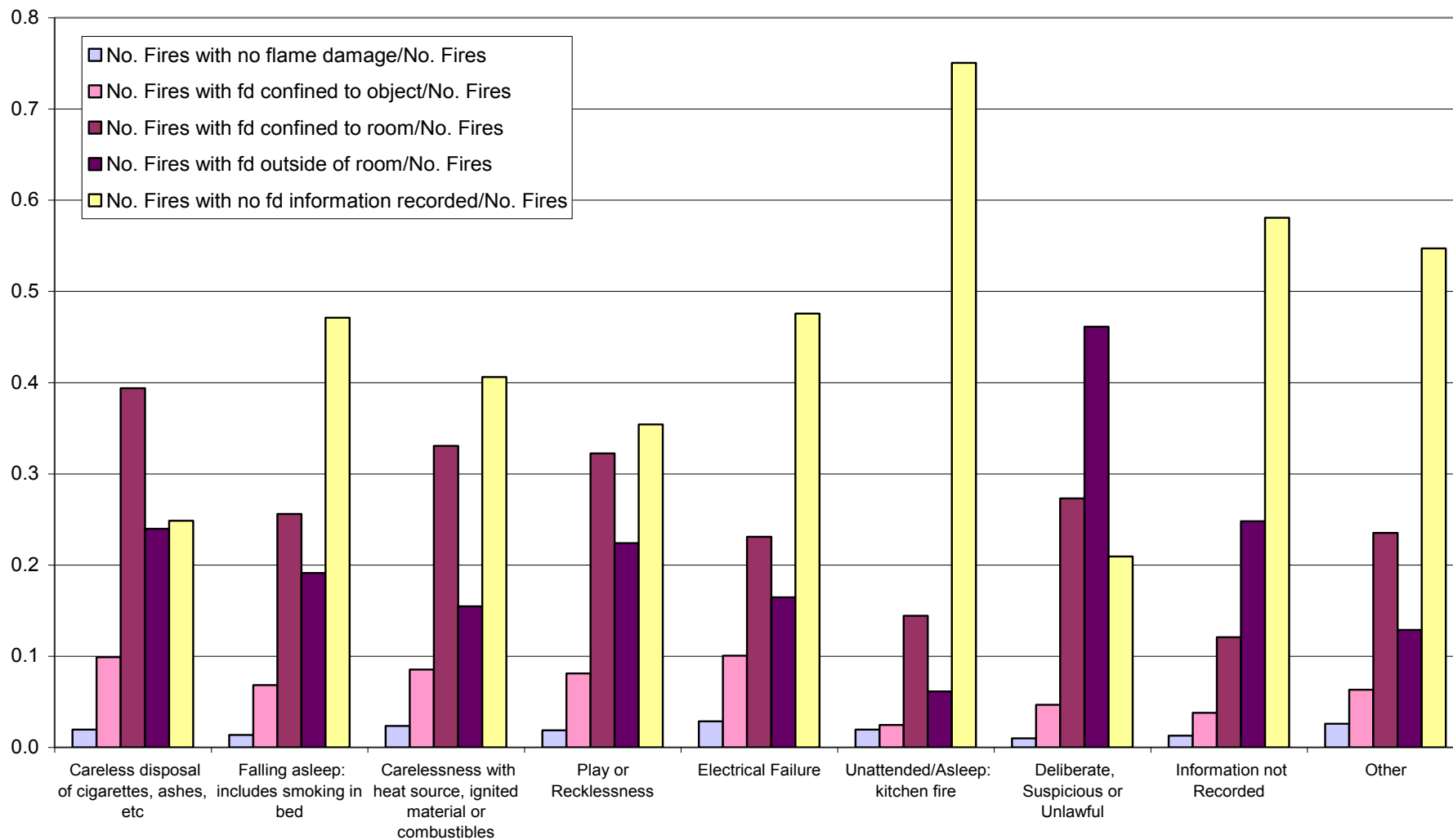


Figure 269: Number of fires according to the extent of flame damage recorded per number of residential fires recorded for each reported cause of ignition (1985-2005).

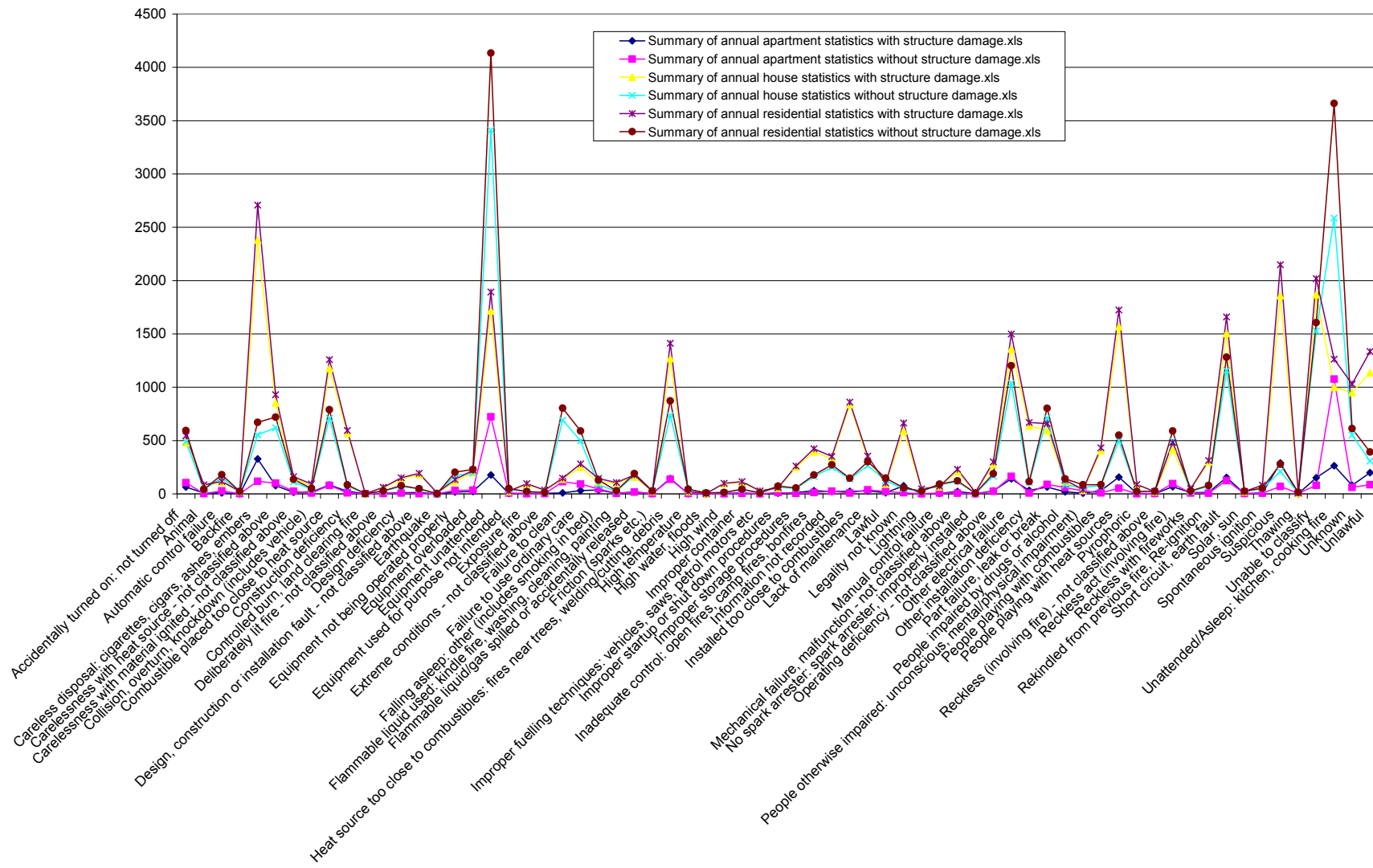


Figure 270: Number of residential fires according to reported cause of ignition (1986-2005).

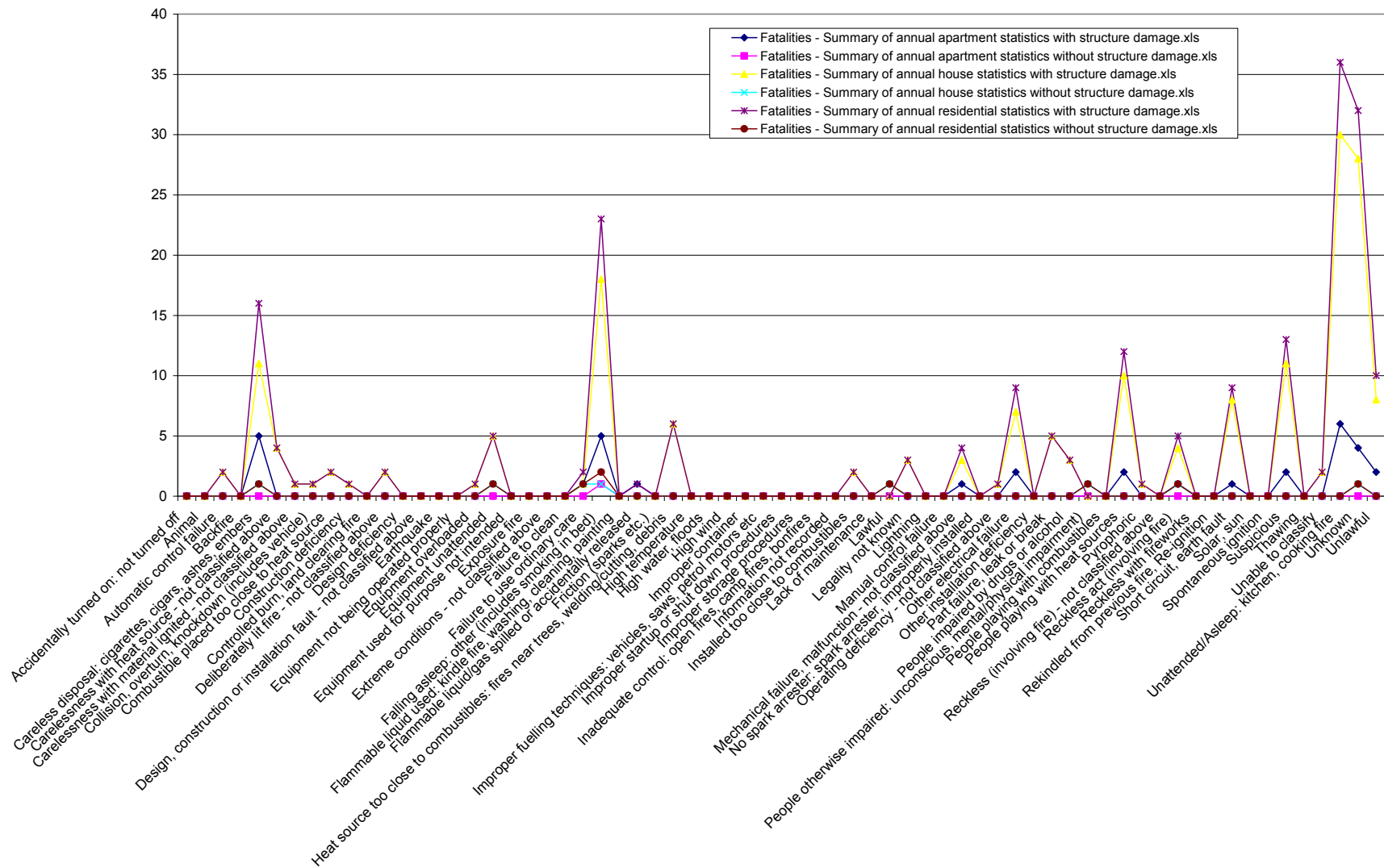


Figure 271: Number of fatalities residential fires according to reported cause of ignition (1995-2005).

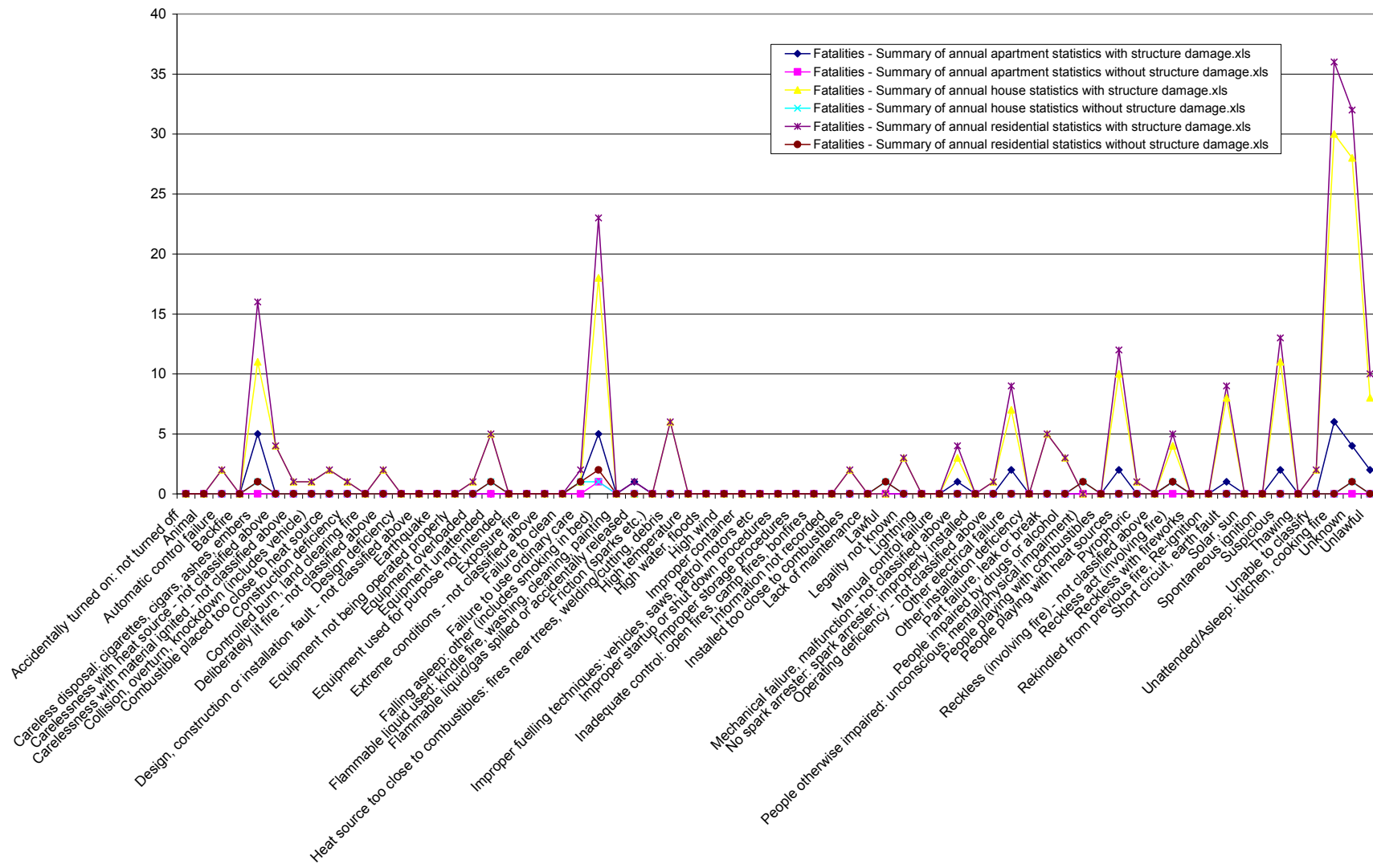


Figure 272: Number of injuries from residential fires according to reported cause of ignition (1995-2005).

