Fire Research Note No 962

ANALYSIS OF A QUESTIONNAIRE ON ATTITUDES

by

S J MELINEK, SARA K D WOOLLEY and R BALDWIN

March 1973

FIRE RESEARCH STATION

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SUMMARY

This paper is an analysis of the results of a questionnaire, distributed during the Open Days at the Fire Research Station in 1972, which was designed to assess public awareness of risks and attitudes towards risks for the purpose of helping to establish a rational basis for expenditure on safety measures. The questions examine the perceived causes of accidents, the effects of magnitude and frequency of accidents on public concern, public assessment of relative risks, and willingness to take risks. The sample was biased but some tentative conclusions are possible.

KEY WORDS: Safety, attitudes, survey, cost-benefit, analysis

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JOINT FIRE RESEARCH ORGANIZATION

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INTRODUCTION

In order to make a building or machine safer, it is generally necessary to spend money on it. To balance economy with safety, a value must be placed on safety, and in particular on human life.

It is not easy to put a monetary value on life; estimates vary widely according to the methods and ideas applied. For example, the Roskill Commission valued a (male) life at £9300 during their study of the siting of the Third London Airport; £6000[1] and £17 000[2] are values which have been used in road safety problems, and £30 000 has been used by the Home Office for examining the siting of fire stations[3]. Recent work[4], based on the risks people are willing to take to gain certain benefits, suggests a figure in the region of £50 000. The purpose of the present paper is to provide information in support of the latter, and to examine the validity of the assumptions on which it is based.

A questionnaire was designed to supply more information on people's attitudes to risks: whether they perceive them correctly, and the benefits they think they gain from taking risks. It was answered by people attending the Open Days at the Fire Research Station in 1972. The sample, therefore, was biased; but the project was only an experiment at this stage, intended to test the feasibility of the approach.

The questionnaire appeared in two forms. The first version, I, used during the first four days is shown in Appendix I. It was found by some people to be difficult to answer, and so a revised version, II, shown in Appendix II, was put out on the last day.

Each questionnaire had seven questions. These fell into four categories which were:

a. Perceived cause of accidents, question 1.

b. Effect of magnitude and frequency of accidents on public concern impact, question 2 of both questionnaires and question 4 of version I.

c. Assessment of relative risks, question 3 of both questionnaires and question 4 of version II.

d. Willingness to take risks, questions 5, 6 and 7.

Five of the questions on each questionnaire referred specifically to fire risks.

Most of the respondents appeared to take the questionnaire seriously. The average time taken to complete it was approximately six minutes (five minutes for the revised version). It was completed by 873 people out of about 6000 attending the open days.

The results are analysed below. Some of the questions appeared on both I and II; these are marked with an asterisk.

Analysis

a) Perceived cause of accidents

Question 1*

Do you think more fires are caused by:	I	II
a. Carelessness?	538	265
b. Unforeseeable accident?	40	27

In this question, the respondents were asked to rank two causes of fires. More of them (92%) thought that more fires are caused by carelessness than by unforeseeable accident.

b) Effect of magnitude and frequency of accidents on impact

Question 2*

Which would shock you the most:	I	II
a. ten fires a year, each causing one death?	208	112
b. One fire a year, each causing ten deaths?	89	49
c. One fire every ten years, each causing a hundred deaths?	275	124

The purpose of this question was to discover whether the public, on learning of a certain number of deaths in a disaster, would be more concerned than if they learned of a similar number in smaller incidents, the average number annually being the same in each case; ie whether the utility of n lives lost in a disaster would be greater than n times the utility of a single life lost.

Obviously it is important to prevent both small and large fires, but when public money is being spent on fire prevention it is desirable, while avoiding over-reaction, to reflect social pressures and attitudes in the allocation of resources.

Ninety-eight per cent of the 873 respondents answered this question; of these, 37% ticked a), 16% ticked b) and 47% ticked c).

From these results it appears that people are concerned approximately equally by fires causing large numbers of deaths and a high frequency of fatal fires but less concerned by the intermediate situation. The results can be illustrated graphically as shown in Fig.1. The curved lines represent indifference curves, ie lines of equal concern. They are convex upwards when plotted on a log-log scale but the data are insufficient to plot their exact location.

The number of people ticking each category is a measure of the concern caused. However, to obtain the total concern caused to the community it would be desirable to know not only the situation causing most concern to each respondent but also his level of concern for each situation and the amount he would be willing to pay to reduce each risk.

Question 4 (questionnaire I)

In what proportion of fatal fires do you think there is more than one death? (Expressed as a percentage)

This question demonstrated that most people overestimate the average number of fatalities that occur in a fatal fire, possibly because multiple-death fires gain more publicity. The results are plotted in Fig.2. The mean value was 35% and the median 28%. There was a peak in the interval corresponding to the correct value - about 12% - perhaps indicating 'inside knowledge'; it would have been interesting to have given the question to a group of people with no interest in fire. The castellated appearance of the histogram merely reflects the tendency for people to put 40%, 50%, 60% etc, rather than values in between.

c) Assessment of relative risks

In these questions hazards had to be compared or placed in order of risk. The object was to find out how accurately relative risks were perceived.

