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FIRE RISK IN DWELLINGS IN MULTIPLE OCCUPATION

by

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SUMMARY

The Ministry of Housing and Local Government have been studying general problems arising from the multi-occupation of dwellings, and with 'fire risks' in mind a survey was carried out to try to obtain precise statistical information.

A detailed study of fire reports from five local authorities known to have in their areas a high proportion of multiple occupancy dwellings suggests that the risk of a fire occurring is five times as great in these dwellings as in single occupancies. The chance that the fire will result in a non-fatal casualty is more than twice as great for the multiple occupancies as for single occupancies and the chance that it will trap occupants, necessitating rescue or escape is almost seven times greater.

The occupant of a multi-occupancy dwelling is more likely to die in a fire than in a single occupancy, is about $4\frac{1}{2}$ times as likely to become a non-fatal casualty and is about 14 times as likely to be placed in a dangerous situation.

Oil heaters are the main single cause of fires in multiple occupancies.

KEY WORDS: Fire risk; dwelling; occupation, multiple

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INTRODUCTION

The fire risk in dwellings in multiple occupation would be expected to be more serious than those in single occupancy because, (a) there are more people to cause fires and (b) there are more people at risk if fire occurs. The Ministry of Housing and Local Government felt that there was a need for more detailed statistical evidence on this question.

At the request of the Ministry, the Home Office asked the Chief Fire Officers of five selected local authorities if they would participate in a survey of fires in their areas which occurred in premises in multi-occupation.

The definition of a house in multi-occupation, as laid down in the Housing Act 1961, is one which is let in lodgings or is occupied by the members of more than one family. It does not include purpose built multi-occupancy buildings such as flats and maisonettes.

METHOD

The five areas selected were Birmingham, Bradford, Coventry, Nottingham and Wolverhampton, representing areas known to have a high proportion of multi-occupied houses. To allow to some extent for seasonal effects the survey was carried out over two periods, the first from May 1 - July 31 1967 (summer) and the second from December 15 1967 - February 15 1968 (winter).

The fire authorities concerned were asked to supply the following information additional to that normally recorded on fire reports relating to the fires in multi-occupied houses:-

1. The storey on which the fire started.
2. Whether or not in the opinion of the reporting officer casualties might have been prevented if satisfactory means of escape had been provided.
3. The number of persons normally resident, and the number of households in the house.

This additional information together with the details normally recorded on the fire reports, provide the basis for this investigation.

The Joint Fire Research Organization also examined for the same periods and the same areas reports of fires in dwellings in single occupancy.

RESULTS

FREQUENCY OF FIRES

In general more fires occur in dwellings during the winter than in the summer, and Table 1 shows this to have been true in all but one of the areas studied, (Bradford being the exception but having only a small number of fires. The figures also indicate a larger increase (64 per cent) in the number of fires in multi-occupancy dwellings from summer to winter than in the dwellings in single occupancy (14 per cent). It should however be noted that the number of houses at risk could have changed slightly during the period of the survey.

Table 1. Number of fires

Brigade	Multi-occupancy		Single occupancy		Total		Per cent in multi-occupancy		Per cent in single occupancy	
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2
Birmingham	12	21	173	175	185	196	6.5	10.7	93.5	89.3
Bradford	3	1	70	58	73	59	4.2	1.7	95.8	98.3
Coventry	1	3	41	49	42	52	2.3	5.7	97.7	94.3
Nottingham	9	17	31	74	40	91	22.5	18.6	77.5	81.4
Wolverhampton	3	4	27	35	30	39	10.0	10.2	90.0	89.8
TOTAL	28	46	342	391	370	437	7.5	10.5	92.4	89.4

CAUSES OF FIRES

The supposed causes of fires in both multiple and single occupancies are laid out in Table 2 and if it can be assumed that the number of fires caused by space heating appliances is an indication of the type most used, it is evident that oil appliances are widely used in multi-occupancy dwellings. These accounted for 17 (23 per cent) of the 74 fires recorded, and from a study of the actual causes, four heaters were found to be defective, four flared up due to being placed in a draught, three flared up while being refilled, and the remainder ignited either clothing on persons standing too close, or clothing being aired.

Solid fuel appliances were recorded as being the supposed cause of 11 (15 per cent) of the fires in multi-occupancy dwellings mainly due to clothing being placed too near the appliance to air.

'Children with matches' and 'smoking materials' were the other two main causes, followed by 'gas cooking appliances'.

In single occupancy dwellings 90 (12 per cent) of the 733 fires were shown to be caused by solid fuel appliances; 'smoking materials' and both gas and electric cooking appliances were the other main causes, and 48 (about 7 per cent) of the fires were attributed to oil space heaters.