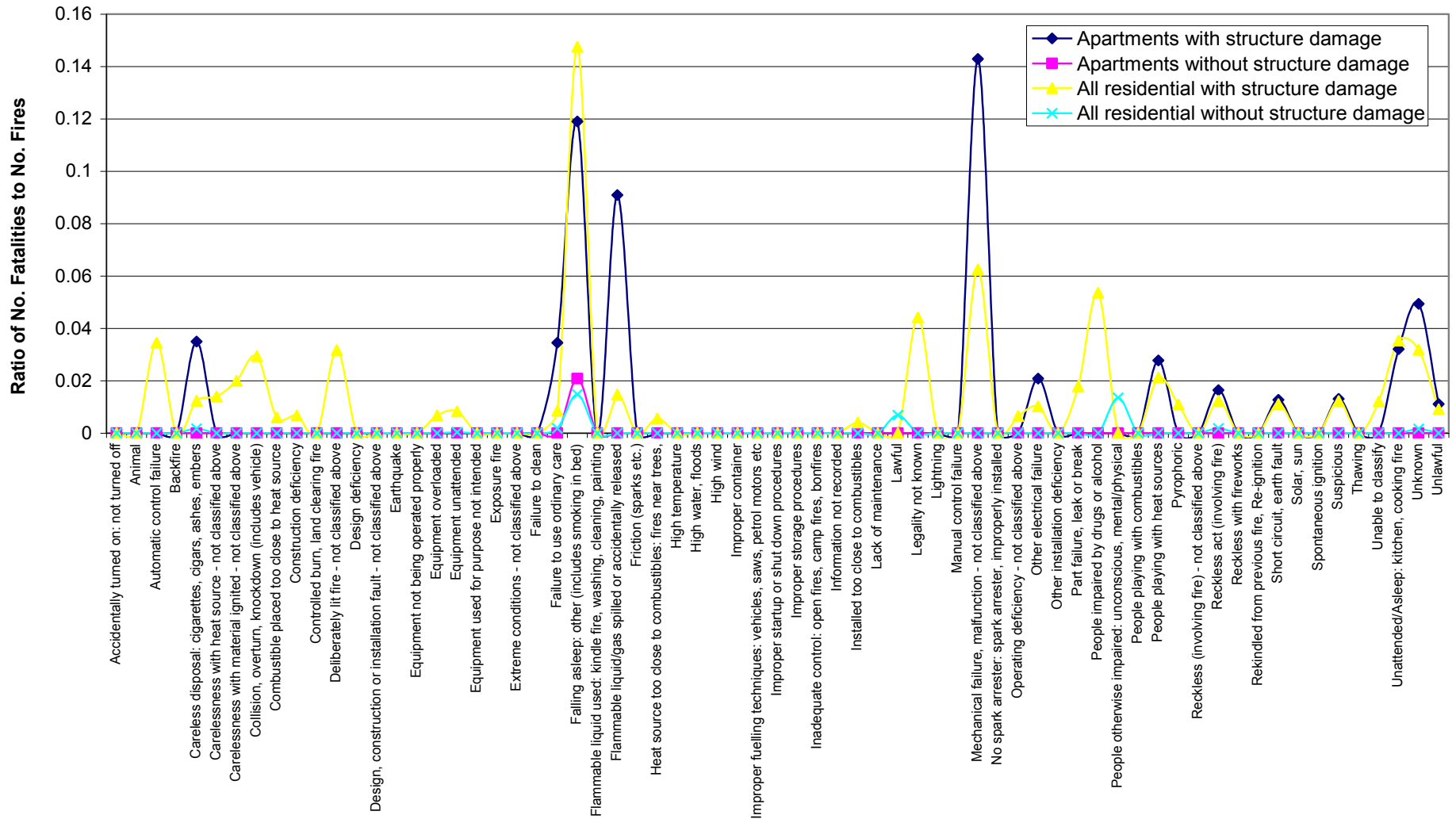


Figure 273: Ratio of number of fatalities to number of fires for each cause of ignition recorded (1995-2005).

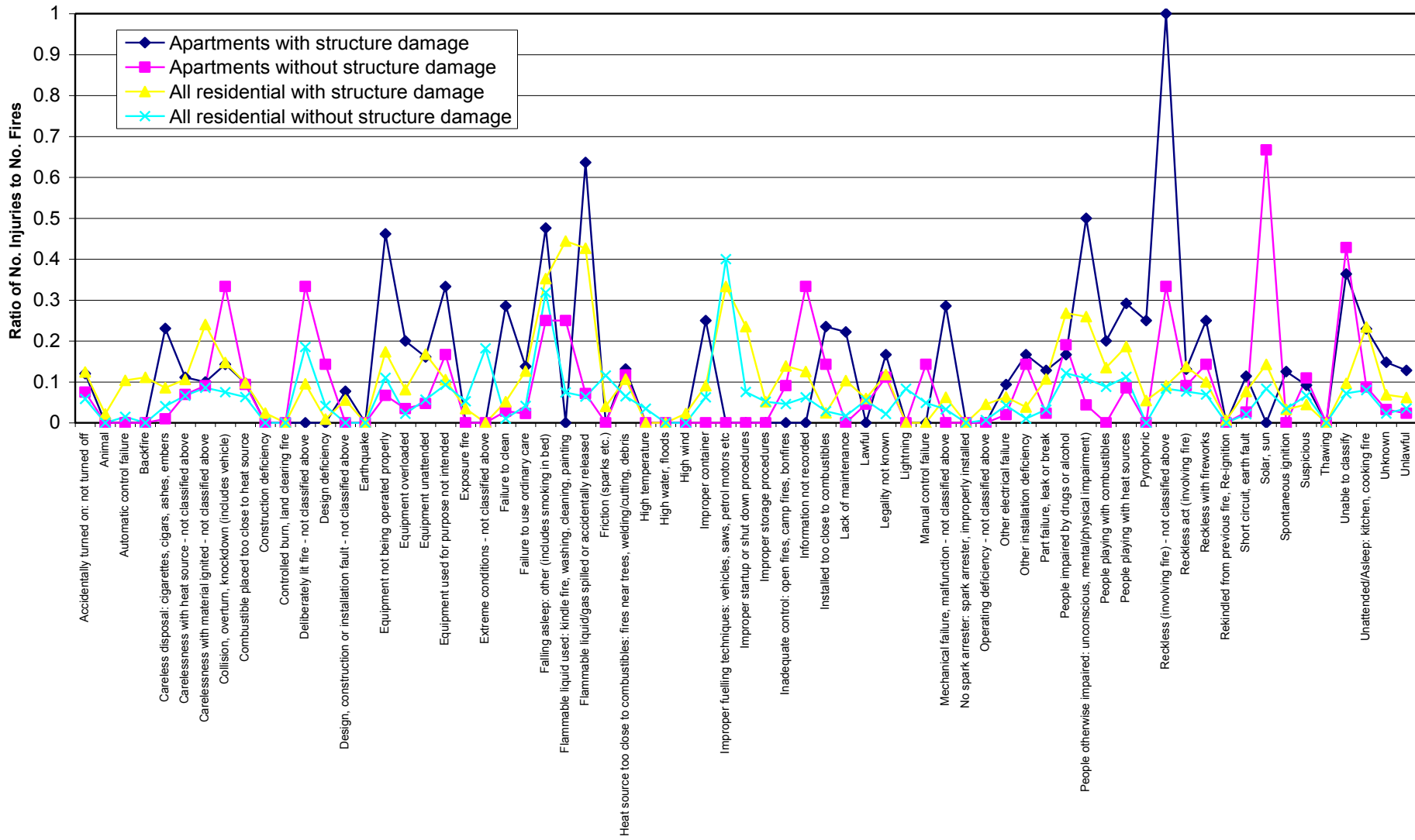


Figure 274: Ratio of number of injuries to number of fires for each cause of ignition recorded (1995-2005).

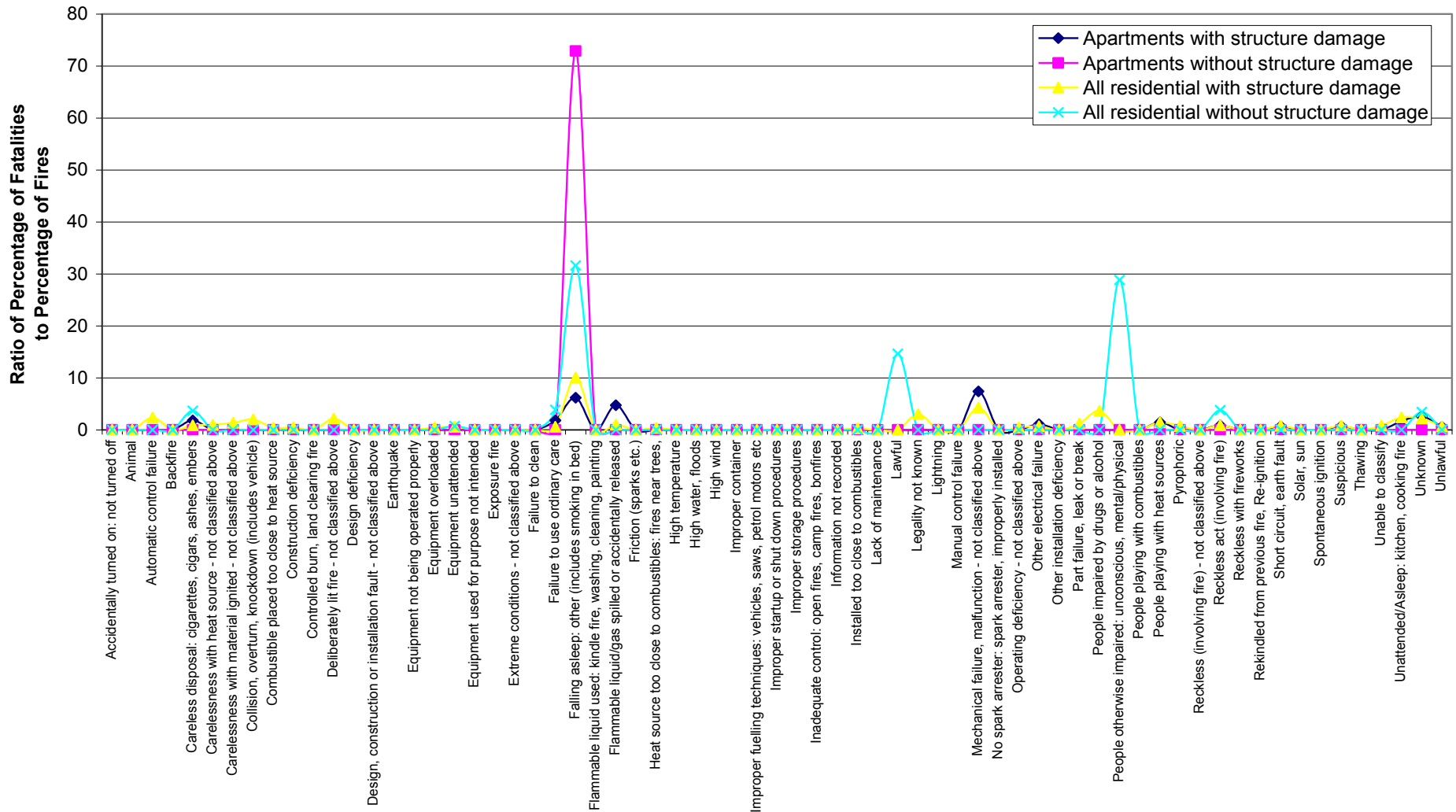


Figure 275: Ratio of percentage of total fatalities to percentage of total number of fires reported according to cause of ignition (1995-2005).