Question 3

There were two versions of this question. In a few cases the respondents ticked a hazard instead of ranking them. In these cases a tick was assumed to represent a ranking of 1.

Questionnaire I

Please put the following in what you think is the order of safety
(1 = safest, 4 = least safe)

		1	2	3	4
a.	One hundred mile car drive	68	197	188	105
b.	One scheduled flight to the Mediterranean	339	97	73	55
c.	Being in your home when it catches fire	67	107	115	275
d.	One crossing of a busy road	110	155	178	121

The following approximate values for risk have been derived (see Appendix 3)

		Death	Death or injury
A.	One hundred mile car drive	1.6×10^{-6}	8×10^{-5}
B.	One scheduled flight to the Mediterranean	8×10^{-6}	8×10^{-6}
C.	Being in your home when it catches fire	4×10^{-3}	2.3×10^{-2}
D.	One crossing of a busy road	10^{-8}	3.5×10^{-7}

It can be seen that if fatalities alone are considered, the car drive is safer than the Mediterranean flight, but that if the risk of injury is also considered then the order is reversed. (There is a high risk of injury while driving but practically none while flying). The correct order is therefore D, A, B, C (D being the safest) if only the risk of death is considered and D, B, A, C taking the risk of death or injury.

When the results were analysed, any answer which placed a pair of hazards in the right order was considered correct for that pair, eg B, A, D, C and D, B, C, A both have B before C and people who produced these answers were right in thinking that the flight was safer than being in the home when it catches fire. There were six pairs of results. On this basis and taking only the 551 questionnaires for which the answer to this question was complete, the following results were obtained. The columns marked (a) are for risks ranked considering only the probability of death and those marked (b) are for the risk of death or injury.

Percentages of correct replies for comparison of risks

i) Pairs

Pair	% of replies correct (a)	% of replies correct (b)	Ratio of the risks in each pair (a)	Ratio of the risks in each pair (b)
AB	24	76	5	10
AC	65	65	2 500	300
AD	50	50	160	250
BC	78	78	2 000	3 000
BD	28	28	300	25
CD	65	65	400 000	70 000

ii) Average for each risk

Risk	Average % of correct comparisons (a)	Average % of correct comparisons (b)
A	46	64
B	43	61
C	69	69
D	48	48

iii) Number of correct comparisons

Number of pairs correct out of 6	Percentage of 551 replies (a)	Percentage of 551 replies (b)	Percentage expected by chance
0	4.5	0.7	4.2
1	9.4	5.6	12.5
2	17.1	12.9	20.8
3	30.7	23.2	25.0
4	22.3	31.8	20.8
5	10.5	20.5	12.5
6	5.4	5.3	4.2

(a) risk of death

(b) risk of death or injury.

The average number of correct pairs was 3.1 (52%) if only the risk of death is considered and 3.6 (60%) taking the risk of death or injury. The latter is significantly greater at the 1% level than the result (3 ± 0.063) expected by chance.

Situation D (crossing a busy road) is compared correctly with other situations less often than would be expected by chance. Situations A, B and C were compared correctly with each other in a fairly high proportion of cases. If we take these three situations only, the average number of correct pairs out of three is 1.67 (56%) if only death is considered and 2.19 (73%) taking death or injury. Both these values are significantly greater at the 1% level than the result (1.5 ± 0.041) expected by chance. This result will be discussed further below.

Question 3 (Questionnaire II)

Assume each year you drive 10 000 miles and take a holiday by air in Europe. Please put the following in what you think is the order of likelihood (1 = most likely, 3 = least likely).

		1	2	3
a.	Being killed while driving	167	80	10
b.	Dying in an air accident	11	12	199
c.	Being killed while crossing the road	114	127	12

The question specified death, but one explanation of the answers given is that people consider the probability of death or injury. The question has therefore been analysed twice: firstly on the basis of being killed, and secondly on the basis of being killed or injured.

The following estimated figures were derived (see Appendix 3).

		Risk during the year	
		Death	Death or injury
A.	Driving	1.6×10^{-4}	8×10^{-3}
B.	Air accident	1.6×10^{-5}	1.6×10^{-5}
C.	Crossing the road*	7×10^{-6}	2×10^{-5}

*Holders of driving licences only (there were 495 drivers and only 49 non-drivers among the respondents).

From these figures the correct order of the risks is A, B, C (A being most likely) if only death is considered (case(a)) and A, C, B for death or injury (case(b)). Forty-two per cent of the 293 respondents answering this question gave A, C, B while only 2% gave A, B, C. Twenty-six per cent gave C, A, B. For the 220 complete answers the following results were obtained:

Percentage of correct replies for comparison of risk

i) Pairs

Pair	Percentage of replies correct (a)	(b)	Ratio of risks (a)	(b)
AB	93	93	10	500
AC	60	60	20	400
BC	7	93	2	1.3

ii) Average for each risk

Risk	Average % of correct comparisons (a)	(b)
A	77	77
B	50	93
C	34	77

iii) Number of correct comparisons

No. of pairs correct out of 3	Percentage of 220 replies (a)	(b)	Percentage expected by chance
0	2.7	2.3	16.7
1	36.8	4.5	33.3
2	57.3	37.7	33.3
3	3.2	55.5	16.7

(a) risk of death

(b) risk of death or injury

The average number of pairs correct out of three was 1.61 (54%) in case (a) and 2.46 (82%) in case (b). The latter result is significantly greater at the 1% level than the value (1.5 ± 0.065) expected by chance.