Table 2. Cause of fire

Cause	1st Period		2nd Period		TOTAL	
	Occupancy -		Occupancy -		Both periods	
	Multi	Single	Multi	Single	Multi	Single
Ashes and soot	1	2	1	8	2	10
Chimney, stovepipe, flue overheating on fire etc	-	15	2	8	2	23
Malicious or intentional ignition	-	4	-	1	-	5
Matches	1	7	-	9	1	16
Children with fire	3	24	4	35	7	59
Naked light	1	8	-	2	1	10
Natural occurrences	-	2	-	-	-	2
Rubbish burning	-	-	-	5	-	5
Smoking materials	6	51	2	30	8	81
ELECTRICAL APPLIANCES AND INSTALLATIONS						
Cooking appliances	1	39	1	35	2	74
Space heating	1	14	2	31	3	45
Wire and cable	-	6	3	14	3	20
Wireless and television	1	8	-	6	1	14
Blanket and bedwarmer	-	8	-	21	-	29
Refrigerator	-	-	-	1	-	1
Lighting	-	4	-	5	-	9
Supply apparatus	-	1	-	1	-	2
Other	1	21	-	4	1	25
GAS (TOWN) APPLIANCES AND INSTALLATIONS						
Cooking appliances	4	52	1	26	5	78
Space heating	1	1	1	13	2	14
Other	-	5	1	5	1	10
SOLID FUEL APPLIANCES AND INSTALLATIONS						
Fire in grate	1	15	10	75	11	90
Slow combustion stove	-	1	-	2	-	3
Other	-	1	-	-	-	1
OIL APPLIANCES AND INSTALLATIONS						
Space heating	3	9	14	39	17	48
Welding or cutting equipment	-	5	-	-	-	5
L.P.G. APPLIANCES AND INSTALLATIONS						
Welding or cutting equipment	-	2	-	-	-	2
Other	-	-	-	1	-	1
OTHER AND UNSPECIFIED FUEL APPLIANCES AND INSTALLATIONS						
	-	2	-	-	-	2
MISCELLANEOUS						
	-	2	-	2	-	4
UNKNOWN						
	3	33	4	12	7	45
TOTAL	28	342	46	391	74	733

AGE OF DWELLINGS AND SPREAD OF FIRE

That the majority of multi-occupancy dwellings are quite old is apparent from Table 3 but whether this contributed particularly to the severity of the fires is not evident.

The fire damage in both single occupancy dwellings, (where the age of the buildings varied to a greater extent), and in the multi-occupancy dwellings was confined in most incidents to the room where the fire originated (Table 4).

The proportion which spread to involve the whole of a building or to an adjacent building was greater in the multiple occupancies (about 10 per cent) than in the single occupancies (about 7 per cent) and the age of the building, materials used and method of construction might have contributed to the severity of these fires.

Table 3. Date of construction

Brigade	Pre-1900		1901-1920		1921-1940		1941-1960		1961-1969		Unknown		TOTAL	
	Multi-occupancy	Single occupancy	Multi-occupancy	Single occupancy	Multi-occupancy	Single occupancy	Multi-occupancy	Single occupancy	Multi-occupancy	Single occupancy	Multi-occupancy	Single occupancy	Multi-occupancy	Single occupancy
Birmingham	25	143	-	48	3	88	-	39	-	20	5	10	33	348
Bradford	1	51	2	-	-	34	-	18	-	14	1	11	4	128
Coventry	3	7	1	13	-	28	-	28	-	14	-	-	4	90
Nottingham	23	53	3	23	-	14	-	8	-	5	-	2	26	105
Wolverhampton	5	14	2	4	-	17	-	17	-	1	-	9	7	62
TOTALS	57	268	8	88	3	181	-	110	-	54	6	32	74	733

Table 4. Extent of damage

	Exterior fittings		External components		Confined to -						Extended to adjacent buildings		TOTAL							
					Common service space	Appliance	Room of origin	Floor of origin	Building of origin single storey	Building of origin multi-storey										
Occupancy	M	S	M	S	M	S	M	S	M	S	M	S	M	S						
Brigade																				
Birmingham	-	-	-	1	-	8	1	26	28	274	1	15	-	8	-	13	3	3	33	348
Bradford	-	-	-	3	-	3	1	11	3	101	-	7	-	3	-	-	-	-	4	128
Coventry	-	1	-	-	-	1	-	11	3	57	-	8	-	12	1	-	-	-	4	90
Nottingham	-	-	-	1	-	2	4	8	18	85	1	3	-	6	3	-	-	-	26	105
Wolverhampton	-	-	-	1	1	-	-	8	5	48	1	1	-	3	-	-	-	1	7	62
TOTAL	-	1	-	6	1	14	6	64	57	565	3	34	-	32	4	13	3	4	74	733

M - Multiple occupancy
 S - Single occupancy

RATE OF INCIDENCE

Tables 5 and 5a show the numbers of dwellings at risk in both multi- and single occupancies, together with the number of fires recorded in the areas. From these figures the fire incidence rate per 10,000 dwellings at risk has been calculated, and while remembering that the survey covered a period of only five months, and the numbers of fires recorded are comparatively small, there is an indication that the average risk of fire in multi-occupancy dwellings, is about 5 times that in single occupancies. In Nottingham, the number of fires per 10,000 multi-occupancy dwellings at risk is almost three times the average in multi-occupancies.