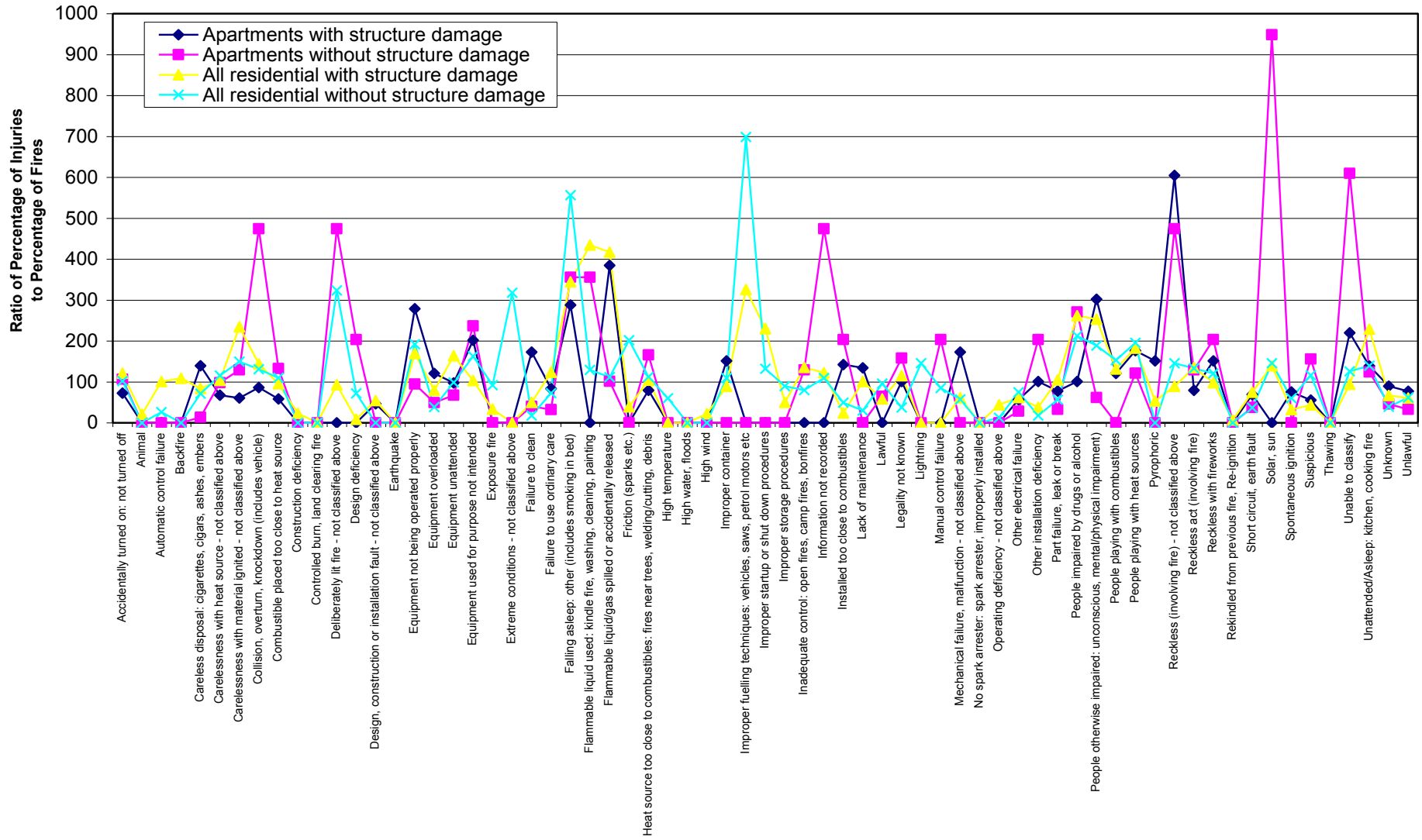


Figure 276: Ratio of percentage of total injuries to percentage of total number of fires reported according to cause of ignition (1995-2005).

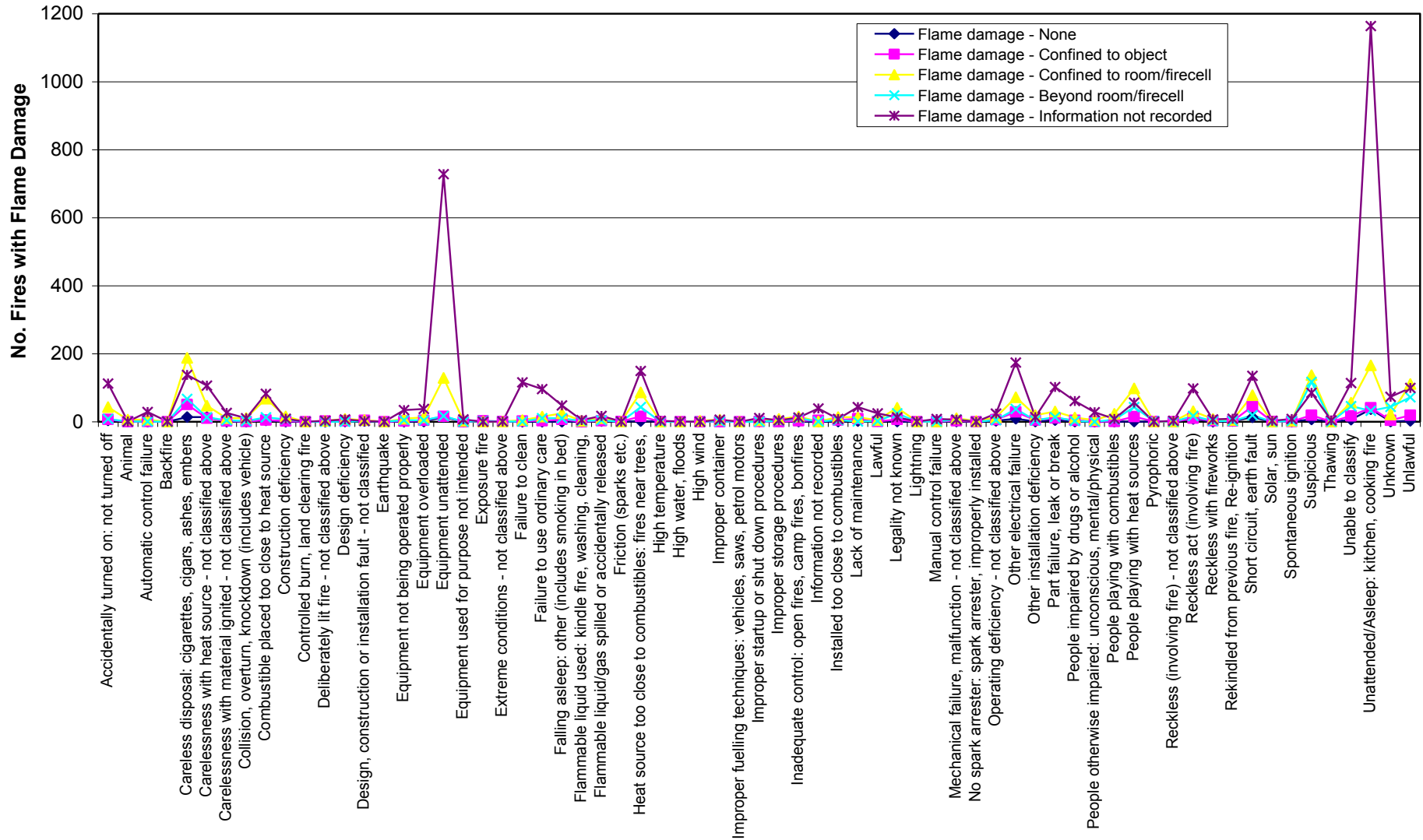


Figure 277: Number of apartment fires according to extent of flame damage and reported cause of ignition (1986-2005).

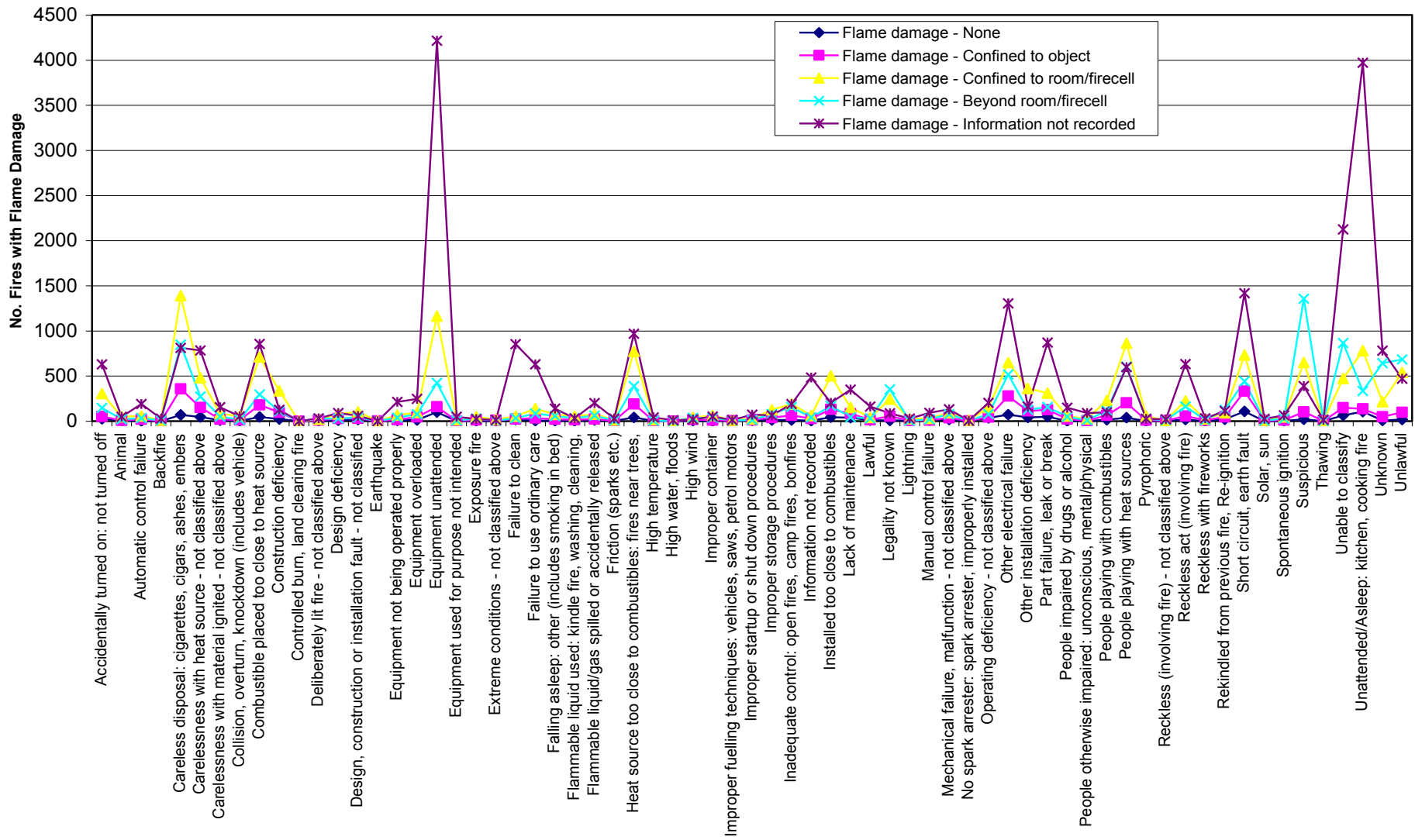


Figure 278: Number of all residential fires according to extent of flame damage and reported cause of ignition (1986-2005).

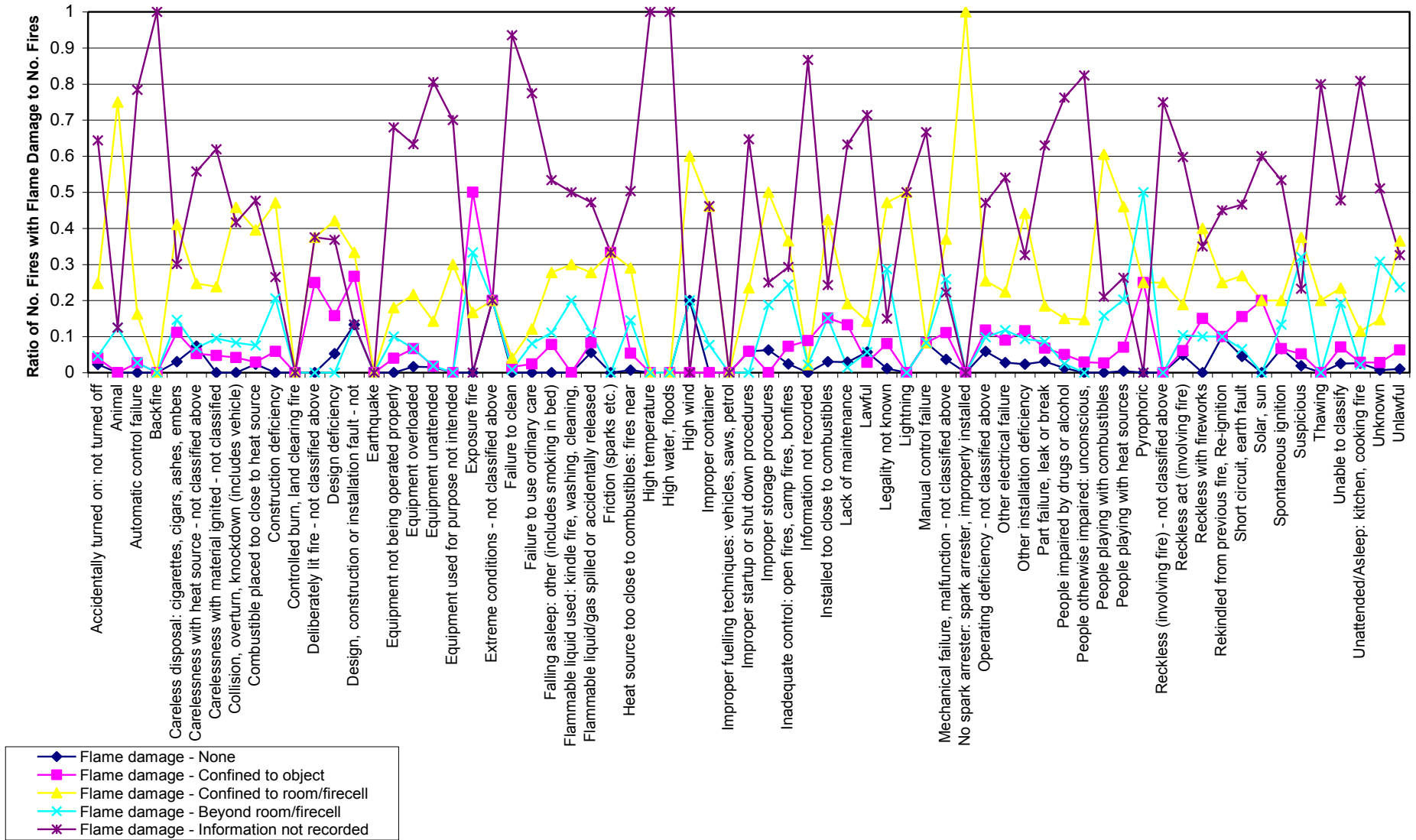


Figure 279: Ratio of the number of apartment fires according to extent of flame damage to the number of total fires attributed to each cause of ignition reported (1986-2005).