Question 4 (Questionnaire II)

This question was included in the second questionnaire to find out how dangerous people consider a fire risk to be. As in Question 3 the respondents were required to compare risks. The following answers were given:

Would you say that the following are less risky/more risky/equally risky than being in your house when it catches fire

	Less risky	More risky	Equally risky
a. One hundred mile car drive	140	89	50
b. One scheduled flight to the mediterranean	213	37	26
c. The next time you cross a busy road	96	117	69

The correct answer would be to mark them all less risky. Out of 288 replies,

63 were correct

81 had two correct

78 had only b) correct

19 thought they were all more risky

32 gave other answers

15 were incomplete

At least 210 (72%) underestimated the dangers of being in the home when it catches fire, in relation to other risks. Some respondents from the fire brigade were heard to comment that they were unlikely to be trapped by a fire at home as they would know how to escape.

From Appendix 3 the risks are approximately:

	Risk of death	Ratio to risk from fire	Risk of death or injury	Ratio to risk from fire
Being in house when it catches fire (15-64 age group)	4.5×10^{-3}	-	2.7×10^{-2}	-
100 mile car drive	1.6×10^{-6}	0.0004	8×10^{-5}	0.003
Scheduled flight to Mediterranean	8×10^{-6}	0.002	8×10^{-6}	0.0003
Crossing road (once)	10^{-8}	2×10^{-6}	3.5×10^{-7}	10^{-5}

Discussion on Results of Question 3 (both questionnaires) and Question 4 (Questionnaire II)

In each version of Question 3 the ranking of one pair of risks (A, B in version I, B, C in version II) is reversed if the chance of death or injury is considered instead of only death. In both cases the proportion of correct answers is much higher if it is assumed that the risk of death or injury was taken. Thus it appears that when

comparing hazardous situations people assess the risk of injury or possibly the risk of an accident occurring rather than the risk of being killed, probably because accidents are more frequent than deaths so people have more opportunity of assessing the probability.

In Question 4. (Questionnaire II) and Question 3 (Questionnaire I) people seem to have overestimated the risk attached to crossing the road once. This may have been due to their not appreciating when the questions specified one crossing of the road. It is also possible that people sometimes estimate the risk of being killed or injured in the event of an accident and ignore the smallness of the probability of having an accident. People were heard to comment that they would not stand much chance if hit when crossing the road. This fact increased their estimate of the risk despite the small probability of being hit, particularly when crossing the road only once.

There appears to be little correlation between the proportion of respondents ranking a pair of risks in the correct order and the ratio of the risks. However, if pairs of risks are ranked according to the chance of death or injury, then except in the case of one crossing of the road, the proportion of correct answers was in all cases significantly greater at the 1% level than expected by chance.

d) Willingness to take risks

The purpose of these questions was to find how much people are willing to pay for safety and to discover the implied value that they put on their lives when undertaking risky activities.

In most of these questions the respondents were asked what they would be willing to pay to avoid a given risk. It would also have been of interest to know for what benefits risks would be taken, as a check for consistency and because, due to limitation of the individual resources and psychological reasons, the sum a person is willing to pay to avoid a risk is likely to differ from the payment required to take the risk. The risks were specified. No questions were asked on the risk that would be taken for a specified benefit or saving.

Behaviour depends on perceived risks and benefits. Question 6 of Questionnaire I was designed to indicate how accurately people can estimate risks and benefits in numerical terms.

5. a) One in 80 000 people are killed in fires in the home every year. How much would you be willing to pay for a safety measure in your home (eg a detector) which would reduce the risk to you and your family to a tenth?

		Number of replies
i)	Nothing?	47
ii)	Not over 50p?	16
iii)	Not over £1?	31
iv)	Not over £2?	54
v)	Not over £5?	189
vi)	Not over £10?	226
vii)	Not over £20?	128
viii)	Not over £50?	75
ix)	Not over £100?	30
x)	Over £100?	49

On Questionnaire II the following questions were also asked:

b. How many people live in your home including yourself who are members of your family?

6. Have you ever had a fire in your home which was attended by the fire brigade? 32 said yes, 255 said no.

In calculating the average amount that people are willing to spend, we took the mid-point between each specified interval; for example, some replied that they would spend 'not over £10'. We assumed that they would spend on average, £7.5 each, the previous interval being 'not over £5'. 'Over £100' was arbitrarily taken to mean an average of £120.

The average number of persons per household was 3.4. The average sum people were willing to spend was £17.9 per household or £5.3 per person. The median acceptable expenditure was about £6.5 per household or £1.9 per person.

