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THE COST EFFECTIVENESS OF A SMOKE ALARM GIVE-AWAY PROGRAMME USING DATA FROM A RANDOMISED CONTROLLED TRIAL

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1. Introduction

In 1998 local authority fire brigades attended 856,000 fires or false alarms in the United Kingdom, 70,700 of which were domestic fires [23]. In 1998 it is estimated that 489 people died in fires in the home and approximately 14,900 people were injured [23]. There is also a steep social class gradient in the risk of fire-related death among children aged 1-15. This risk is 15 times higher in social class V compared to social class I [10]. The risk of having a residential fire is 25% higher in inner city areas compared to non-inner city areas [1].

Fires detected by smoke alarms tend to be discovered more rapidly after ignition and are associated with a reduced risk of death (3 versus 9 deaths per 1,000 fires) and non-fatal casualty (137 versus 178 per 1,000 fires), and less property damage [13]. For several years, the Home Office has conducted annual publicity campaigns to increase the percentage of households that have a fitted operational smoke alarm. The National Community Fire Safety Centre estimated that, in 1998, 82% of households owned a smoke alarm. However materially deprived households are less likely to own a smoke alarm [30]. New strategies are, therefore, needed to increase the number of households with smoke alarms in these areas.

An observational study, conducted in Oklahoma City, distributed smoke alarms to target areas using various give-away strategies [1]. Results of this study showed an 80% decline in serious injuries in the follow up period. The cost effectiveness of the give-away programme, however, was not assessed. It is unclear whether the results of this study can be generalised from a small mid western US city to an urban, materially deprived, ethnically diverse, British population. Its non-random experimental design, moreover, may have biased the results of the study [29]

A randomised-controlled trial was conducted to determine whether a smoke alarm give-away programme directed to such a population is effective and cost effective in reducing the risk of fires and fire related deaths/injuries. The net cost of the programme will depend on the cost of giving away alarms and any savings generated, as a result of a reduction in the incidence of fires, in the cost of fire extinction, damage costs and costs to the health service. Cost effectiveness will involve relating this net cost to the effectiveness of the programme in terms of deaths and injuries avoided.

2. Methods

2.1 Trial Design

A cluster-randomised controlled trial was conducted in the inner London Boroughs of Camden and Islington. Households were categorised into wards, based on geographical location. Wards included were those with above average material deprivation, defined as a Jarman Under Privileged Area score ≥ 20 [31]. Wards were pair matched according to Jarman score. Random allocation to either intervention (smoke alarm give-away) or control (no smoke alarm give-away) was then undertaken within the matched pairs.

Forty wards, averaging 3,683 households in each, were randomised to intervention and control status. Free smoke alarms and fire safety information was then distributed to the intervention wards, by community groups and paid workers. The aim was to increase the proportion of households with smoke alarms in the intervention wards from 47% to 72% (national prevalence, as of 1996) [7].

The give-away programme, called the "Let's Get Alarmed!" Initiative [7], distributed 20,050 smoke alarms, batteries, and fire safety brochures. Recipients who signed indemnification forms were asked if they would require smoke alarm fitting by specially trained staff; installation was provided to 8% of recipients in intervention wards. One year later, postcards were sent to all recipients who provided complete addresses (72%), reminding them to test and vacuum the alarm and to change its battery [7].

The primary outcomes in the trial were the number of fires and the number of fire-related injuries and deaths. The trial also collected data to facilitate a cost effectiveness analysis from a societal perspective.

2.2 Trial data collection

Details relating to the number of injuries/deaths and the number of fires, in each ward, were collected prospectively in intervention and control wards for a period of between 22.9 and 25 months (mean 23.9).

2.2.1 Fire Brigade data

The number of fires occurring in each ward was restricted to those reported by the fire brigade. It is recognised that this is likely to represent only a small percentage of the fires that actually occurred: in 1998 it has been estimated that between 81 and 88% of fires did not result in a fire brigade call [17]. However, it can probably be assumed that the most costly fires were those to which the fire services was called. The fire brigade data collection forms, which were filled out for each fire attended in the trial wards, contained information on: fire brigade time at fire, cause of fire, police attendance, extinction details, suspected injuries, address of fire, extent of damage and damage details.

2.2.2 Injury data

Injuries were defined as those which resulted in an accident and emergency attendance. These data were collected from local accident and emergency department registers. Data were recorded on date of admission, method of arrival, number of ambulances, diagnosis, details of actions taken and method of departure.

Follow up data - for further A&E attendances, GP-visits, hospital admissions, burns unit admissions, surgery and outpatient clinics - were also collected for those patients recommended for follow-up. Deaths occurring as a result of fire were recorded in the A&E and follow up forms, and were verified by the coroners' records.

