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"GET OUT, STAY OUT" VERSUS OCCUPIER INDEPENDENCE: THE RESULTS OF AN 18 MONTH STUDY OF HUMAN BEHAVIOUR IN ACCIDENTAL DWELLING FIRES IN KENT

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ABSTRACT

Building upon a paper presented at the International Symposium on Human Behaviour in Fire 2012, this paper presents the findings of a study conducted by Kent Fire and Rescue Service and the University of Greenwich into human behaviour during accidental dwelling fires (ADFs). In order to develop an understanding of the behaviours and motivations of those experiencing a domestic fire, quantitative and qualitative data were collected through the use of a questionnaire survey that was distributed by post to those who directly experienced an ADF in Kent between April 2011 and October 2012. Using a methodology employed in the study of evacuation behaviour in the 9/11 World Trade Center attacks, 177 participants' activities were coded into a series of Information Tasks and Action Tasks and entered into a database from which statistics were produced using the software package SPSS. Results demonstrated that participants were more likely to have been affected by the flames and smoke and considered retreating from the room of origin of the fire (ROO) if they perceived the fire as being more, rather than less, serious. Additional analysis undertaken on the number and sequence of tasks undertaken revealed a large proportion of participants undertook several activities during the fire including; entering the ROO, fighting the fire, and re-entering the property. Furthermore, among the majority of those who did so, calling the fire service was the final or penultimate activity undertaken. This work is the precursor to a large-scale regional study that will begin later this year and involve Kent Fire and Rescue Service, the University of Greenwich and several other UK fire and rescue services.

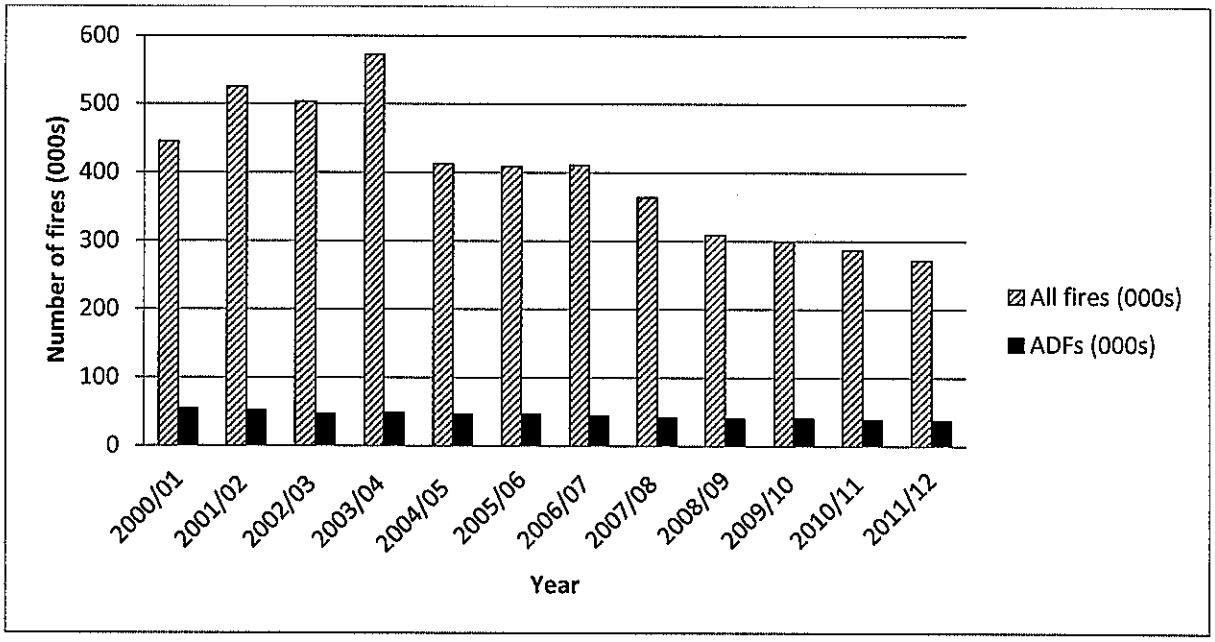
INTRODUCTION

Human behaviour in fire is a well-established subject area covering several areas of enquiry[1-4]. However, the primary focus has been on the study and understanding of human behaviour in fires in public, commercial and industrial spaces; the study of human behaviour in dwelling fires has not received a comparable degree of attention. This is an important consideration as the range of different factors acting upon those experiencing a dwelling fire mean that the knowledge of human behaviour in fires in public, commercial and industrial spaces cannot be assumed to be automatically applicable to behaviour in dwelling fires[3,5,6,7]. The literature that does focus on behaviour in domestic spaces has tended to explore issues related to fire-related deaths, particularly the identification of contributory factors[8-11]. Consequently, human behaviour in dwelling fires (particularly those with non-fatal outcomes) remains, arguably, one of the subject's least understood aspects. As a result, this study has focussed on the behaviour and motivations of those who survive dwelling fires (either with or without sustaining injury). With over 37,000 ADFs in the UK resulting in approximately 7,800 injuries, there is an enormous amount of highly valuable data to be accessed from developing a comprehensive

understanding of people's experiences of dwelling fires. Within the UK, accidental dwelling fires (ADFs) constitute just 13% of all recorded fires by type; however, they are the cause of almost 70% of all fire-related deaths and injuries[12]. The implications for the fire service and wider society of a greater knowledge and understanding of this area are far-reaching and will be of great assistance in further reducing deaths and injuries (both number and severity) that occur as a result of fires in the home[13].