There was no significant correlation between the sum per household and the number in the household ($\chi^2 = 89.10$, $\nu = 71$). Thus the sum per person decreases as the number of people in the household increases, possibly as a result of larger households having lower disposable income per person, or because the number of persons in the household was not taken into account.

The annual risk per person of dying in a fire in the home[5] is 1/80 000 (1.25×10^{-5}). A reduction of the risk to one tenth therefore represents a reduction of 1.125×10^{-5} per annum.

If a detector is expected to last twenty years and the expenditure is discounted at 10% per annum, then the outlay of £5.3 per person is equivalent to an annual sum of 62p, from which

$$\text{implied value of life} = \frac{\text{expenditure}}{\text{reduction of risk}}$$

$$= £0.62 \quad (1.125 \times 10^{-5})$$

$$= £55\,000$$

This value is in reasonable agreement with earlier estimates[3,4].

The average acceptable expenditure was largely determined by a few people putting high values. Ninety-six per cent of the average was due to 18% of the answers. Taking the median acceptable expenditure gives an implied value of life of £20 000.

It is assumed above that the sum people are willing to pay to reduce or eliminate a risk is proportional to the reduction of risk, so that a reduction of a risk is equivalent to the elimination of a risk equal to the reduction made.

Respondents may have felt that the answers expected of them lay towards the centre of the list. This factor might have had some influence on the results.

Thirty-two (11%) of Friday's respondents had had fires in their homes which had been attended by fire brigades - this is slightly higher than the estimated national average of 8%. However, the amount these people were willing to pay did not differ significantly from the amount that those people were willing to pay who had not had a fire attended by the brigade.

Question 6 (Questionnaire I)

a) When travelling by car, what is the minimum saving of time for which you would consider it worth while overtaking (assuming that you wait until you feel it is reasonably safe, and that you are on a road with two-way traffic)?

i) Nothing? 136

ii) Not over 5 seconds? 19

iii) Not over 10 seconds? 23

iv) Not over 30 seconds? 58

v) Not over one minute? 71

vi) Not over two minutes? 62

vii) Not over five minutes? 79

viii) Not over ten minutes? 63

ix) Over ten minutes (please specify) ...35...

b) Under the circumstances outlined in (a), do you think that the chance of your being killed while performing this overtaking manoeuvre is;

i) One in 100 million? 48

ii) One in 10 million? 52

iii) One in 1 million? 123

iv) One in 100,000? 139

v) One in 10,000? 125

vi) One in 1,000? 62

c) Do you drive? Yes / No
495 49

The question assumed that saving of time is the main reason people overtake. It is now realised that it is unrealistic to make this assumption. The wording of this question was found to be confusing and it may have been misunderstood by many of those who did answer it. Some people commented that saving of time was not usually their reason for overtaking.

The question was worded to imply that time was the only benefit being considered in this case and has therefore been analysed on the basis of those replies which specified a time saying greater than zero. It should be born in mind that some of the answers may have been given by people who were not clear what the question was asking.

The frequency of replies was:

Time saving (seconds)	Perceived risk					
	10^{-8}	10^{-7}	10^{-6}	10^{-5}	10^{-4}	10^{-3}
Up to 5	4	1	4	5	3	2
10	4	4	7	3	5	0
30	4	11	17	11	12	3
60	3	8	19	22	13	5
120	4	8	15	20	8	6
300	2	6	16	22	24	8
600	8	4	12	6	14	5
over 600	2	1	6	10	7	7

It is assumed below that the required savings of time were the maximum value specified in each interval except for 'over 600 seconds', where the mean value specified of 1360 s was taken.

It appears that most people are poor at estimating risks in numerical terms. The mean perceived risk was 1.4×10^{-4} with median of 8×10^{-6}. The latter is higher than the actual value of approximately 1.4×10^{-8} (see Appendix 3) by a factor of about 500. Moreover, at the 5% level of significance, there was no correlation between estimated numerical risk and the required saving of time ($\chi^2 = 49.78$, $\nu = 35$), which suggests that there is little relationship between the perceived risk and the value given. People may nevertheless be able to assess qualitatively what is an acceptable risk.

The average saving of time required was 5.0 min, with a median of 2 min. These values are reasonably close to the actual average value. In a study of driving behaviour[6] the time taken for a 29 km drive varied with the overtaking ratio, O/T (number of overtakings/number of times overtaken). The time taken was

approximately 35 min when O/T was 0.2 and 30 min when O/T was 5.0. Assuming the average number of overtakings in these cases was 0.5 and 5.5 respectively then

$$\text{time saved per overtaking} = (35-30)/(5.5-0.5)$$
$$= 1 \text{ min}$$

The fact that most of the respondents gave a higher required time saving than this value is consistent with people's declaration that they often overtake when the time saving alone is not worthwhile.

In view of the wide divergence of the estimated risk from the actual value, it is unlikely that the results represent an acceptable balance between risk and benefit

Question 7

If you are a cigarette smoker, then how much extra, if any, would you be willing to pay per packet of twenty for cigarettes which were absolutely safe to the health but otherwise identical to ordinary cigarettes?