2.2.3 Ambulance data

Ambulance data were recorded by the ambulance service. Record forms contained details of ambulance number; date of call; ambulance timings (e.g. time origin, time mobilised, and time of return to base); if other ambulance on scene; if Helicopter Emergency Medical Service on scene; if police on scene; if Fire Brigade on scene, destination, mileage, details of call and address of fire. Ambulance presence at a fire was verified through the A&E data and the Fire Brigade reports.

2.3 Cost analysis

2.3.1 The give-away programme

The total cost of the give-away programme has been detailed elsewhere [7] and is summarised in Table 1. The total cost of the give-away was £157,823 overall intervention wards, including the one-year reminder postcards, which constituted £12,723. A total of 20,050 alarms were given away.

2.3.2 Fire Brigade events

For each fire event, resource use items were assigned a unit cost, and where possible these were taken from published sources (Table 2). Fire costs constituted fire extinction (both by fire brigade and occupier), fire damage, fire investigation, property damage and insurance administration.

Fire Brigade costs were calculated by multiplying the time spent by the Fire Brigade at the scene of a fire, by a cost per pump-hour [32]**.** For fires with more then 4 pumps present, a cost for the fire investigation unit, £57 per hour, was added. When it was apparent that injuries had occurred in the fire, and more than 4 pumps were used, a cost of the Assistant Divisional Officer (ADO) attendance was also added at £47 per hour [32].

2.3.3 Police costs

Police presence at the scene of a fire was assigned a fixed cost of £110 [33] per fire, regardless of the number of injuries. This cost was added to those fires indicating police attendance, as recorded by the Fire Brigade.

2.3.4 Property damage costs

For those fires which were attended by the Fire Brigade, property damage costs were estimated from the 1996 British Crime Survey (BCS) [17]. The Fire Service defined fires as one of four types: inside/no spread, inside/spread, outside/no spread, outside/no spread. This definition was consistent with the categorisation used in the BCS from which cost data were available. Respondents in the BCS who had experienced a fire in the last year, gave an estimate of the cost of damage and this was used to derive a mean cost of damage for the four types of fire.

2.3.5 Ambulance journeys

Duration of ambulance journeys was measured from the time of the first call to the time the ambulance returned to base. A cost per hour was used to cost this time [25]**.** Helicopter emergency ambulance journeys were assigned an average cost [5]**.**

2.3.6 Injury costs

All cases that presented at accident and emergency were assigned a cost of £41 [25]**.** Follow up costs - for re-admissions, GP visits and surgery - were then added on if records were available for the patient. When recommended actions were given at A&E, it has been presumed the patient attended the facility, and hence incurred a cost. Deaths resulting from fires also incurred a cost (£1730) representing the average cost of a funeral, coroners' costs and autopsy costs. [34]

2.4 The Decision Model

Given the cluster-randomised nature of the trial, and the fact that costs occurred at various levels (individual, household and ward), a standard trial-based economic evaluation was not considered feasible. Instead, the data collected in the trial were synthesised with unit cost data and analysed using the decision tree model illustrated in Figure 1. The model focuses on the household level of analysis to which all probabilities and costs relate. Based on the outcome measures collected in the trial, Figure 1 shows ten mutually exclusive fire-related events (pathways), although no events for pathway 10 were recorded in the trial.

Pathway 1: FB attend, Inside fire, no spread, A&E admission
Pathway 2: FB attend, inside fire, no spread
Pathway 3: FB attend, inside fire, spread, A&E admission
Pathway 4: FB attend, inside fire, spread
Pathway 5: FB attend, outside fire, no spread, A&E admission
Pathway 6: FB attend, outside fire, no spread
Pathway 7: FB attend, outside fire, spread, A&E admission

Pathway 8: FB attend, outside fire, spread
Pathway 9: FB not attend, A&E admission
Pathway 10: FB not attend, no A&E admission

Tables 2 and 3 detail the input parameters used in the model based largely on trial data. Mean input values are shown together with a measure of uncertainty. Within the model, second order uncertainty in cost data is characterised as a gamma distribution and uncertainty in probability data as a beta. The follow-up period in the trial, on a ward basis, ranged between 22.9 and 25 months. For the model, all event probabilities were standardised to the mean follow-up period of 24 months.

Monte Carlo simulation[2] was used to analyse the model on a stochastic basis. This provides a measure of uncertainty in the results of the analysis, namely the expected costs and effects in experimental and control wards. The measure of effectiveness used in the analysis gives deaths or injuries associated with fires in the two groups of wards, during the 2-year follow-up period. To establish the net cost of the give-away pragramme, the household-level cost data from the model are aggregated to ward level on the basis of the mean number of households per ward in the trial (3686). The ward level cost of the give-away process itself was then considered.

The results of the analysis are shown in three ways. Firstly, the expected costs and effects, estimated by the model, at household level are presented. Secondly the expected net costs (including the costs of the give-away) and expected effects at ward level are presented. Thirdly, cost effectiveness acceptability curves[9] are used to characterise the uncertainty around the results.