Table 5. Rate of incidence - multi-occupancies

Brigade	Multi-occupancies at risk	Fires in multi-occupancies	Number of fires per 10,000 multi-occupancies
Birmingham	9,890	33	33.6
Bradford	640	4	62.5
Coventry	1,080	4	37.0
Nottingham	1,890	26	137.5
Wolverhampton	1,280	7	54.6
TOTAL	14,780	74	50.0

Table 5a. Rate of incidence - single occupancies

Brigade	Single occupancies at risk	Fires in single occupancies	Number of fires per 10,000 single occupancies
Birmingham	315,430	348	11.0
Bradford	100,140	128	12.7
Coventry	103,090	90	8.7
Nottingham	100,100	105	10.4
Wolverhampton	80,670	62	7.6
TOTAL	699,430	733	10.4

OCCUPATION OF DWELLINGS

Table 6 shows the approximate population of the areas in both single and multiple occupancy, and of the total population just under 5 per cent reside in multi-occupied dwellings.

The distribution of this 5 per cent in relation to the dwellings gives some idea of the density of population in the areas under survey (Table 6A). An overall average figure of 7 persons per dwelling is shown, and in the dwellings where fires occurred the average figure was 9 persons per dwelling.

In Birmingham, Coventry and Nottingham the average number of persons in dwellings involved in fires was higher than the average in dwellings at risk. It is not known how many of the total population reside in the single occupancy dwellings involved in fire, so these figures have been estimated (in Table 6B) on the assumption that all single occupancies have the same number of occupants whether involved in fire or not. An average of 3.0 persons per dwelling was recorded for all dwellings at risk.

Table 6. Approximate population of areas

Brigade	Single occupancy		Multi-occupancy		TOTAL
	No.	Per cent	No.	Per cent	
Birmingham	966,590	93.32	69,150	6.68	1,035,740
Bradford	279,420	98.59	3,990	1.41	283,410
Coventry	318,190	98.20	5,830	1.80	324,020
Nottingham	285,640	96.13	11,490	3.87	297,130
Wolverhampton	251,300	97.12	7,450	2.88	258,750
TOTAL	2,101,140	95.55	97,910	4.45	2,199,050

Table 6a. Fires and population in multiple occupancies

Brigade	Involved in fires			Total at risk		
	Dwellings	Population	Average persons per dwelling	Dwellings	Population	Average persons per dwelling
Birmingham	33	369	11.18	9,890	69,150	6.99
Bradford	4	23	5.75	640	3,990	6.23
Coventry	4	33	8.25	1,080	5,830	5.40
Nottingham	26	234	9.00	1,890	11,490	6.08
Wolverhampton	7	41	5.86	1,280	7,450	5.82
TOTAL	74	700	9.46	14,780	97,910	6.62

Table 6B. Fires and population in single occupancies

Brigade	Involved in fires			Total at risk		
	Dwellings	Population	Average persons per dwelling (assumed)	Dwellings	Population	Average persons per dwelling
Birmingham	348	1,065	3.06	315,430	966,590	3.06
Bradford	128	358	2.79	100,140	279,420	2.79
Coventry	90	278	3.09	103,090	318,190	3.09
Nottingham	105	300	2.85	100,100	285,640	2.85
Wolverhampton	62	194	3.12	80,670	251,300	3.12
TOTAL	733	2,195	3.00	699,430	2,101,140	3.00

CASUALTIES

As indicated in Table 7 there were four fatal casualties in multi-occupancy dwellings during the period under survey. Three of these were in a fire in Wolverhampton, the supposed cause of which was recorded as 'unknown', and it was stated on the report that the children were too young to escape unaided by any means; one child was rescued from this fire.

The fourth fatal casualty was another child in a fire in Birmingham of which the supposed cause was shown as 'children ignited wooden spill from gas fire'; four other children were rescued from this fire. It was not stated whether or not adequate means of escape were provided.

There were ten non-fatal casualties in fires caused by oil space heaters. Two of these were in fires where ten people had to escape and there was no adequate means of escape; exit had to be made from first floor windows by ladders. The fire started on the ground floor and spread to the first floor via a staircase.