The words 'to the health' were not included in the first questionnaire but were added after a few people had enquired whether 'safe' meant safe from fire risk. There was little difference in the average amount specified before and after this addition. Three hundred and nine respondents answered this question. The average sum specified was 9.2p.

The risk due to smoking has been widely publicised and the value put on life can be estimated from peoples willingness to take this risk. The sum spent on tobacco is about £1.7 x 10^9 per annum in the United Kingdom[7]. About 27 500 people a year under 65 die from smoking[8]. If F is the extra amount as a fraction of the current cost which people would be prepared to pay for cigarettes which were safe but otherwise identical to ordinary cigarettes then the value put on a life is

$$F \times £1.7 \times 10^9 / 27\,500 = F \times £62\,000.$$

Including deaths over 65, or ignoring the tobacco smoked by people over 65, might give a value 25% lower or F x £46 500.

If we assume that a packet of cigarettes costs 25p, then, on average, people would be willing to spend 37% more for safe cigarettes, giving

$$V = 0.37 \times 46\,500$$
$$= £17\,200$$

A typical comment was 'I would never spend more than ...p on cigarettes'. However, if they considered the danger from smoking would justify another 10p on the price of a packet of 20, and felt unwilling to spend more than 30p for cigarettes then they would not be willing to pay 25p for ordinary cigarettes.

CONCLUSIONS

The results are encouraging in that they show that a survey of this type is feasible, although it appears that questions may be misunderstood unless very great care is taken over their wording.

On the basis of answers from a fairly small and biased sample of the population, one can draw the following tentative conclusions:

1. More people think that more fires are caused by carelessness than by unforeseeable accident. Increased expenditure on fire safety education would therefore be likely to meet with public approval.

2. Infrequent fires causing many deaths and frequent fires each involving only one death but the same total number of deaths cause a higher level of public concern than the same number of deaths in fires of intermediate frequency and severity.

3. It appears that people's assessment of risks depends on the probability of an accident or of injury more than on the probability of death; the perceived probability of an accident being fatal may also be important in some cases, eg crossing the road.

4. Most people cannot accurately estimate risks in numerical terms.

5. Average implied values of life of £17 000 and £55 000 were obtained by taking the calculated value of the risks and the perceived value of reducing or eliminating the risk.

6. People can rank risks reasonably accurately in most cases. It is therefore likely that they can judge when a risk is acceptable, so that it is possible to pay some attention to public opinion when considering safety expenditure, without being illogical.

7. A fire hazard (being in the home when it catches fire) was underestimated by a substantial proportion of respondents.

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APPENDIX I

Questionnaire I used Monday to Thursday

QUESTIONNAIRE - ATTITUDES TO RISK

Fire precautions exist to save lives. Unfortunately the money available to spend on precautions is limited, and so it is desirable that it should be allocated in the best way possible. In order to do this, we need to know more about how people value their time and safety, and also about their attitudes to risks - how willing they are to take risks, and whether they recognise them accurately.

When you glance through the following questions, you may think that one or two of them have little to do with fires, but we can assure you that they have been very carefully thought out, and the information will be relevant. Knowledge of statistics is not required - your impressions are the important thing (your answers will be treated anonymously - please do not put your name on the paper).

Please tick where appropriate

1. Do you think that more fires are caused by

   a) Carelessness? ☐

   b) Unforeseeable accident? ☐

2. Which would shock you the most

   a) Ten fires a year, each causing one death? ☐

   b) One fire a year, each causing ten deaths? ☐

   c) One fire every ten years, each causing a hundred deaths? ☐

3. Please put the following in what you think is the order of safety (1 = safest, 4 = least safe)

   a) One hundred-mile car drive ☐

   b) One schedule flight to the Mediterranean ☐

   c) Being in your home when it catches fire ☐

   d) One crossing of a busy road ☐

4. In what proportion of fatal fires do you <u>think</u> there is more than one death?

(Expressed as a percentage) .....

5. One in 80,000 people are killed in fires in the home every year.

How much would you be willing to pay for a safety measure in your home (e.g. a detector) which would reduce your risk of dying in a fire to a tenth?

a) Nothing? ☐

b) Not over 50p? ☐

c) Not over £1? ☐

d) Not over £2? ☐

e) Not over £5? ☐

f) Not over £10? ☐

g) Not over £20? ☐

h) Not over £50? ☐

j) Not over £100? ☐

k) Over £100? ☐

6. a) When travelling by car, what is the minimum saving of time for which you would consider it worth while overtaking (assuming that you wait until you feel it is reasonably safe, and that you are on a road with two-way traffic)?

i) Nothing? ☐

ii) Not over 5 seconds? ☐

iii) Not over 10 seconds? ☐

iv) Not over 30 seconds? ☐

v) Not over one minute? ☐

vi) Not over two minutes? ☐

vii) Not over five minutes? ☐

viii) Not over ten minutes? ☐

ix) Over ten minutes (please specify) .....

b) Under the circumstances outlined in (a), do you think that the chance of your being killed while performing this overtaking manoeuvre is;

i) One in 100 million? ☐

ii) One in 10 million? ☐

iii) One in 1 million? ☐

iv) One in 100,000? ☐

v) One in 10,000? ☐

vi) One in 1,000? ☐

c) Do you drive? Yes / No

7. If you are a cigarette smoker, then how much extra, if any, would you be willing to pay per packet of twenty for cigarettes which were absolutely safe but otherwise identical to ordinary cigarettes?