3. Results

3.1 Costs of the give-away programme

The average cost of the smoke alarm give-away, for an average intervention ward (3686 households) was £7141. The mean smoke alarm give-away, in the intervention wards, reached on average 22.10% of households.

3.2 Cost and effect inputs used in the model

The number of events in intervention and control wards can be seen in Table 3. Wards which received smoke alarms had more fire events than those who did not receive smoke alarm, 576/73399 and 518/74045 respectively. All types of event were slightly more apparent in the intervention wards, apart from inside fire/no spread/no A&E visit and inside fire/spread/A&E visit.

The probability of a household having an event was calculated using the total number of events occurring across all wards divided by the total number of households at risk across all wards over the two-year follow-up period. The probability data used as inputs into the model can be seen in Table 3. A household in a ward randomised to receive a smoke alarm was slightly more likely to have a fire event over the two-year follow-up period (0.0078 versus 0.0070), and less likely to have the event attended by the fire brigade (0.91 versus 0.95).

For each of the 9 pathway events, the mean cost per household, for injury, extinction, damage and damage administration were calculated from trial data and used as model inputs. These costs can be seen in Table 4. No outside fires resulting in an A&E attendance occurred in the trial, and hence these pathways are not included in the table.

3.4 Expected costs and effects

The stochastic model was used to generate a distribution of expected costs, and expected total injuries/deaths, for intervention and control, at the household level. This does not include any cost for the give-away programme, which occurred at the ward level. The expected costs and effects from the model can be seen in Table 5, along with the 2.5 and 97.5 percentiles from the distribution. Give-away households have lower expected costs than control wards (£17.76 compared to £18.86), and higher expected outcomes, (deaths and injuries) (0.00203 compared to 0.00145). However the overlapping 2.5 and 97.5 percentiles indicates the extent of uncertainty in these estimates.

To calculate the net expected cost of the give-away compared to no give-away, the cost of the actual programme (£1741 per ward) was added to intervention wards. This cost occurred at the ward level, and hence household expected costs and effects were multiplied by the standard number of households in a ward (3686). Table 6 shows the net expected costs and effects for a ward randomised to each group.

Expected costs, excluding the cost of the give-away programme, are higher in a ward randomised to control than intervention (£69,523 and £65,481 respectively). However, when the cost of the give-away programme is added intervention wards have a higher net expected cost (£72,622 and £69,523 respectively). Expected total injuries/deaths are also higher in the intervention wards (7.48 compared to 5.34). The upper and lower percentiles for the expected costs and effects show great variability in the estimates. Figure 2 shows the range of net costs for intervention and control wards. Net costs are also highly skewed.

3.5 Cost-effectiveness acceptability curve

On the basis of mean costs and outcomes, the give-away programme is a dominated intervention with higher overall expected costs and more deaths/injuries. To examine the uncertainty in these means, a cost-effectiveness acceptability curve was used as shown in Figure 3.

It can be seen that as the value of a death/injury averted increases, the probability that a smoke alarm give-away programme is cost effective, decreases. When an averted injury/death is valued at £1,000 a smoke alarm give-away has 0.055 probability of being cost effective. When an averted injury/death is valued at £50,000, the probability of a smoke alarm give-away programme being cost effective is approximately 0. The shape of the acceptability curve reflects the fact that mean deaths/injuries were actually higher in intervention wards.

Discussion

On the basis of mean costs and effects, the give-away programme evaluated in this study is actually a dominated intervention, with higher expected costs and higher expected deaths/injuries. It should be emphasised, however, that there is considerable uncertainty surrounding these mean estimates. From a decision-making viewpoint, the importance of this uncertainty is shown in the cost-effectiveness acceptability curve in Figure 3. Overall, the results of this study indicate that, as operated in the trial, a smoke alarm give-away programme is not a cost-effective use of societal resources.

From a policy perspective, it is important to emphasise that the results of this study do not suggest that a smoke alarm give-away programme can never be cost-effective. The results shown in the trial probably reflect the fact that too few alarms were distributed, installed and maintained over the study period. Inspection of a random sample of council-owned homes suggested that the prevalence of functioning smoke alarms 12-18 months after the programme was nearly identical in intervention and control households. Hence the distribution of 20,000 free alarms in an area of 73,400 homes was insufficient to increase the overall prevalence of functioning alarms. It is important to recognise the potential barriers to functioning fire alarms in the populations studied in the trial. These include illiteracy or poor command of English preventing the occupant from reading or understanding instructions, concerns that landlords might object to installation, lack of installation tools, and competing priorities for the time needed to install the alarm and the funds required to replace batteries. Perhaps most importantly, false or nuisance alarms, caused by incorrect installation near sources of steam or cooking smoke and by the over-crowded living conditions in inner London social housing, may lead many occupants to remove batteries from installed alarms [8,11]. A further trial is now underway to assess whether providing different types of smoke alarm (ionising and optical) from different power sources (alkaline batteries, lithium batteries, mains installed) can increase the prevalence of functioning alarms.