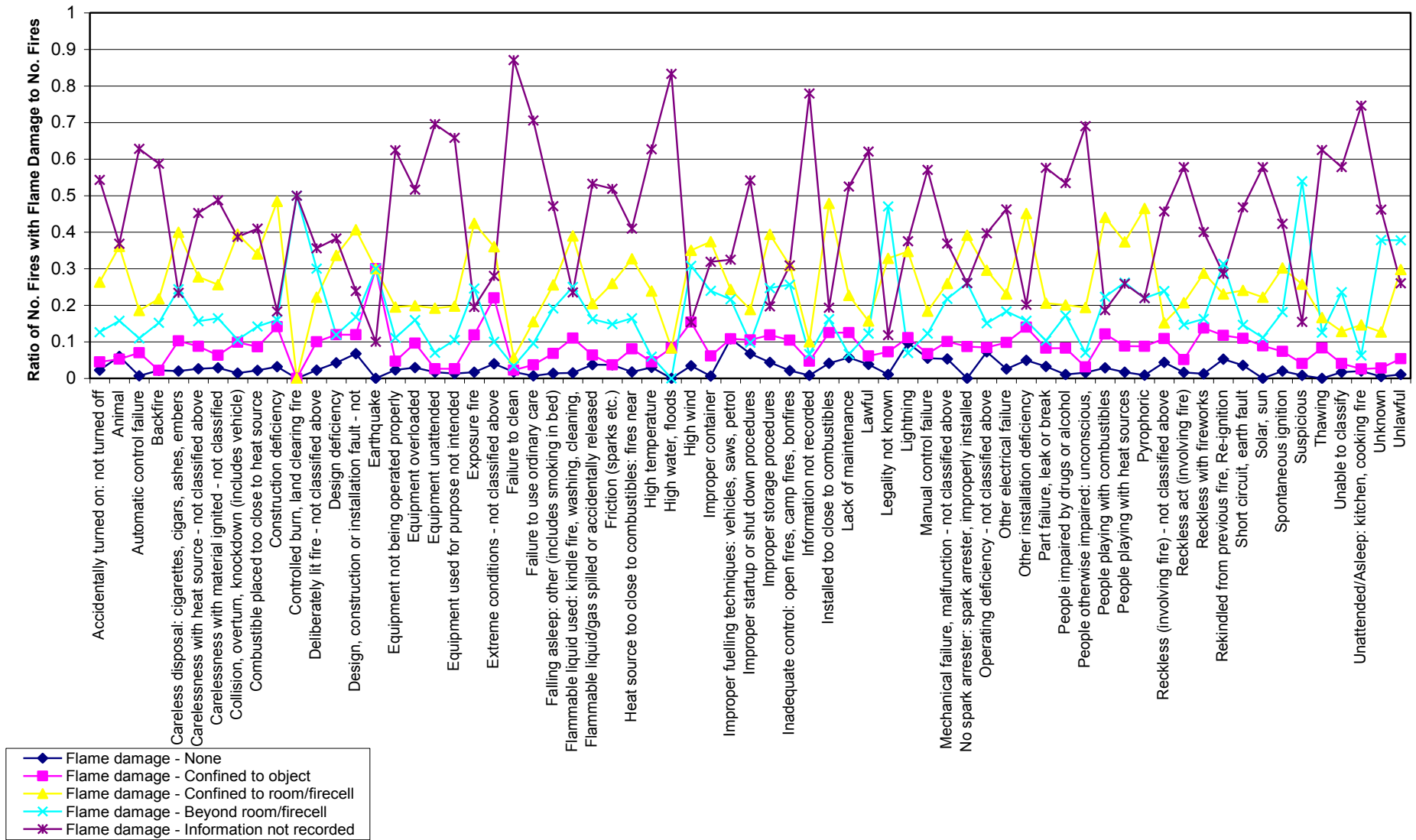


Figure 280: Ratio of the number of apartment fires according to extent of flame damage to the number of total fires attributed to each cause of ignition reported (1986-2005).

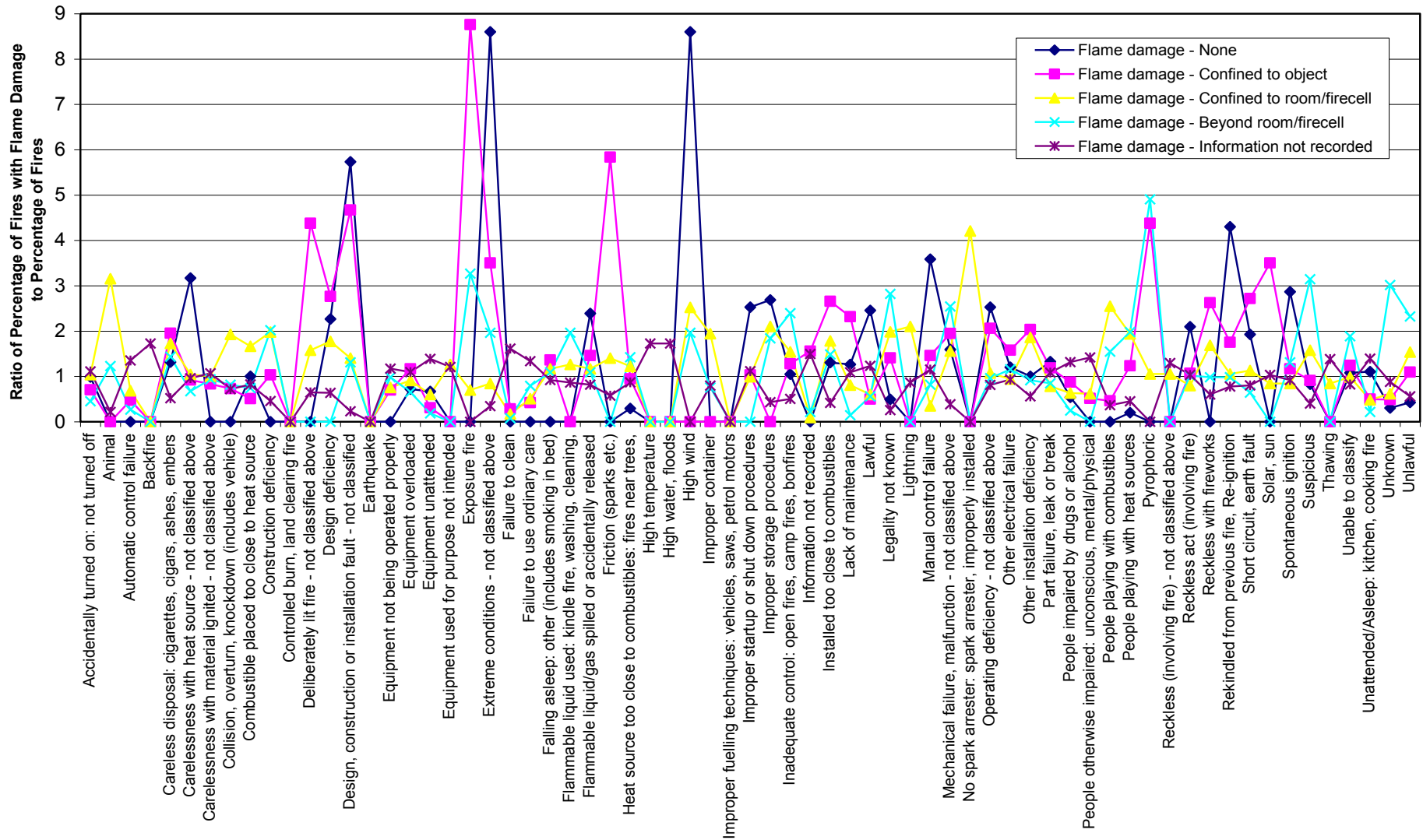


Figure 281: Ratio of the percentage of apartment fires according to extent of flame damage to the percentage of total fires attributed to each cause of ignition reported (1986-2005).

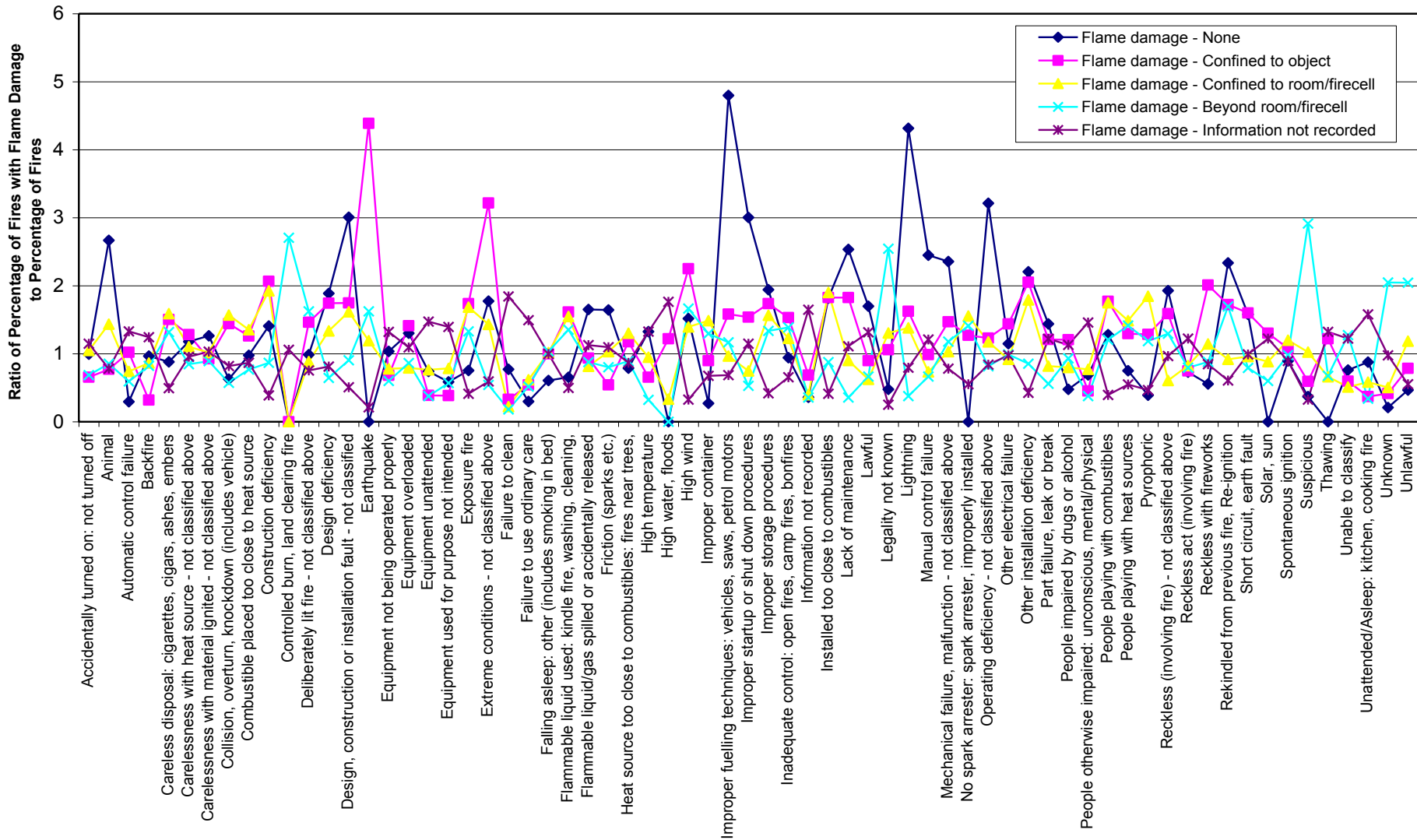


Figure 282: Ratio of the percentage of all residential fires according to extent of flame damage to the percentage of total fires attributed to each cause of ignition reported (1986-2005).