.....

Thank you very much for your help.

APPENDIX II

Questionnaire II used on Friday

QUESTIONNAIRE - ATTITUDES TO RISK

Fire precautions exist to save lives. Unfortunately the money available to spend on precautions is limited, and so it is desirable that it should be allocated in the best way possible. In order to do this, we need to know more about how people value their time and safety, and also about their attitudes to risks - how willing they are to take risks, and whether they recognise them accurately.

When you glance through the following questions, you may think that one or two of them have little to do with fires, but we can assure you that they have been very carefully thought out, and the information will be relevant. Knowledge of statistics is not required - your impressions are the important thing (your answers will be treated anonymously - please do not put your name on the paper).

Please tick where appropriate

1. Do you think that more fires are caused by
   a) Carelessness? ☐
   b) Unforeseeable accident? ☐
2. Which would shock you the most ☐
   a) Ten fires a year, each causing one death? ☐
   b) One fire a year, each causing ten deaths? ☐
   c) One fire every ten years, each causing a hundred deaths? ☐
3. Assume each year you drive 10 000 miles and take a holiday by air in Europe. Please put the following in what you think is the order of likelihood (1 = most likely, 3 = least likely).
   a) being killed while driving ☐
   b) dying in an air accident ☐
   c) being killed while crossing the road ☐

p.t.o.

4. Would you say that the following are less risky/more risky/equally risky than being in your house when it catches fire

	Less risky	More risky	Equally risky
a) One hundred-mile car drive	.....	.....	.....
b) One scheduled flight to the mediterranean	.....	.....	.....
c) The next time you cross a busy road	.....	.....	.....

5. a) One in 80 000 people are killed in fires in the home every year. How much would you be willing to pay for a safety measure in your home (e.g. a detector) which would reduce the risk to you and your family to a tenth?

i)	Nothing?	.....
ii)	Not over 50p?	.....
iii)	Not over £1?	.....
iv)	Not over £2?	.....
v)	Not over £5?	.....
vi)	Not over £10?	.....
vii)	Not over £20?	.....
viii)	Not over £50?	.....
ix)	Not over £100?	.....
x)	Over £100?	.....

b) How many people live in your house including yourself who are members of your family? .....

6. Have you ever had a fire in your home which was attended by the fire brigade? Yes / No

7. If you are a cigarette smoker, then how much <u>extra</u>, if any, would you be willing to pay per packet of twenty for cigarettes which were absolutely safe to the health but otherwise identical to ordinary cigarettes? .....

Thank you very much for your help.

APPENDIX 3

ESTIMATION OF RISK LEVELS

i) Being in your home when it catches fire

Number of dwellings (Great Britain, 1969)[7] = 1.8×10^7

Number of fires in dwellings[5] = 44 792

Population[7] = 5.4×10^7

Twelve per cent of fires in dwellings occur between midnight and 8 am, 55% between 8 am and 6 pm and 33 per cent between 6 pm and 12 pm. If it is assumed that the proportion of people at home at these times is 98%, 50% and 75% respectively, then, on average, 64% of the occupants of dwellings are present when a fire occurs.

Risk of a fire in a dwelling during the year = 44 792/18 000 000
= 0.0025

Number of people in whose home there is a fire = 0.0025 x 54 000 000
= 138 000

Number of people at home when there is a fire = 0.64 x 138 000
= 88 000

Number of deaths = 667

Total number of casualties = 4 024

Therefore Risk of death = 667/88 000
= 7.5×10^{-3}

Risk of death or injury = 4 024/88 000
= 4.5×10^{-2}

Most of the people attending the Open Days were in the age range of 15 to 64. For this age range the death rate from fires, is about 60% of the average for the whole population. Assuming the risk of death from a fire in the home is lower for this age group by this factor then

Risk of death = 4.5×10^{-3}

Risk of death or injury = 2.7×10^{-2}

ii) A scheduled flight to the Mediterranean

0.55 passengers are killed per 10^8 passenger km[7]. Assuming a scheduled flight to the Mediterranean is 1500 km (930 miles) then risk of death

$= 1500 \times 0.55/10^8$

$= 8 \times 10^{-6}$

For a holiday by air in Europe (assume 3000 km flying) risk of death

$= 1.6 \times 10^{-5}$.

iii) Driving

Fatal casualty rate for drivers (cars and taxis)[9]

$= 1.6 \times 10^{-8}$ per mile ($1.0 \times 10^{-8}/cm^{-1}$)

Since there are about 50 casualties per death[9], the risk of death or injury is

8×10^{-7} per mile ($5 \times 10^{-7}/cm^{-1}$).

From these figures the risk during a hundred mile drive or during 10 000 miles can be calculated.

iv) Overtaking

In one study[6], forty drivers each driving 29 km overtook a total of about 100 times. In another[10], fifty drivers driving 19 km overtook about 125 times.