There are a number of methodological issues emerging from this study. The first is that this is the first randomised-controlled trial of a smoke-alarm give-away programme, and shows that it is feasible to use experimental designs to evaluate important public health initiatives. The results seen in the trial are markedly different to those in the observational study conducted in Oklahoma upon which the give-away intervention was modelled [1]. In part, this may reflect population differences - for example, fewer owner-occupiers, fewer English speakers, and a materially poorer, less literate population in the UK study. Among recipient households in the London trial, only 17% had correctly installed and functional alarms 12-18 months after the programme, compared to 51% in Oklahoma City at 12 months. However, the non-experimental design in Oklahoma might also explain the differences in results. In the UK trial, wards were all located in the same geographic area of inner London. Intervention and control groups were matched by socio-economic status and health care needs, and were similar in size, population characteristics, and baseline fire and injury rates. Random allocation was used to ensure that the two groups were as similar as possible for unmeasured variables. In contrast, the intervention area in Oklahoma City was selected for its high baseline fire injury rate, and may have differed from the rest of the city (used as controls) in other ways that were not reported or measured.

The economic analysis reported here also raises some methodological issues. In recent years there has been rapid development in the methods of trial-based economic evaluation. In particular, in clinical trials, methods are now available to use patient-level data to present uncertainty in cost-effectiveness using net benefits or cost-effectiveness acceptability curves [3,9]. However, the smoke-alarm give-away trial had design characteristics that make standard trial-based economic evaluation difficult to use. In particular, the main unit of analysis was the household as this is where fires take place, but the intervention was at the ward level. For this reason, a cluster-randomised trial was used to evaluate the programme and, for the effectiveness analysis, multi-level modelling has been used to adjust household-level estimates of effectiveness for intra-cluster correlation. For the economic analysis, however, costs take place at various levels in the analysis: wards (give-away programme), households (fires damage) and individuals (health service costs); furthermore, the key measure of effectiveness (deaths and injuries) is an individual level variable. This complexity made multi-level modelling difficult to use for the economic analysis. Rather, a stochastic decision model was chosen within which to synthesise the cost and effectiveness results from the trial. This enabled the mean overall net costs and effects of the give-away programme to be estimated, together with the uncertainty around those estimates. The modelling approach was also an advantage given that some uncertain variables in the analysis were taken from sources other than the trial – in particular, the cost of fire damage which was based on the British Crime Survey.

The inputs into the decision model are currently based on simple pooling or averaging across households in the study, allowing for whether a household was in a ward randomised to intervention or control. This approach does not, however, allow for the potential clustering effects given that the trial was randomised by ward. For example, clustering effects may take the form of fires spreading from one household to the next; and of property damage costs being affected by property values which may be correlated in wards. Work is currently underway to use multi-level modelling to adjust the input parameters in the model for potential clustering effects. Although such adjustment is very unlikely to affect the key conclusions of the model, it will allow clustering effects to be represented in the model.

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Table 1: Cost of give-away programme [7]

Item	Resources	Value
Smoke alarm packs	20,050 alarms, batteries, fittings, manufacturer's instructions	£49,200
Educational brochures on fire safety and smoke alarms	25,750 fire safety brochures (in English and other languages) 25,000 smoke alarm brochures	£1,392
Bags	25,000 bags	£125
Supplies Photocopying	50,000 units (indemnity forms, address sheets, leaflets, posters, contracts, drop cards) 50,000 units (indemnity forms, address sheets, leaflets, posters, contracts, drop cards)	£45 £2,225
Transport	Vans and drivers for 50 days @£125/day	£6,250
Storage	≈5-6 boxes (20 alarms/box0 per day x 6 months	£200
Training	London Fire Brigade staff: 3 person hours plus travel costs	£217
Bagging	468 person-hours	£1,638
Distribution Installation	4,831 person-hours 1,604 alarms installed	£23,915 £12,000
Programme co-ordination	2 staff at 2/3 FTE x 12 months; 1 staff at 0.5 FTE x 7 months	£47,791
Pilot test	18 person- hours	£89
give-away Programme		**£145,087**
Mailing list preparation	Entry of 14,496 names and addresses into computerised database	£9,228
Reminder postcards	14,039 cards, printing, postage and mail sorting	£3,508
Reminder Postcards	**Sub- Total**	**£12,736**
	Grand Total	**£157,823**