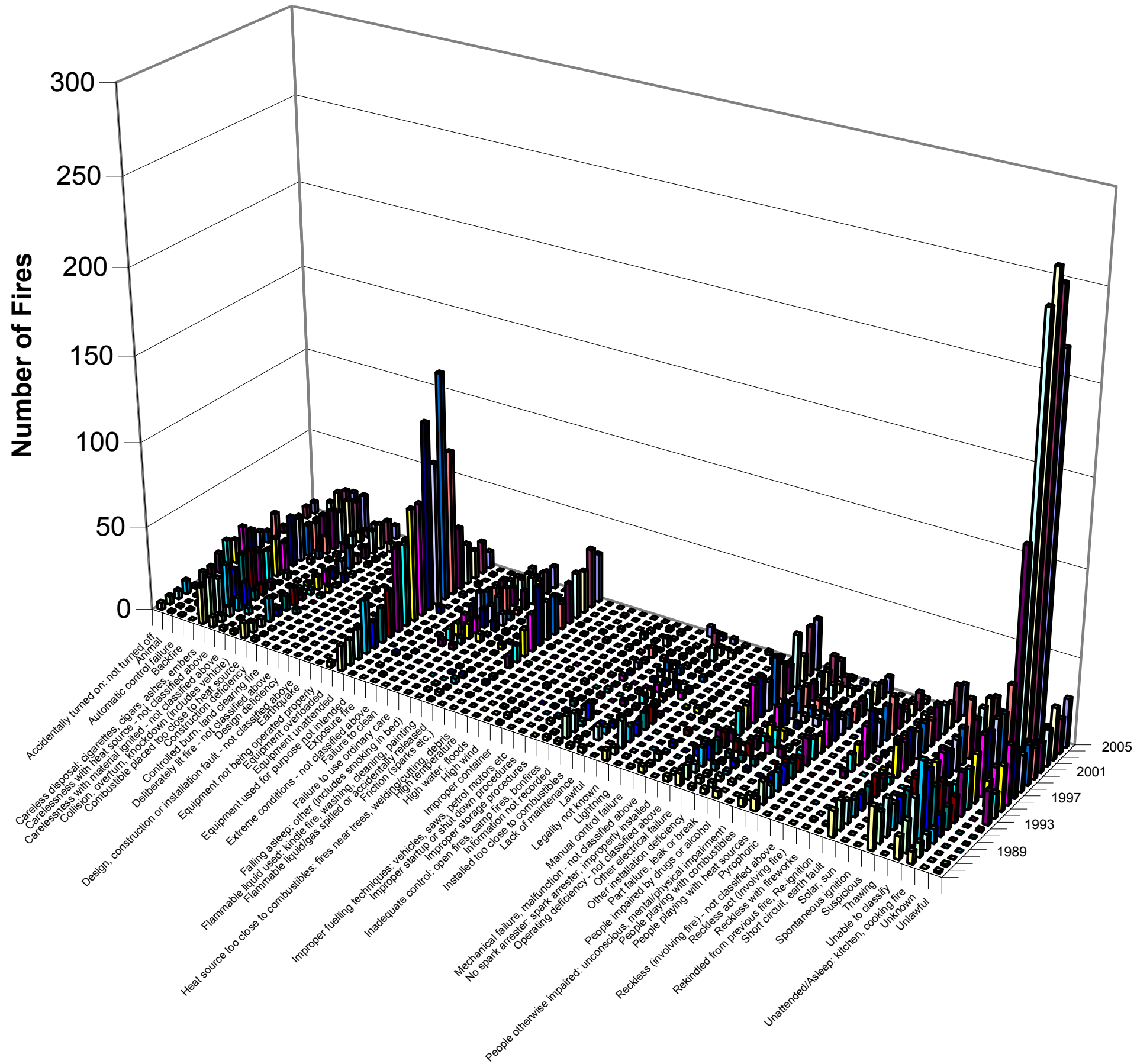
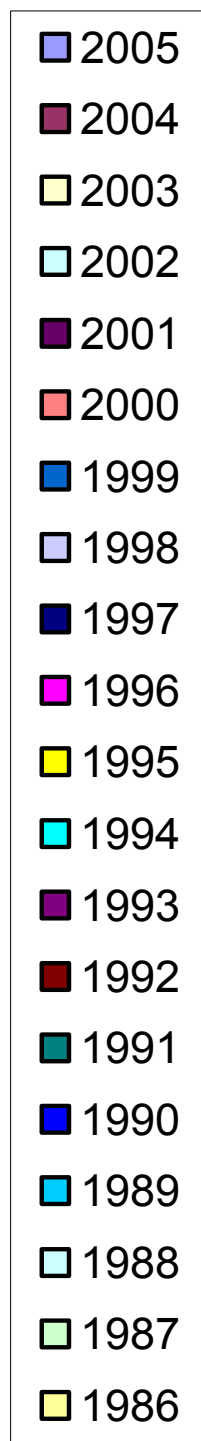


Figure 283: Number of fires each year that occurred in apartments for each reported cause of ignition (1986 – 2005).

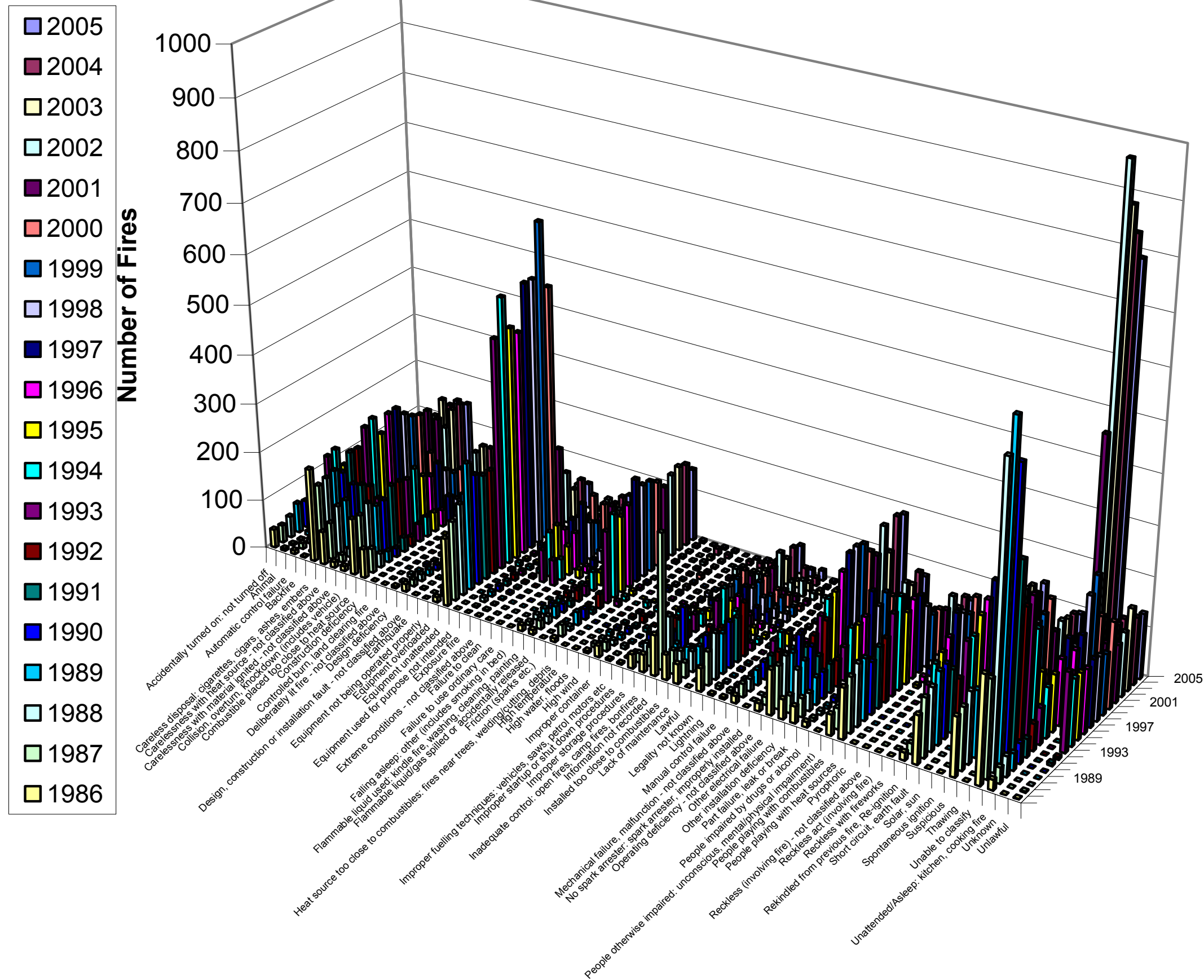


Figure 284: Number of fires each year that occurred in all residential structures for each reported cause of ignition (1986 – 2005).

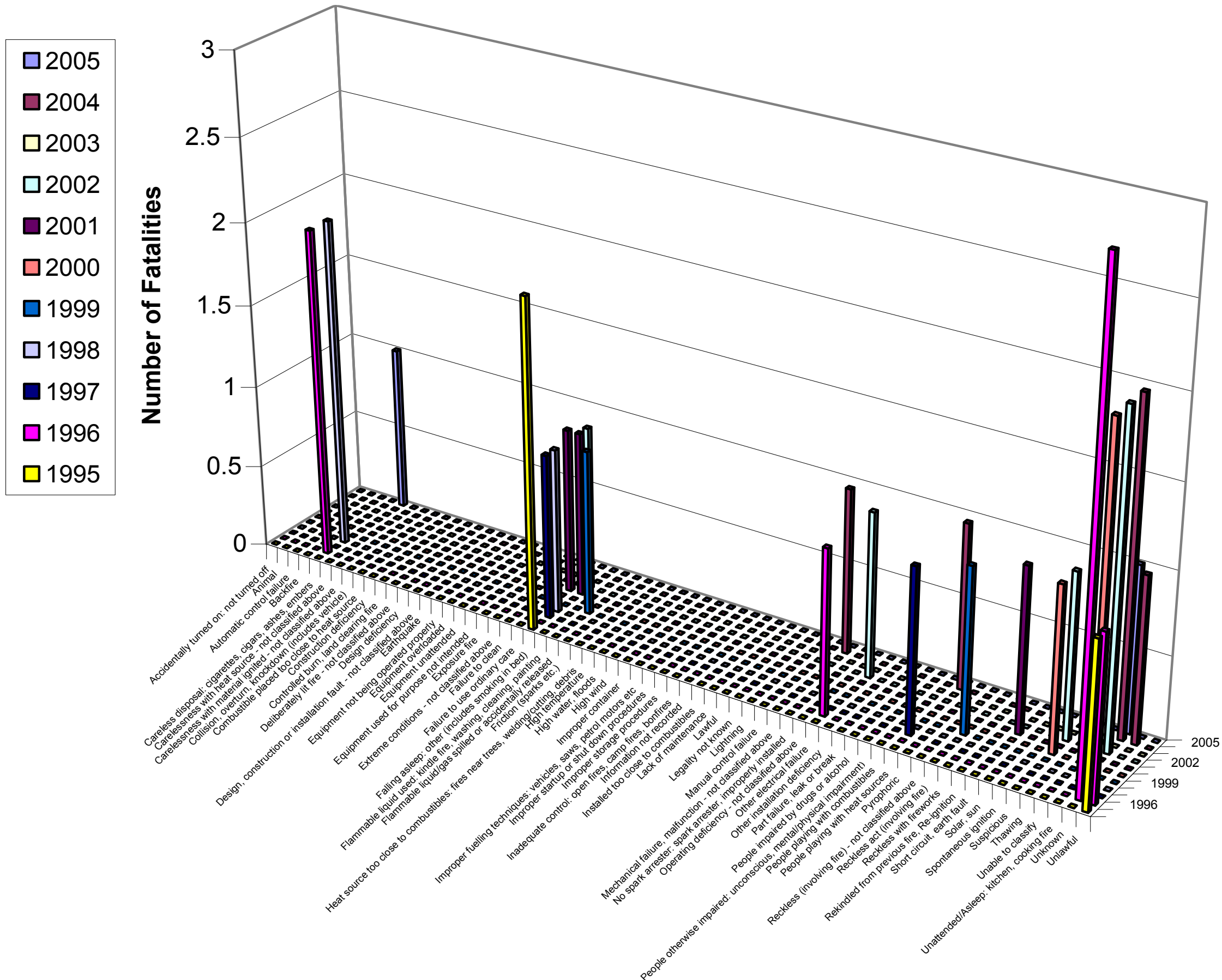


Figure 285: Number of fatalities from apartment fires per year for each reported cause of ignition (1995-2005).

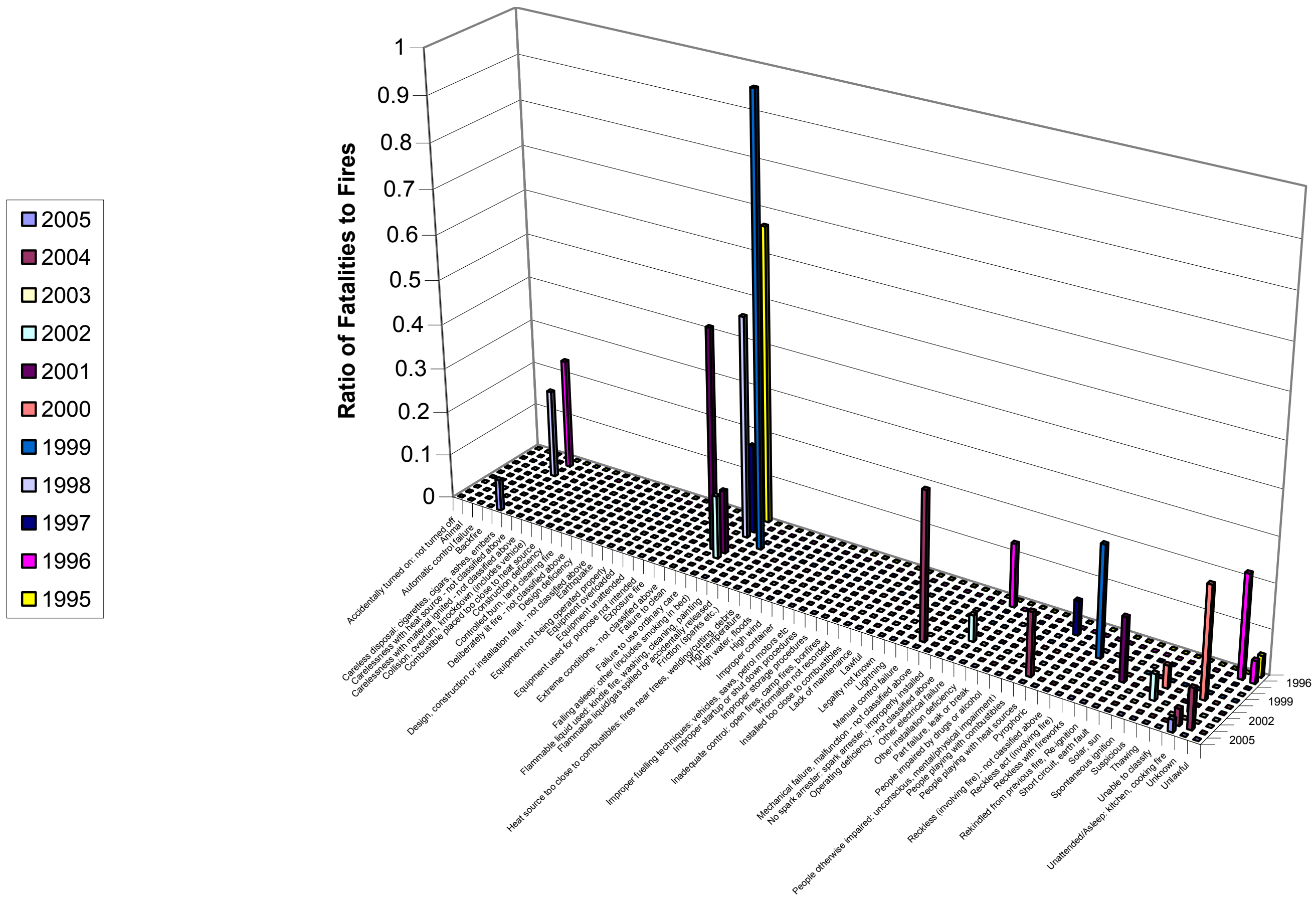


Figure 286: Ratio of the number of fatalities to the number of fires in apartments each year for each reported cause of ignition (1995-2005).