Distance driven $= 40 \times 29 + 50 \times 19$

$= 2100$ km

No. of overtakings $= 225$

$= 0.107\ km^{-1}$

Fatal casualty rate for drivers[9] $= 1.0 \times 10^{-8}\ km^{-1}$

About 10% of drivers involved in injury accidents are engaged in overtaking[9]. It is probable that the driver overtaking has a high probability of being killed or injured. If it is assumed that 15% of drivers killed are engaged in overtaking then their chance of death from this manoeuvre is $0.15 \times 10^{-8}\ km^{-1}$.

Risk of death per overtaking $= 0.15 \times 10^{-8}/0.107$

$= 1.4 \times 10^{-8}$

Assuming 50 casualties per death[9], risk of death or injury per overtaking = 7×10^{-7}.

These figures are approximate. More detailed data should become available following the setting up of an international study on overtaking behaviour[11].

v) Crossing the road

At and near 25 crossings in London with average flows of 553 pedestrians per hour there was 169 injury accidents to pedestrians during a four year period[12]. The number of crossings made was approximately 5×10^8 giving

probability during each crossing of death or injury = $169/(5 \times 10^8)$

= 3.5×10^{-7}

3.5% of pedestrian casualties are fatal[7].

Therefore probability of death = 10^{-8}.

About two thirds of pedestrian casualties occur during crossings from which assuming 2900 deaths per year[7],

number of pedestrians killed crossing road = 1900 p.a.

Annual probability of death crossing road = $1900/(5.4 \times 10^7)$

= 3.6×10^{-5}

The risk that a car driver will be killed while walking across the road is less than average. Only 10% of pedestrian fatalities are drivers although 50% of pedestrians possess driving licences[13].

Annual risk of driver being killed while crossing the road

$$= \frac{1900 \times 0.1}{54 \text{ m} \times 0.5}$$

$= 7 \times 10^{-6}$

Since the probability of death or injury is about thirty times the probability of being killed,

annual probability of death or injury while crossing road

= 10^{-4} for all pedestrians

2×10^{-5} for drivers.