Table 2: Unit costs

Resource	Unit measured	Unit Cost	Source
Police	Attendance at scene of fire	£110	Strathclyde Fire Brigade, 1998 [33]
Fire Brigade Extinction	Cost per pump, per minute	£2.63	LFCDA [32]
Fire investigation Unit	Cost per hour	£57	LFCDA [32]
A.D.O	Cost per hour	£47	LFCDA [32]
Self extinction			
Fire blanket	Per blanket	£13.95	SP services [40]
9 litre water extinguisher	Per extinguisher	£55.50	FPS fire protection [39]
2 kg carbon dioxide extinguisher	Per extinguisher	£83.50	FPS fire protection [39]
9 litre foam AFFF extinguisher	Per extinguisher	£64.50	FPS fire protection [39]
Halogen Extinguisher (1kg)	Per extinguisher	£46.81	Fire Master [38]
Halogen Extinguisher (1.5 kg)	Per extinguisher	£63.83	Fire Master [38]
Halogen extinguisher (2 kg)	Per extinguisher	£85.11	Fire Master [38]
Dry powder extinguisher (1 kg)	Per extinguisher	£27.50	FPS fire protection [39]
45 litre AFFF	Per unit	£506.19	Wireless alarms [41]
Property damage			
Inside/no spread	Per fire	£231.14	British Crime survey 1998 [17]
Inside/spread	Per fire	£3103	British Crime Survey 1998 [17]
Outside/spread	Per fire	£543.4	British Crime Survey 1998 [17]
Outside/no spread	Per fire	£69.19	British Crime Survey 1998 [17]
Insurance administration	Cost per fire claim	51.5% damage claim	Association of British Insurers,1999 [21]
Injury costs			
Ambulance services	Cost per minute	£4.53	PSSRU, 1999 [25]
HEMS	Cost per mission	£3624.08	J.Brazier et al, 1996 [5]
A& E attendance	Cost per visit	£41	PSSRU, 1999 [25]
GP attendance	Cost per visit	£23.50	PSSRU, 1999 [25]
Outpatient clinic	Cost per visit	£37	PSSRU, 1999 25
A&E ward	Cost per day	£359	PSSRU, 1999 [25]
Hospital generic ward	Cost per day	£222	PSSRU, 1999 [25]
Intensive care unit	Cost per day	£1845.72	Specific NHS Hospital [42]
Burns unit	Cost per day	£826.32	Specific NHS Hospital [42]
Plastic surgery	Cost per graft	£2076.45	Specific NHS Hospital [42]
Tracheotomy	Cost per procedure	£214.75	Specific NHS Hospital [35]
Hyperbolic Oxygen therapy	Cost per session	£1000	Specific NHS Hospital [36]
Funeral	Cost per service	£1600	Co-operative Funeral

			directors [37]
Coroners costs	Cost per death	£30	Home office [22,18]
Autopsy	Cost per procedure	£100	University of Leicester [34]

Table 3: Fire events per ward

	GIVE-AWAY	**NO GIVE-AWAY**
FIRE EVENTS		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	576/73399 0.0078	518/74045 0.007
FIRE BRIGADE ATTEND, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	527/576 0.91	493/518 0.95
FIRE BRIGADE ATTEND, INSIDE, NO SPREAD, A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	29/319 0.091	20/285 0.0709
FB ATTEND, INSIDE, NO SPREAD, NO A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	290/319 0.9089	264/285 0.92
FB ATTEND, INSIDE, SPREAD, A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER PROBABILITY (HOUSEHOLD)	27/190 0.141	33/199 0.16
FB ATTEND, INSIDE, SPREAD, NO A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	163/190 0.85	165/199 0.83
FB ATTEND, OUSIDE, NO SPREAD, A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	0 0	0 0
FB ATTEND, OUTSIDE, NO SPREAD, NO A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	12/12 1	8/8 1
FB ATTEND, OUTSIDE, SPREAD, A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	0 0	0 0
FB ATTEND, OUTSIDE, SPREAD, NO A&E, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	6/6 1	0.95/0.95 1