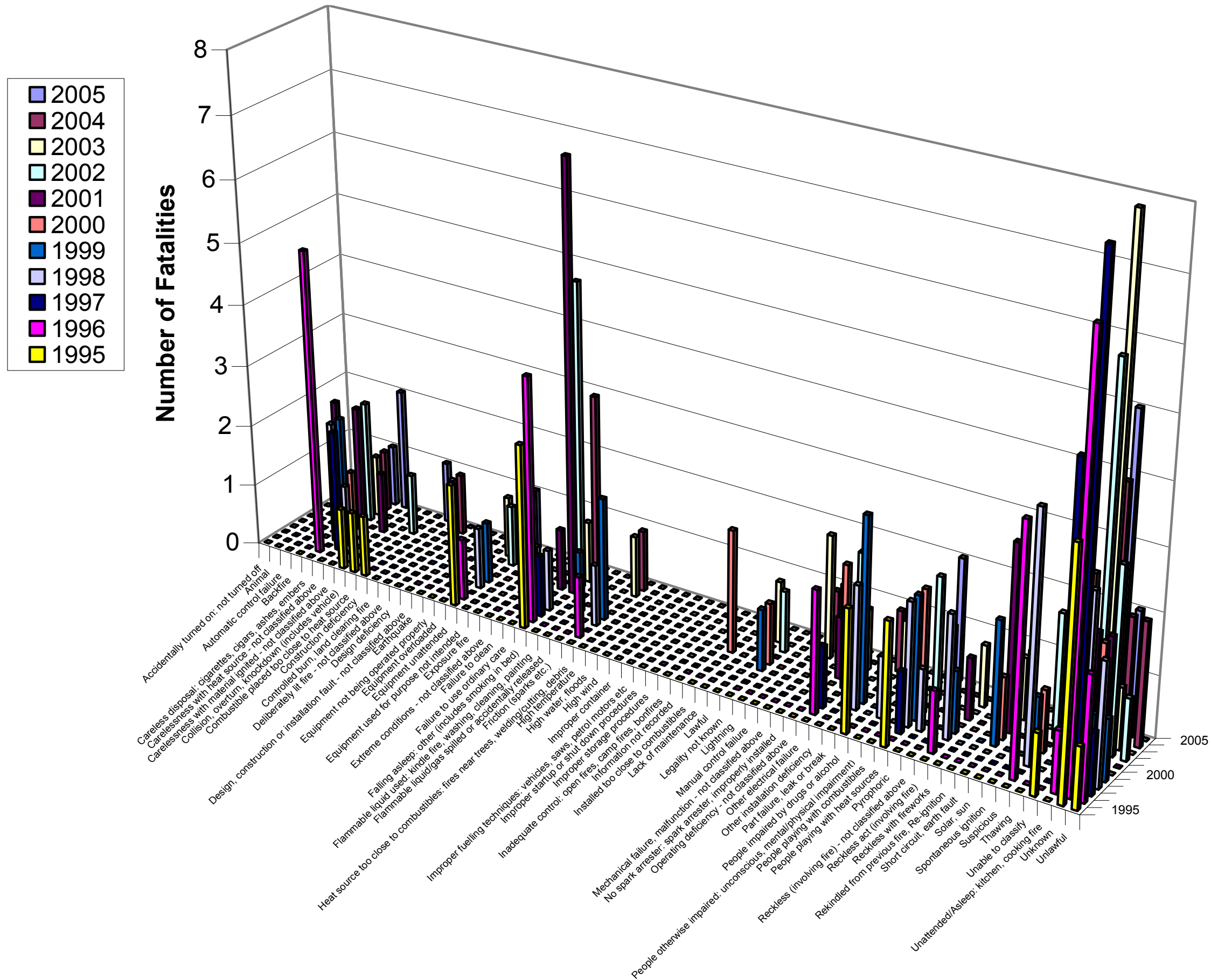


Figure 287: Number of fatalities from all residential structure fires per year for each reported cause of ignition (1995-2005).

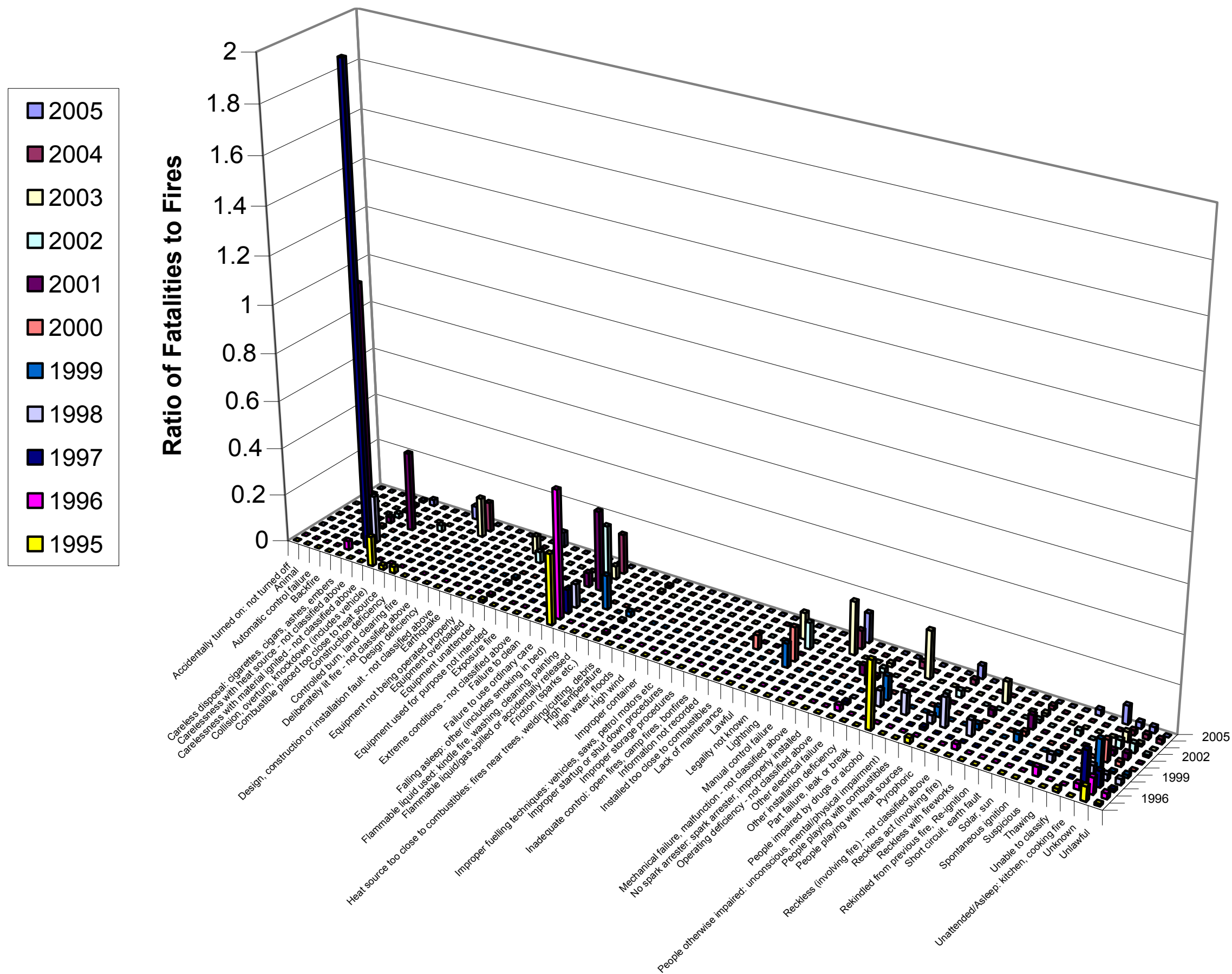


Figure 288: Ratio of the number of fatalities to the number of fires in all residential structures each year for each reported cause of ignition (1995-2005).

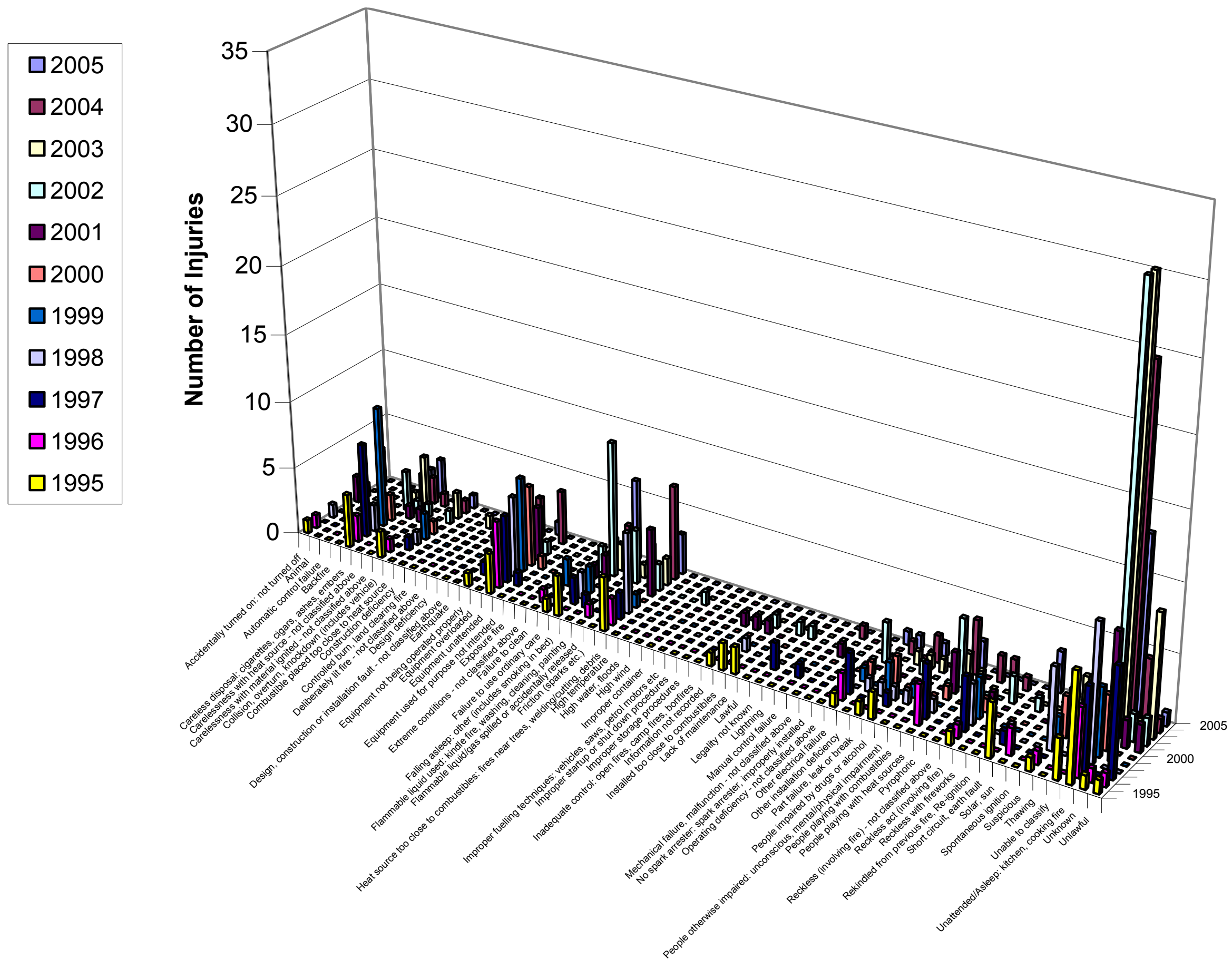


Figure 289: Number of injuries from apartment fires each year for each reported cause of ignition (1995-2005).