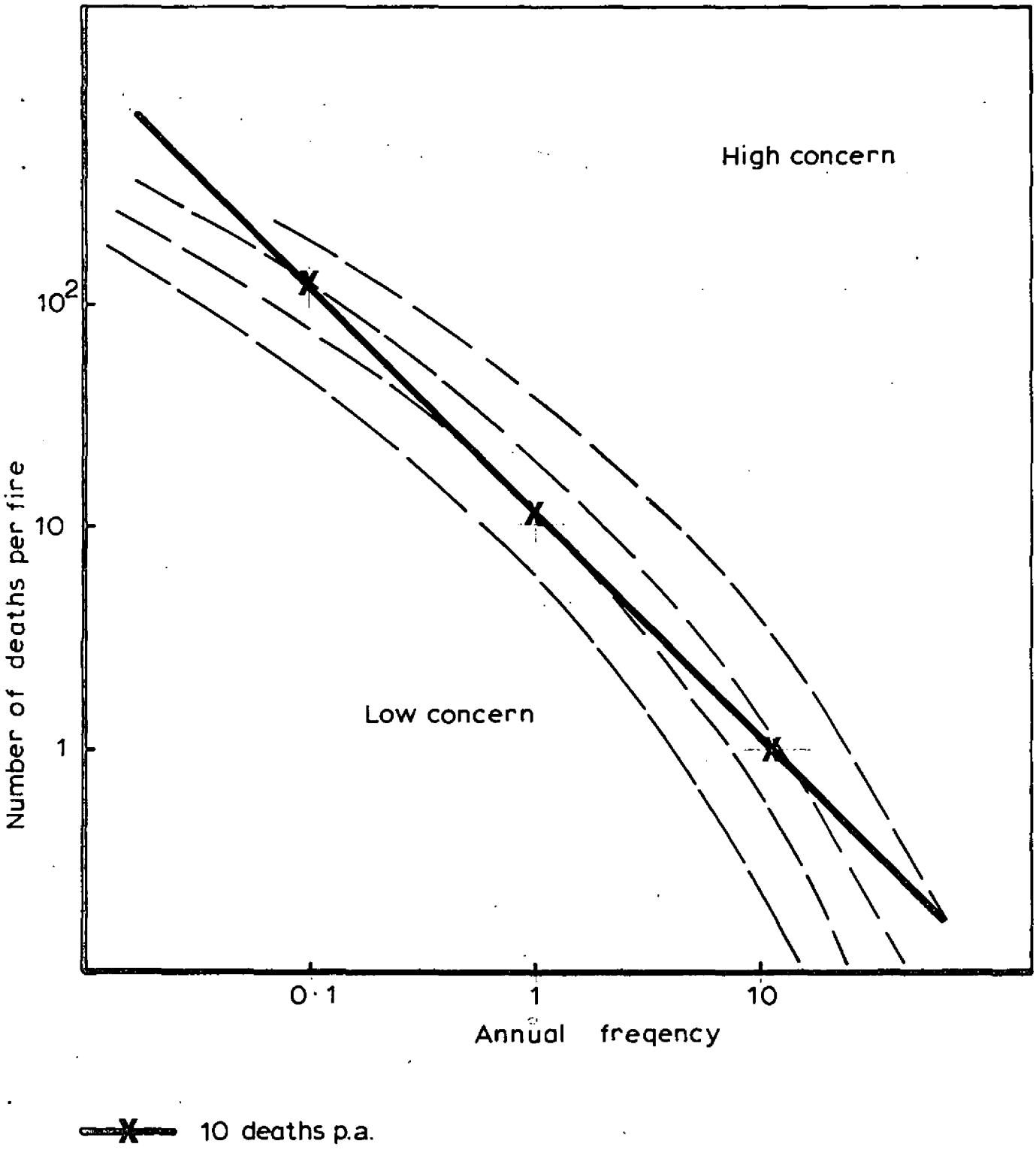

FIG 1 EFFECT OF MAGNITUDE AND FREQENCY OF ACCIDENTS ON LEVEL OF CONCERN

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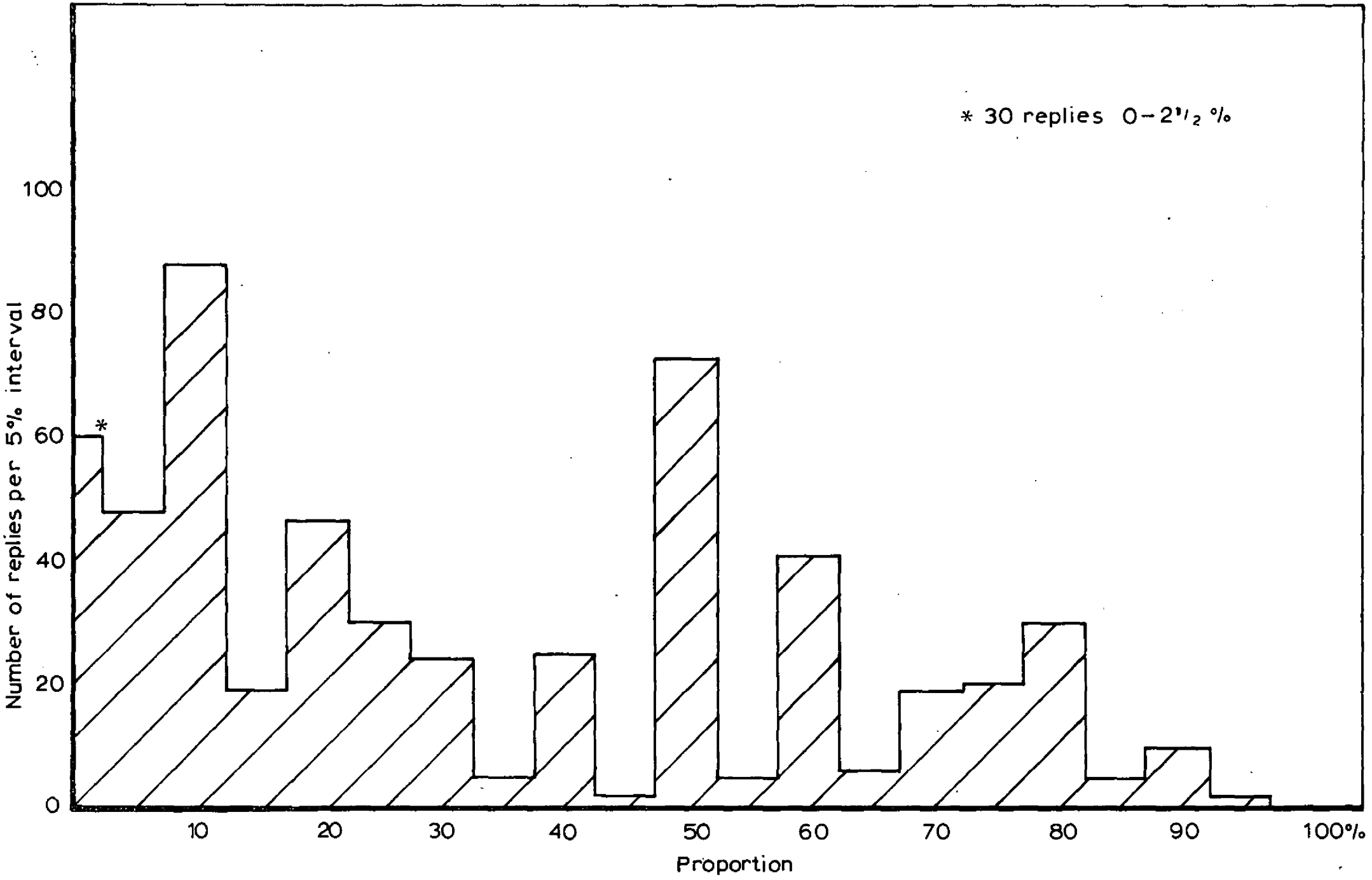

FIG 2 PROPORTION OF FATAL FIRES IN WHICH THERE WAS THOUGHT TO BE MORE THAN ONE DEATH