NO FB, A& E ADMISSION, GIVEN A FIRE EVENT		
TOTAL NUMBER **PROBABILITY (HOUSEHOLD)**	48/576 0.0834	25/518 0.048

Table 4: Mean costs (standard errors), by fire event

	GIVE-AWAY	**NO GIVE-AWAY**
FB/INSIDE/NO SPREAD/NO A&E		
MEAN COST OF EXTINCTION **MEAN COST OF DAMAGE** **MEAN COST OF INSURANCE ADMIN**	204.91 (15.48) 231.14 (80.56) 119.03 (41.49)	236.42 (21.12) 231.14 (80.56) 119.03 (41.49)
FB/INSIDE/NO SPREAD/A&E		
MEAN COST OF INJURY **MEAN COST OF EXTINCTION** **MEAN COST OF DAMAGE** **MEAN COST OF INSURANCE ADMIN**	1652.57 (491.85) 689.51 (82.78) 231.14 (80.56) 119.03 (41.49)	691.4 (238.4) 860.03 (159.64) 231.14 (80.56) 119.03 (41.49)
FB/INSIDE/SPREAD/NO A&E		
MEAN COST OF EXTINCTION **MEAN COST OF DAMAGE** **MEAN COST OF INSURANCE ADMIN**	308.93 (91.70) 3103 (32.26) 1598.04(685.34)	402.59 (51.32) 3103 (1330.75) 1598.15 (685.34)
FB/INSIDE/SPREAD/A&E		
MEAN COST OF INJURY **MEAN COST OF EXTINCTION** **MEAN COST OF DAMAGE** **MEAN COST OF INSURANCE ADMIN**	1065.61 (234.42) 700.26 (65.95) 3103 (1330.75) 1598.15 (685.34)	844.35 (152.1) 1725.36 (934.1) 3103 (1330.75) 1598.15 (685.34)
FB/OUTSIDE/NO SPREAD/NO A&E		
MEAN COST OF EXTINCTION **MEAN COST OF DAMAGE** **MEAN COST OF INSURANCE ADMIN**	432.47 (274.45) 69.19 (29.93) 35.63 (15.41)	224.56 (119.17) 69.19 (29.9) 35.63 (15.41)
FB/OUTSIDE/SPREAD/NO A&E		
MEAN COST OF EXTINCTION **MEAN COST OF DAMAGE** **MEAN COST OF INSURANCE ADMIN**	1169.9 (868.26) 543.4 (443.56) 279.85 (228.43)	970.47 543.4 (443.56) 279.85 (228.43)
NO FB/ A&E ATTENDANCE		
MEAN INJURY COST	754.38 (247.2)	1323.07 (1185.18)

Table 5: Mean costs and outcomes for a household, based on the Monte Carlo simulation

	GIVE-AWAY	NO GIVE-AWAY
EXPECTED COST	**17.76**	**18.86**
2.5 percentile	8.45	8.33
97.5 percentile	31.5	34.06
EXPECTED INJURY COST	**1.55**	**1.06**
2.5 percentile	0.73	0.35
97.5 percentile	2.76	2.43
EXPECTED EXTINCTION COST	**2.21**	**3.32**
2.5 percentile	1.15	1.64
97.5 percentile	3.59	5.59
EXPECTED DAMAGE COST	**9.27**	**9.69**
2.5 percentile	3.48	3.20
97.5 percentile	19.09	19.66
EXPECTED INSURANCE ADMIN	**4.73**	**4.79**
2.5 percentile	1.69	1.69
97.5 percentile	9.37	9.88
MEAN EXPECTED NUMBER OF INJURIES/DEATHS	**0.00203**	**0.00145**
2.5 percentile	0.00101	0.00070
97.5 percentile	0.00330	0.0025

Table 6: Net expected costs and expected effects for a ward, including the cost of the give-away programme

	GIVE-AWAY	NO GIVE-AWAY
GIVE-AWAY PROGRAMME	1741	0
TOTAL EXPECTED COST	**65481**	**69524**
2.5 percentile	31168	30718
97.5 percentile	116254	125571
EXPECTED INJURY COST	**5717**	**3898**
2.5 percentile	2723	1302
97.5 percentile	10194	8993
EXPECTED EXTINCTION COST	**8152**	**12253**
2.5 percentile	4250	6064
97.5 percentile	13261	20612
EXPECTED DAMAGE COST	**34167**	**35724**
2.5 percentile	12853	11806
97.5 percentile	70391	73216
EXPECTED INSURANCE ADMIN	**17444**	**17649**
2.5 percentile	6256	6243
97.5 percentile	34551	36441
NET EXPECTED TOTAL COST	**72,622**	**69,524**
2.5 percentile	38309	30718
97.5 percentile	123395	125571
TOTAL EXPECTED NUMBER OF INJURIES/DEATHS	**7.48**	**5.34**
2.5 percentile	3.72	2.57
97.5 percentile	12.16	9.34

Figure 1 simplified decision pathway (receive smoke alarm give-away)