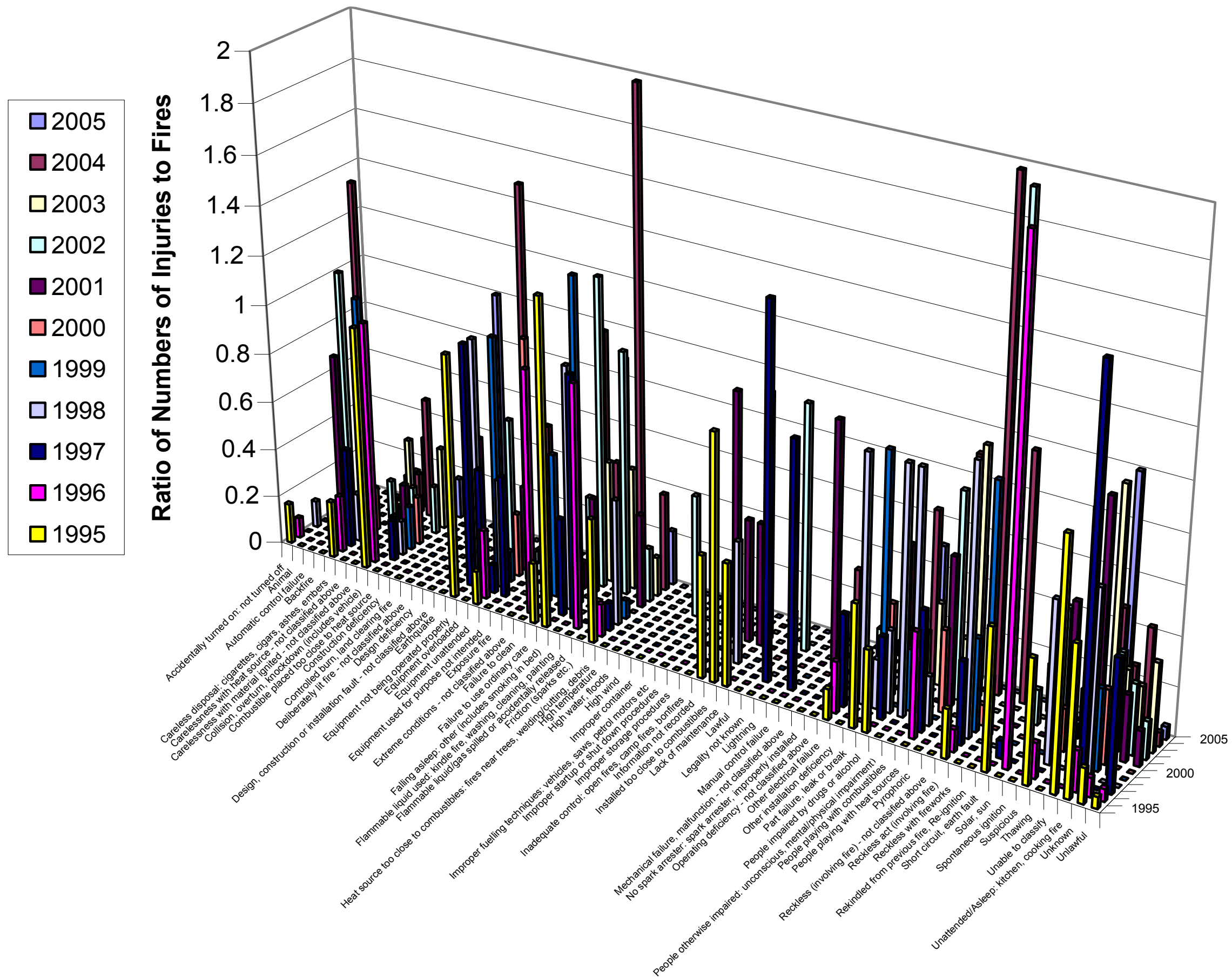


Figure 290: Ratio of the number of injuries to the number of fires that occurred in apartments each year for each reported cause of ignition (1995 – 2005).

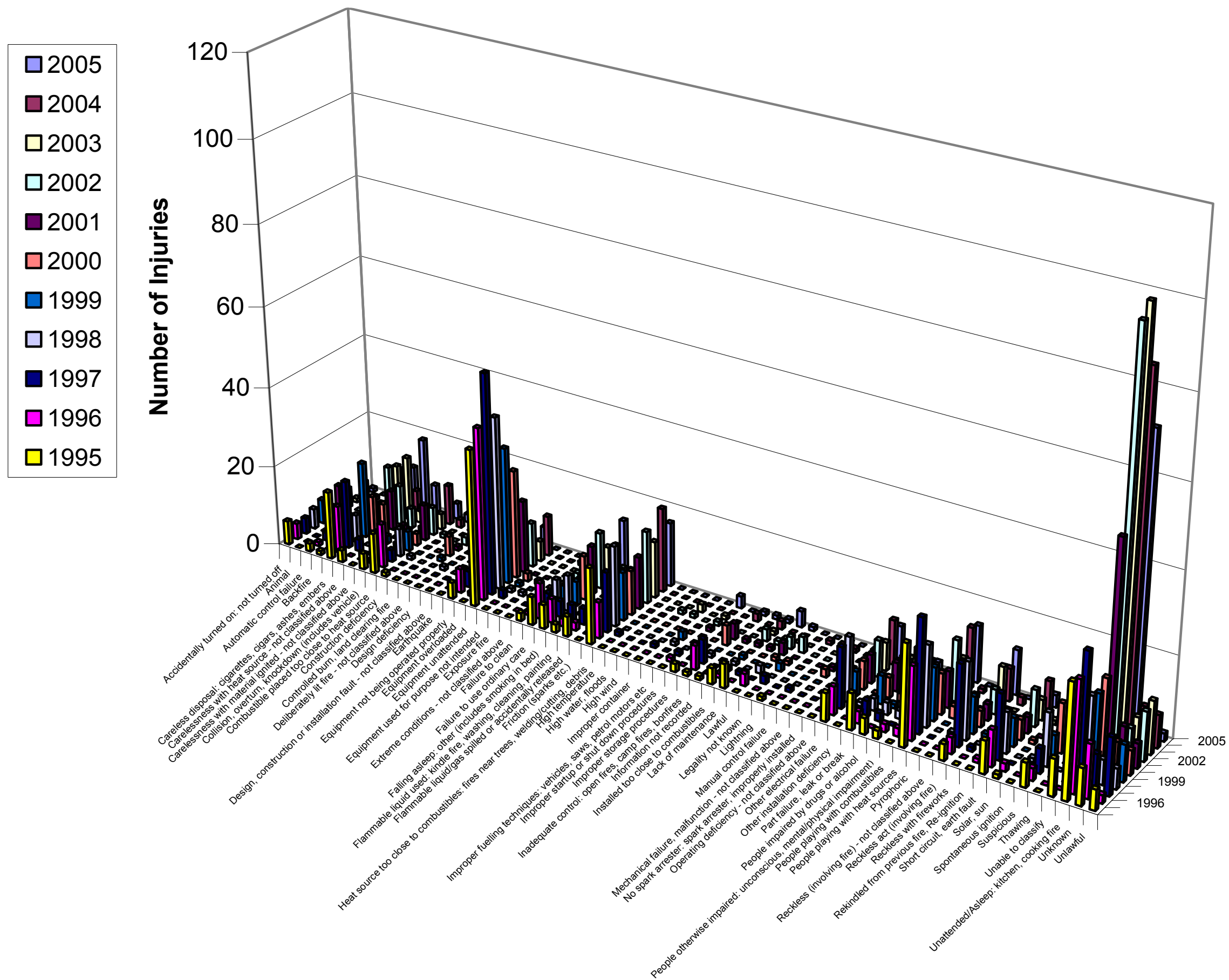


Figure 291: Number of injuries from residential fires each year for each reported cause of ignition (1995 – 2005).

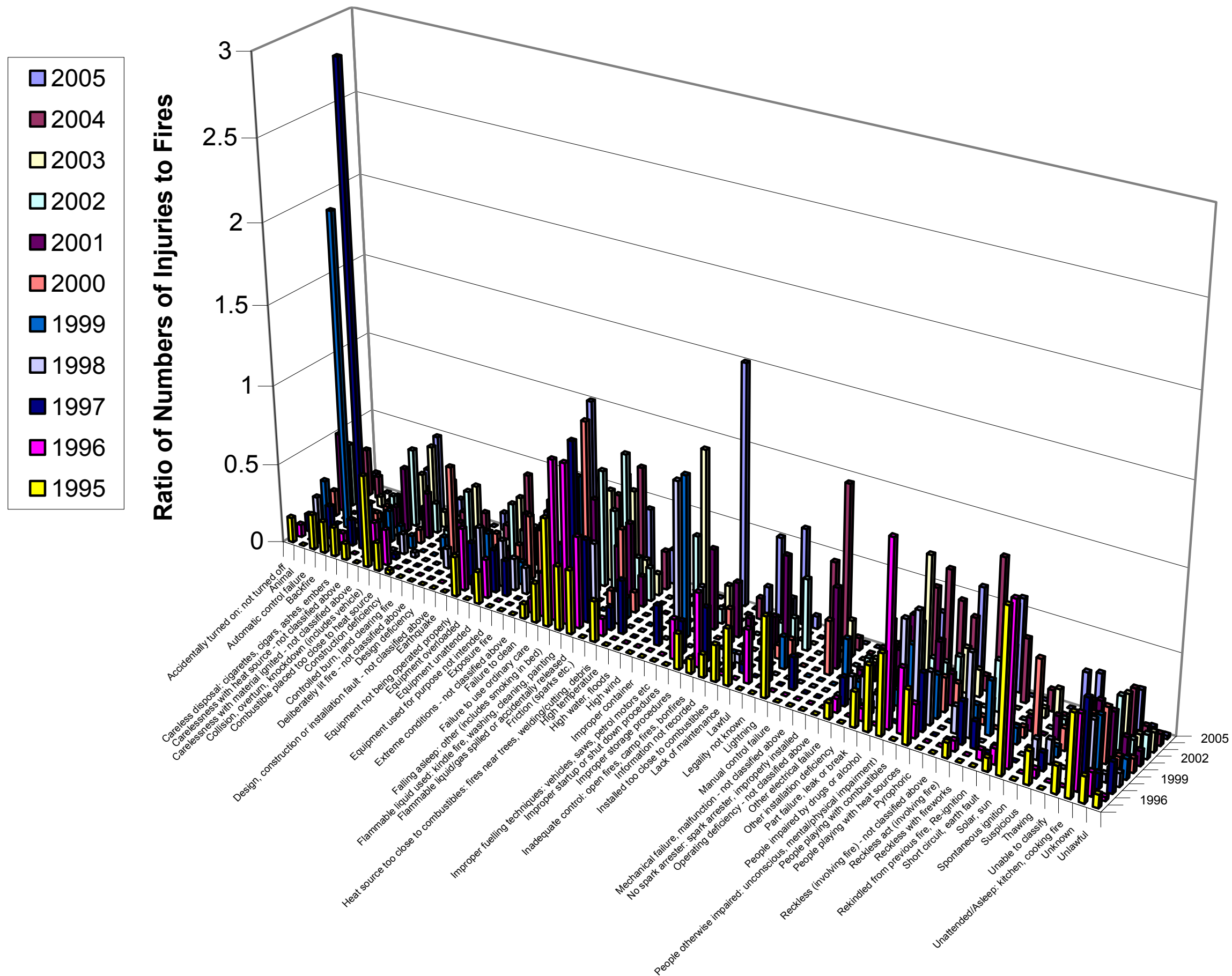


Figure 292: Ratio of the number of injuries to the number of fires that occurred in all residential structures each year for each reported cause of ignition (1995 – 2005).

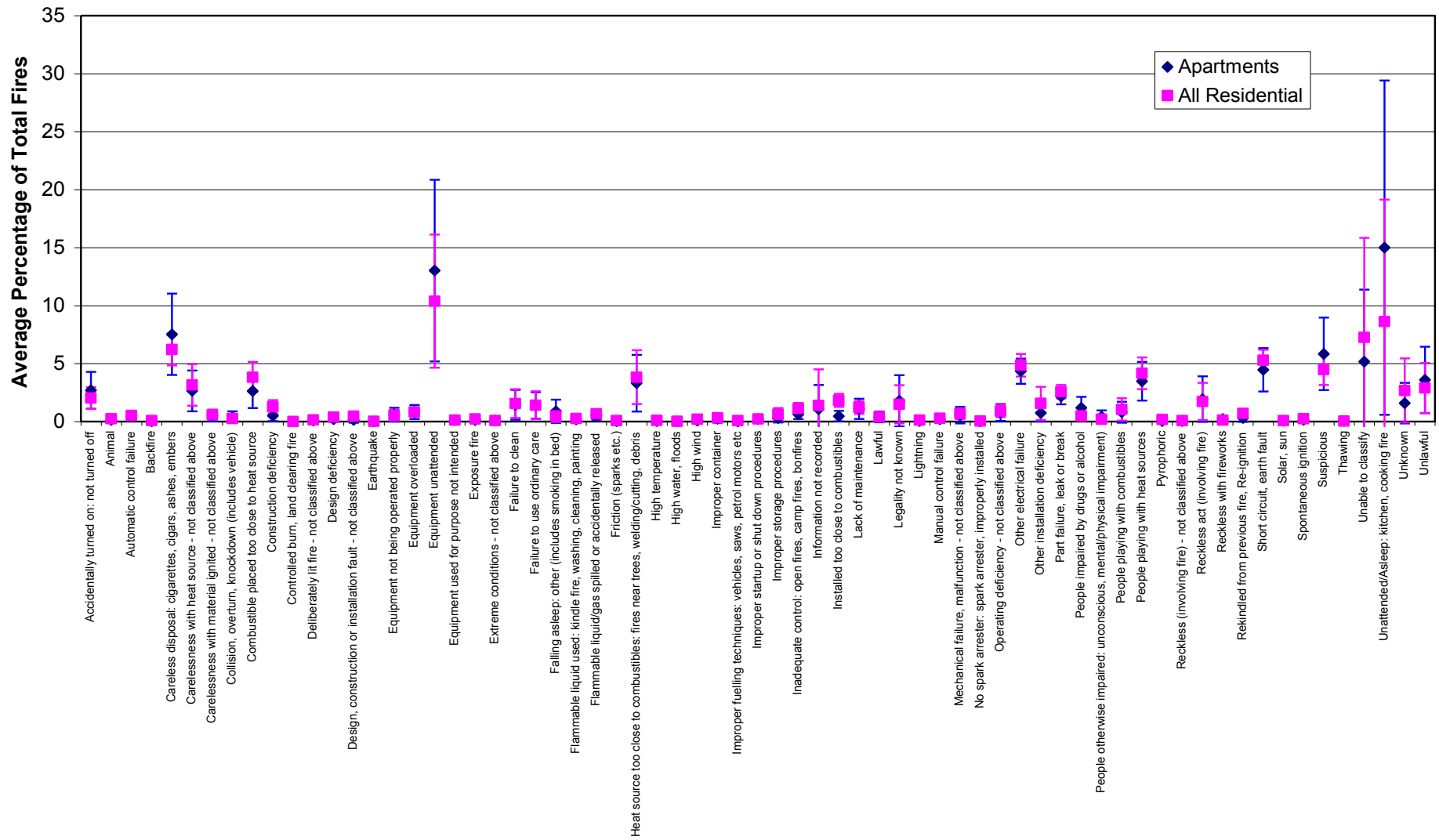


Figure 293: Average percentage of total fires each year for each reported cause of ignition (1995 – 2005).