In another incident four persons were overcome by smoke, and they, together with another three, had to be assisted out of the dwelling by the fire brigade. It was reported that with adequate means of escape the occupants could have made a safe exit.

Not all of the reports indicated whether or not, in the opinion of the fire brigade officer a satisfactory means of escape had been provided; of those that did, only two recorded this as adequate.

Table 7a shows casualties in single occupancy dwellings, and it can be seen that the majority of fatal casualties in both types of dwellings occurred in the summer period of the survey, whereas the majority of non-fatal casualties, rescues and escapes occurred in the winter period.

The probabilities of residents being killed or injured in a fire in single or multiple occupancies are summarised in Table 7b. The chance that a fire will result in a non-fatal casualty is more than twice as great for multiple occupancies as for single occupancies, and the chance that a fire will trap occupants, necessitating rescue or escape, is almost seven times greater. The probability that a fatal casualty will occur in a fire is the same for both occupancies.

The risks to the individual occupants of multiple and single occupancy dwellings, are more clearly indicated by Table 7c in which casualties and rescues are related to the population at risk.

This shows that a person living in a multi-occupancy dwelling is more likely to die in a fire than one living in a single occupancy. He is $4\frac{1}{2}$ times as likely to become a non-fatal casualty and about 14 times as likely to be placed in a dangerous situation

Table 7. Casualties in multiple occupancies

Brigade	Fatal		Non-fatal		Rescues and escapes	
	Period		Period		Period	
	1	2	1	2	1	2
Birmingham	-	1	5	12	12	13
Bradford	-	-	1	-	-	4
Coventry	-	-	-	-	-	1
Nottingham	-	-	2	5	1	12
Wolverhampton	3	-	-	2	1	1
TOTAL	3	1	8	19	14	31

Table 7a. Casualties in single occupancies

Brigade	Fatal		Non-fatal		Rescues and escapes	
	Period		Period		Period	
	1	2	1	2	1	2
Birmingham	18	4	31	46	12	15
Bradford	5	1	9	7	5	7
Coventry	1	-	-	2	2	-
Nottingham	2	3	7	11	5	17
Wolverhampton	3	-	3	7	7	1
TOTAL	29	8	50	73	31	40

Table 7b. Casualties per fire

	No. of fires	Fatalities		Non-fatal casualties		Rescues and escapes	
		No.	Probability	No.	Probability	No.	Probability
Multiple occupancy	74	4	0.05	27	0.36	45	0.60
Single occupancy	733	37	0.05	123	0.16	71	0.09

Table 7c. Casualties in relation to population

	Population	Casualties/10,000 population		Rescues and escapes 10,000 population
		Fatal	Non-fatal	
Multi occupancy	97,910	0.41	2.76	4.60
Single occupancy	2,101,140	0.18	0.59	0.34

DISCUSSION

During the period of the survey the number of fires in both multiple and single occupancies, was as expected, greater in the winter period than in the summer, and this increase is shown to be considerably greater in multi-occupied dwellings than in the single occupancies.

It is evident that oil space heating appliances are widely used in multi-occupancy dwellings, and were reported to be the cause of 17 (almost 23 per cent) of the fires in the survey; this being the largest proportion due to any single cause. Four of these incidents involved casualties, rescues or escapes. Of the 10 fires in which damage spread beyond the room of origin, five were reported to be caused by oil space heaters.

The fire survey was conducted in 1967 and 1968 and it would be useful to relate the figure obtained from it to the number of houses at risk at the time. In the absence of the relevant data, however, it has been necessary to use the figures obtained from the 1966 Sample Census. It is possible therefore that there may have been some changes in the situation, and the numbers should be considered approximate. There is, however, an indication that the risk of fire in multi-occupancy dwellings is considerably greater than in the single occupancy dwellings; particularly in Nottingham, and to a lesser degree, in Wolverhampton.

The number of households occupying the dwellings, their need for separate space heating and cooking appliances, the apparent misuse of appliances (particularly oil heaters), inadequate means of escape, and possibly the type and age of the dwellings are the main factors contributing to the increased risk of fire in multi-occupancy dwellings.

CONCLUSIONS

The risk of fire occurring in multi-occupancy dwellings appears to be five times that in single occupancies, and the chance that the fire will result in casualties is about twice as great.

The residents in multi-occupancy dwellings appear to be more likely to be killed and are about $4\frac{1}{2}$ times as likely to be injured by fire as those in single occupancies. They are about 14 times as likely to find themselves in a dangerous fire situation.

Oil heating appliances are the main single cause of fires in multiple occupancies and cause a high proportion of the fires which spread beyond the room of origin.

ACKNOWLEDGMENTS

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REFERENCES

The Registrar Generals 1966 Sample Census (Regions) H.M.S.O. London 1968.

Population - Table 11

Dwellings - Table 6a