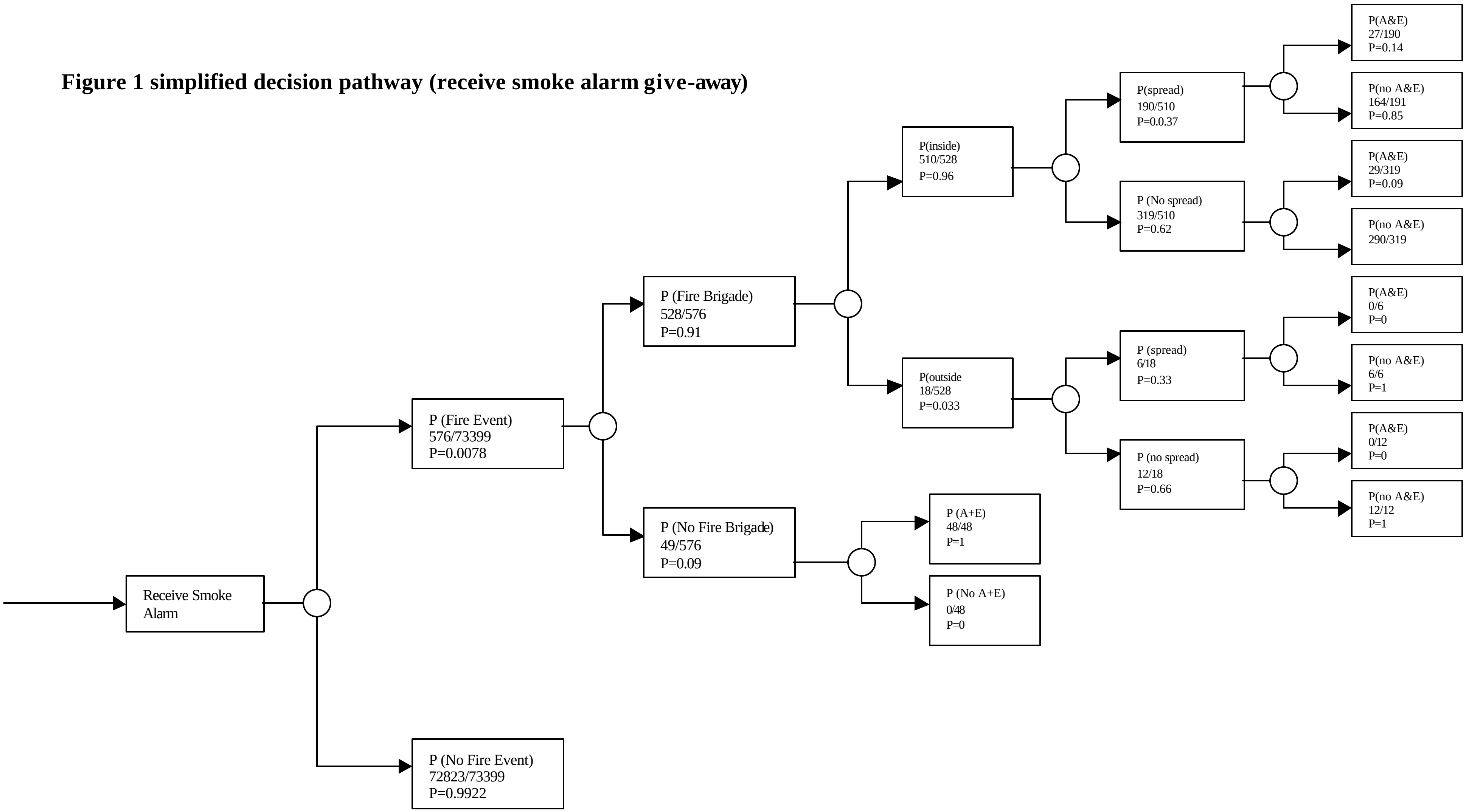

Figure 1 (continued) No smoke alarm give-away

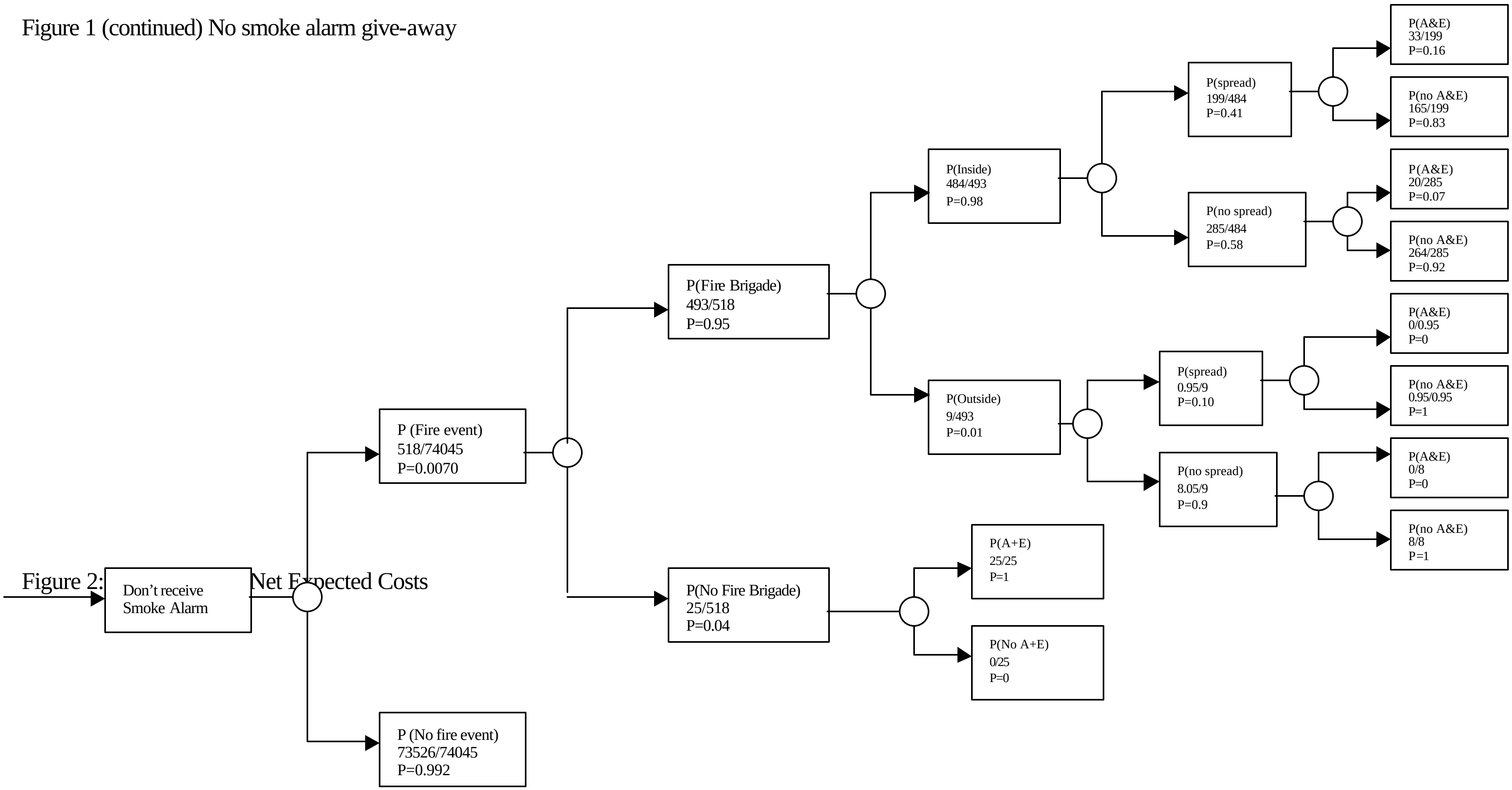

Figure 2: Net Expected Costs