Within the UK over the past ten years there has been a marked decline in the number of reported fires, with the total falling from 445,000 in 2000/01 to 272,000 in 2011/12. Over the same period this has been accompanied by a decline in the number of reported ADFs, from 54,100 to 37,600 (Figure 1), and the numbers of both fire-related deaths and injuries (Table 1). Anecdotally, several reasons are offered to explain this decline; these range from improvements in fire safety regulations for domestic furnishings; improvements in, and the widespread installation of, domestic smoke alarms; and the focus in recent years by fire and rescue services on 'community safety' (the provision of domestic fire prevention advice for the public combined with free home fire safety checks).

Figure 1. Total number of reported fires and ADFs in the UK



Source: Fire Statistics Great Britain, 2011-2012, Department for Communities and Local Government

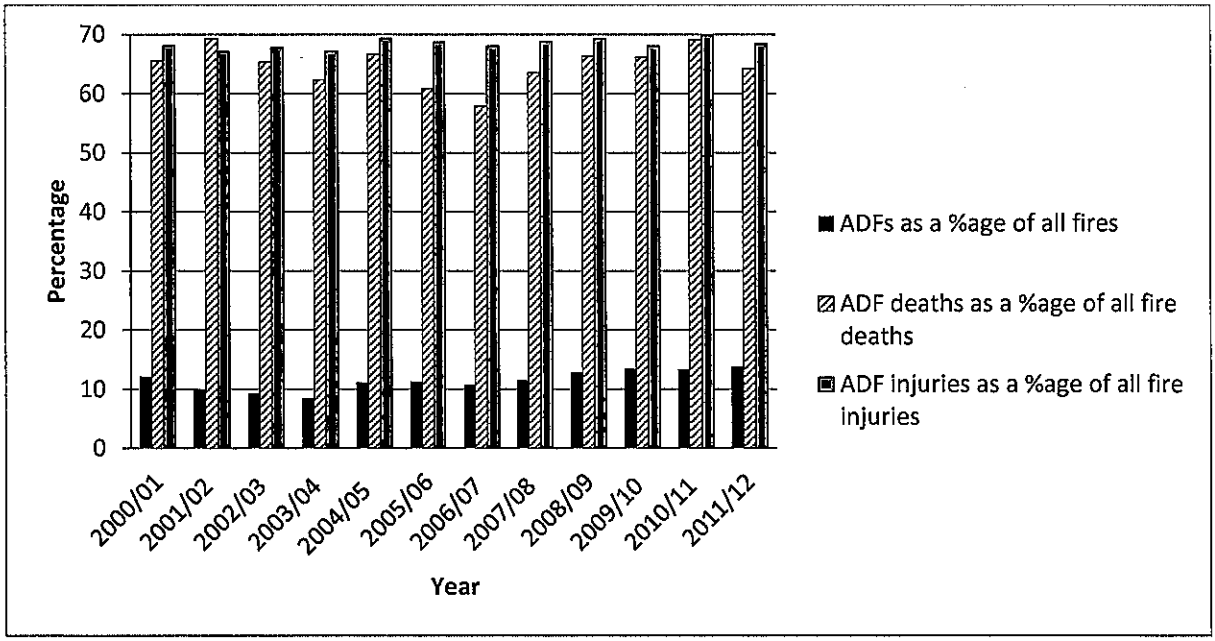
Whatever the true causes of this decline, it has frequently been celebrated as proof of the improving fire safety environment within the UK, something that is to be welcomed. However, it is interesting to note that a slightly closer analysis of these figures shows that, when viewed as a proportion of all fires, ADFs have actually remained at between 8% and 14%. For the first few years following the millennium, the proportion of ADFs declined then rose to 11% in 2004/05, remaining near this level for several years before rising again in recent years to around 14%. Furthermore, during this period the proportion of fire-related deaths and injuries caused by ADFs has also remained consistent at between 58% and 70% (Figure 2). As a result, despite the welcome reduction in the overall number of all fires and ADFs, the proportion of ADF-related injuries and deaths has continued largely unchanged. In short, although the likelihood of having a domestic fire may have decreased, when a domestic fire does occur, the likelihood of being injured or dying in such a fire has not decreased.