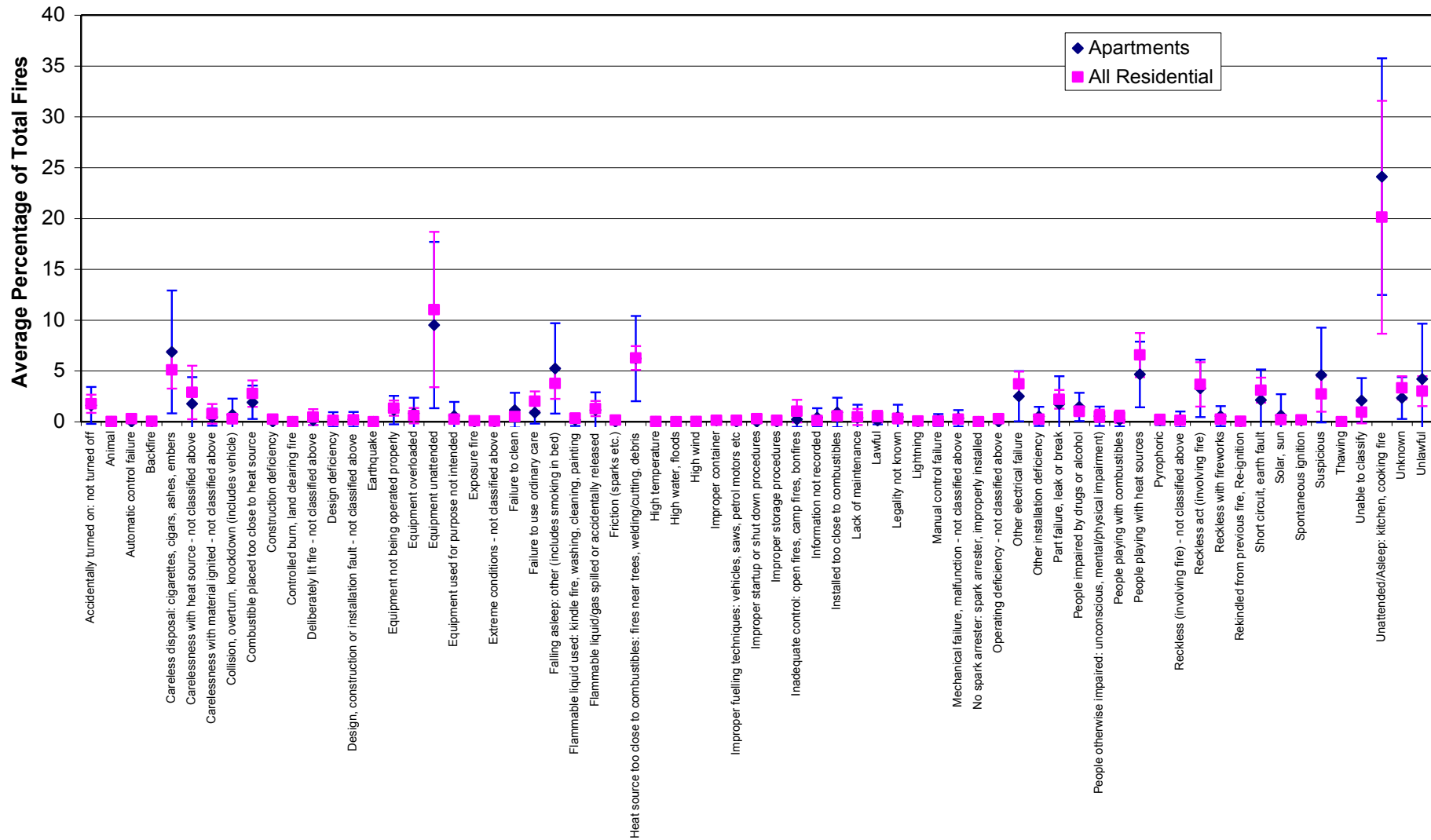


Figure 295: Average percentage of total injuries each year for each reported cause of ignition (1995 – 2005).

APPENDIX J SUMMARY OF ONE-LEVEL EVENT TREE ANALYSIS

Table 91: Summary of correlations between apartment and all residential data sets for cumulative totals and casualties per fire for all entries of each category

Category	Fire Structure Damage	No. Fires ^a	No. Fires ^b	No. Fatalities ^b	No. Injuries ^b	Fatality per Fire ^b	Injury per Fire ^b
Room of Fire Origin	With structure damage	1.0	1.0	1.0	1.0	0.7	0.3
	Without structure damage	1.0	1.0	0.6	1.0	0.8	0.2
	All	1.0	1.0	1.0	1.0	0.7	0.2
Equipment Involved in Ignition	With structure damage	1.0	1.0	1.0	1.0	0.6	0.4
	Without structure damage	0.0	0.0	0.0	0.0	0.0	0.0
	All	0.9	0.8	0.8	0.8	0.6	0.2
Equipment Involved in Ignition (excl. "no information recorded")	With structure damage	0.9	1.0	0.8	1.0	0.6	0.4
	Without structure damage	0.0	0.0	-	0.0	-	0.0
	All	0.1	0.2	0.2	0.3	0.6	0.2
Material First Ignited	With structure damage	0.9	0.9	0.8	1.0	0.6	0.8
	Without structure damage	1.0	1.0	0.3	1.0	0.3	0.6
	All	0.9	0.9	0.8	1.0	0.6	0.4
Cause of Ignition	With structure damage	0.9	0.9	0.9	0.9	0.8	0.6
	Without structure damage	0.9	1.0	0.6	1.0	0.7	0.4
	All	0.9	0.9	0.9	1.0	0.8	0.6

Notes:

^a For years 1986 to 2005.

^b For years 1995 to 2005.

Table 92: Summary of linear correlations between the data sets for apartments only and all residential structures for groups of each category.

Category	Parameter	Linear Correlation between Apartments and All Residential Fire Incident Data Sets	
		1995 - 2005	1986 - 2005
Room of Fire Origin	Fires	1.0	1.0
	Fatalities	1.0	-
	Injuries	1.0	-
	Ratio of Fatalities to Local Fires	0.7	-
	Ratio of Injuries to Local Fires	0.9	-
Equipment Involved in Ignition	Fires	1.0	1.0
	Fatalities	1.0	-
	Injuries	1.0	-
	Ratio of Fatalities to Local Fires	1.0	-
	Ratio of Injuries to Local Fires	0.9	-
Material First Ignited	Fires	0.9	0.8
	Fatalities	0.7	-
	Injuries	0.9	-
	Ratio of Fatalities to Local Fires	0.9	-
	Ratio of Injuries to Local Fires	0.9	-
Cause of Ignition	Fires	1.0	1.0
	Fatalities	0.9	-
	Injuries	1.0	-
	Ratio of Fatalities to Local Fires	1.0	-
	Ratio of Injuries to Local Fires	1.0	-

Table 93: Probabilities of the data set for room of fire origin being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

	Parameter	Probability (%)						
		Bedroom	Kitchen	Laundry/ Bathroom	Dining/ Lounge	Means of Escape	Information not Recorded	Other
Apartments	Percentage of Fires per Year	95	99	94	100	90	59	100
	Percentage of Fatalities per Year	78	85	89	76	84	77	83
	Percentage of Injuries per Year	83	86	56	73	57	54	61
	Ratios of Fatalities per Fire	69	62	65	61	60	65	79
	Ratios of Injuries per Fire	94	94	69	86	60	56	85
All Residential	Percentage of Fires per Year	88	98	79	95	71	58	93
	Percentage of Fatalities per Year	63	64	70	64	62	70	63
	Percentage of Injuries per Year	89	97	69	89	58	56	95
	Ratios of Fatalities per Fire	61	60	-	59	-	-	53
	Ratios of Injuries per Fire	72	72	59	77	57	55	59

Table 94: Probabilities of the data set for equipment involved in ignition being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

	Parameter	Probability (%)								
		Clothes Dryer/ Washing Machine	Electric Blanket	Heater	Water Heater	Oven/ Stove	Power Transfer Equipment	Entertain- ment Equipment	Information not recorded	Other
Apartments	Percentage of Fires per Year	90	78	76	74	76	71	84	81	66
	Percentage of Fatalities per Year	-	55	53	-	59	-	53	67	55
	Percentage of Injuries per Year	53	56	57	53	63	53	53	70	56
	Ratios of Fatalities per Fire	-	60	62	53	69	56	56	77	58
	Ratios of Injuries per Fire	61	76	79	63	89	62	62	95	74
All Residential	Percentage of Fires per Year	77	69	83	66	76	76	78	81	66
	Percentage of Fatalities per Year	-	59	60	53	64	54	56	73	56
	Percentage of Injuries per Year	59	69	74	61	73	61	59	79	63
	Ratios of Fatalities per Fire	-	55	53	-	58	53	53	63	55
	Ratios of Injuries per Fire	55	62	65	56	71	57	57	71	63

Table 95: Probabilities of the data set for material first ignited being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

	Parameter	Probability (%)						
		Fabric	Fat or Food	Combustible or Flammable Liquid	Polymer	Finished Timber	Information not recorded	Other
Apartments	Percentage of Fires per Year	87	90	95	99	85	80	99
	Percentage of Fatalities per Year	58	55	56	56	53	59	58
	Percentage of Injuries per Year	80	81	67	74	66	73	75
	Ratios of Fatalities per Fire	69	62	65	61	60	65	79
	Ratios of Injuries per Fire	98	91	79	80	67	77	95
All Residential	Percentage of Fires per Year	86	95	94	98	79	76	95
	Percentage of Fatalities per Year	65	60	63	59	58	63	66
	Percentage of Injuries per Year	86	90	82	83	73	74	93
	Ratios of Fatalities per Fire	58	55	56	56	53	57	60
	Ratios of Injuries per Fire	74	74	65	68	59	66	76

Table 96: Probabilities of the data set for cause of ignition being representative (within $\pm 10\%$) of the situation in New Zealand (assuming a normal distribution).

	Parameter	Probability (%)								
		Careless disposal of cigarette ashes, etc.	Falling Asleep	Carelessness	Play or Recklessness	Electrical Failure	Unattended / Asleep Kitchen Fire	Deliberate, Suspicious or Unlawful	Information not Recorded	Other
Apartments	Percentage of Fires per Year	97	73	95	79	98	63	98	81	85
	Percentage of Fatalities per Year	56	58	-	56	56	57	57	54	56
	Percentage of Injuries per Year	62	62	72	71	63	71	65	64	76
	Ratios of Fatalities per Fire	64	60	74	69	61	62	62	65	58
	Ratios of Injuries per Fire	78	85	89	76	84	77	83	76	76
All Residential	Percentage of Fires per Year	87	71	91	73	94	64	88	74	76
	Percentage of Fatalities per Year	62	60	67	67	60	63	63	64	62
	Percentage of Injuries per Year	77	75	85	81	80	68	73	75	79
	Ratios of Fatalities per Fire	56	57	-	56	56	55	58	54	56
	Ratios of Injuries per Fire	63	64	70	64	62	70	63	62	63

Table 97: Percentages of fires per year and ratios of fatalities and injuries per local fire for room of fire origin for the all residential data set.

Parameter	Probability (%)						
	Bedroom	Kitchen	Laundry/ Bathroom	Dining/ Lounge	Means of Escape	Information not Recorded	Other
Percentage of Fires per Year (%)	16	33	5	15	3	7	20
Ratios of Fatalities per Fire	0.0158	0.0042	0.0005	0.0134	0.0042	0.0110	0.0015
Ratios of Injuries per Fire	0.14	0.08	0.04	0.08	0.04	0.02	0.03

Table 98: Percentages of fires per year and ratios of fatalities and injuries per local fire for equipment involved in ignition for the all residential data set.

Parameter	Average Yearly Value								
	Clothes Dryer/ Washing Machine	Electric Blanket	Heater	Water Heater	Oven/ Stove	Power Transfer Equipment	Entertain- ment Equipment	Information not recorded	Other
Percentage of Fires per Year (%)	2	3	5	1	14	2	1	66	7
Ratios of Fatalities per Fire	0.0000	0.0227	0.0059	0.0045	0.0039	0.0102	0.0102	0.0085	0.0051
Ratios of Injuries per Fire	0.02	0.11	0.08	0.06	0.09	0.09	0.09	0.08	0.06

Table 99: Percentages of fires per year and ratios of fatalities and injuries per local fire for material first ignited for the all residential data set.

Parameter	Average Yearly Value						
	Fabric	Fat or Food	Combustible or Flammable Liquid	Polymer	Finished Timber	Information not recorded	Other
Percentage of Fires per Year (%)	15	18	8	16	13	10	20
Ratios of Fatalities per Fire	0.0105	0.0022	0.0109	0.0044	0.0065	0.0163	0.0064
Ratios of Injuries per Fire	0.12	0.07	0.17	0.06	0.03	0.06	0.07

Table 100: Percentages of fires per year and ratios of fatalities and injuries per local fire for cause of ignition for the all residential data set.

Parameter	Average Yearly Value								
	Careless disposal of cigarette ashes, etc.	Falling Asleep	Carelessness	Play or Recklessness	Electrical Failure	Unattended / Asleep Kitchen Fire	Deliberate, Suspicious or Unlawful	Information not Recorded	Other
Percentage of Fires per Year (%)	6	0	13	7	10	9	8	11	35
Ratios of Fatalities per Fire	0.0089	0.0895	0.0036	0.0092	0.0051	0.0107	0.0088	0.0197	0.0051
Ratios of Injuries per Fire	0.07	0.35	0.08	0.14	0.05	0.14	0.05	0.06	0.07