Figure 2: Distribution of expected net costs

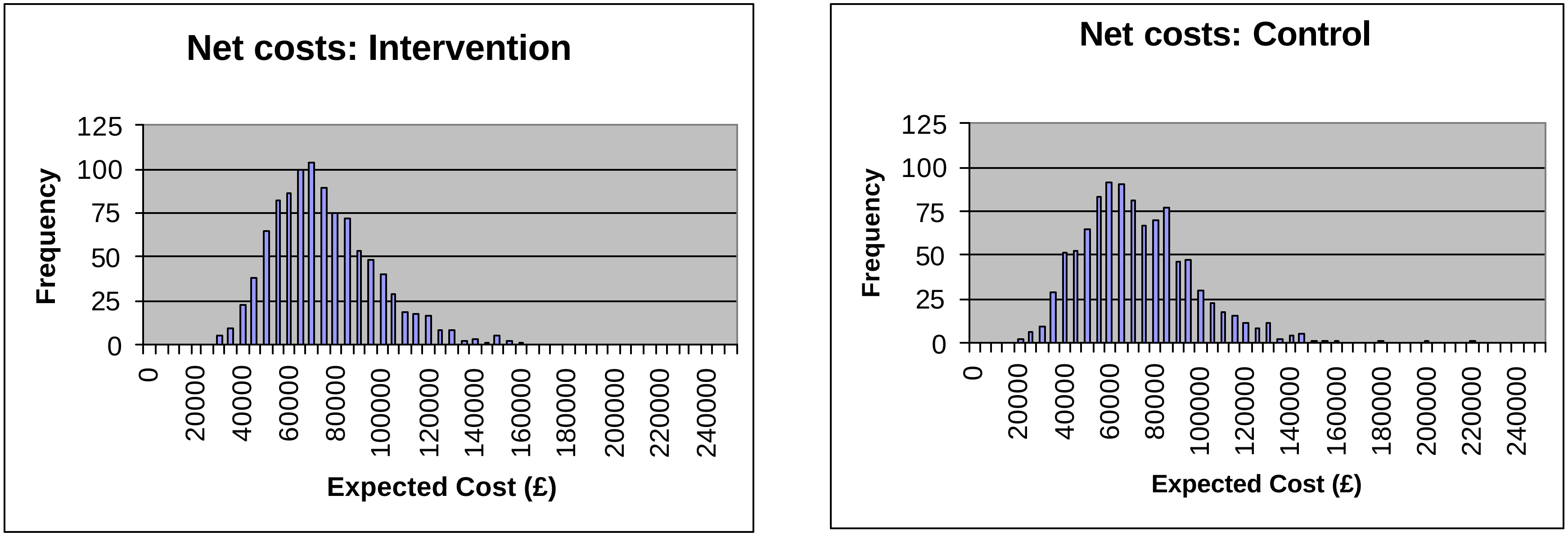

Figure 3: probability that a smoke alarm give-away programme is cost effective