Table 1. Fire-related deaths and injuries in the UK

Year	All fires (000s)	ADFs (000s)	All fire deaths	ADF deaths	All fire injuries	ADF injuries
2000/01	445	54.1	554	363	16,542	11,263
2001/02	525	52.2	583	404	16,907	11,348
2002/03	503	47.1	522	341	15,055	10,200
2003/04	572	48.5	576	359	15,228	10,226
2004/05	412	46.1	483	322	13,672	9,476
2005/06	409	46.1	470	286	13,578	9,323
2006/07	411	44.2	430	249	13,088	8,902
2007/08	364	41.8	458	291	12,669	8,714
2008/09	309	39.6	404	268	11,533	7,987
2009/10	299	40.3	416	275	10,652	7,244
2010/11	287	38.5	388	268	11,134	7,776
2011/12	272	37.6	380	244	11,300	7,729

Source: Fire Statistics Great Britain, 2011-2012, Department for Communities and Local Government

Figure 2. ADFs in the UK as a proportion of all fires, fire-related deaths and injuries



Source: Fire Statistics Great Britain, 2011-2012, Department for Communities and Local Government

BACKGROUND TO THE STUDY

It is a truism to state that a better understanding of human behaviour in dwelling fires will assist fire services and other organisations in reducing both the risks and disproportionately large impact of such fires; particularly the numbers of deaths and injuries and damage to property. Indeed, the importance of developing such an understanding has been recognised by the UK fire service for

some time[14,15,16]. The aim of this project was to develop a better understanding of the behaviour and motivations of those who experienced dwelling fires and identify variables that are more likely to have a direct relationship with specific identified outcomes.

The background to this was a qualitative pilot study undertaken in early 2011[17]. This pilot study comprised ten semi-structured in-depth interviews with individuals who had sustained injuries in ADFs. Interviews were tape recorded, transcribed and analysed thematically. Among the points of interest that arose from this study were the frequent description by participants of a rapid response after becoming aware of the cues of a fire (however it is important to note that in most instances this was not accompanied by a realisation by participants that these cues were themselves representative of a fire), something that contrasts with the 'task attachment' that is often described as a feature of human behaviour in fires occurring in non-domestic spaces[18,19]. Also noteworthy was the frequency with which participants described tackling the fire themselves. Despite lacking any statistical validity, the results of this pilot provided an illustrative (rather than representative) insight into the behaviours and motivations of a small, but varied, group of individuals who experienced fires within Kent. The next stage was the implementation of a project which would attempt to collect data routinely from dwelling fires in Kent. Within Kent there are approximately 600 reported ADFs per year (the latest figure for 2012/13 was 561). Since 1st April 2009 (the year when the electronic 'Incident Recording System' [IRS] was introduced), there has been an average of 56 ADFs per month in Kent, with the highest recorded number (78) in March 2010 and the lowest (37) in October 2012.

METHODOLOGY AND DATA COLLECTION

Data collection was carried out through the use of a mixed methods questionnaire survey that was sent by post to each person aged 16 and over who had directly experienced an ADF. As with the pilot study, the need to respect sensitivity and avoid upsetting people meant that ADFs where there had been a death would not be included in the sample. The survey comprised approximately 50 questions and was divided into five sections. This was structured so that the survey started at the point at which participants first became aware of the initial cues of the fires, it then went through the participants receiving confirmation of the fire and their activities at each of these stages (including behaviours related to fighting the fire), evacuation, wayfinding and re-entering the property. The survey also obtained data on participants' opinions of their activities, risk factors (both personal and environmental), previous fire safety training and experience, and a set of monitoring questions. Because the survey is reliant upon obtaining data from participants' memories, there is of course a risk of certain event details not being recalled well. To attempt to mitigate this, the survey incorporated a timeline onto which participants could record the sequence of activities they undertook and estimates of time spent performing those activities.

Prior to the introduction of this survey KFRS did not routinely collect a contact name and telephone number from occupiers (or indeed other relevant individuals) when attending a dwelling fire, so a system was implemented where firecrews would (where practicable) request a name and contact number from an occupier. Where this consent was given, crews then entered the occupier's name and telephone number onto a specially created section of the IRS. This allowed the prospective participants to be contacted by telephone so that they could be asked if they would be willing to participate in the study; where agreement was given surveys were posted to the participant along with a pre-paid and pre-addressed return envelope. For those incidents where firecrews had not obtained a contact number, a number of surveys equal to the number of occupants listed in the 'Household occupancy at fire start' category on the IRS were sent to the property. A database was created in Excel

listing all of the ADFs for each month, all of which was taken from the IRS. Into this database was entered further relevant information about those individuals who had been contacted by telephone, whether they had agreed to participate in the study or not, the number of surveys sent and subsequently returned (for both those contacted and not contacted), and the code numbers of any returned surveys.

Data collection started in June 2011, with data being collected on ADFs which had occurred between 1st April 2011 and 31st October 2012. During this period there were 994 relevant ADFs[1] in Kent and firecrews obtained contact numbers for 515 of these (52% of the total). A total of 1652 surveys were sent out to these 994 properties and 182 surveys were returned. However, five surveys were excluded from the analysis due to participants either not entering the property until KFRS had arrived or not completing a sufficient amount of the questionnaire. This gave a response rate of around 11% and provided data on 134 separate ADFs. Returned surveys were coded and entered into an Excel database. Of the returned surveys used in the analysis, 59% (105 surveys) were completed by those who had been contacted by telephone first before the survey was sent out. The remaining 41% (72 surveys) were returned by those who had not received any contact prior to being sent a survey.

ANALYSIS AND RESULTS

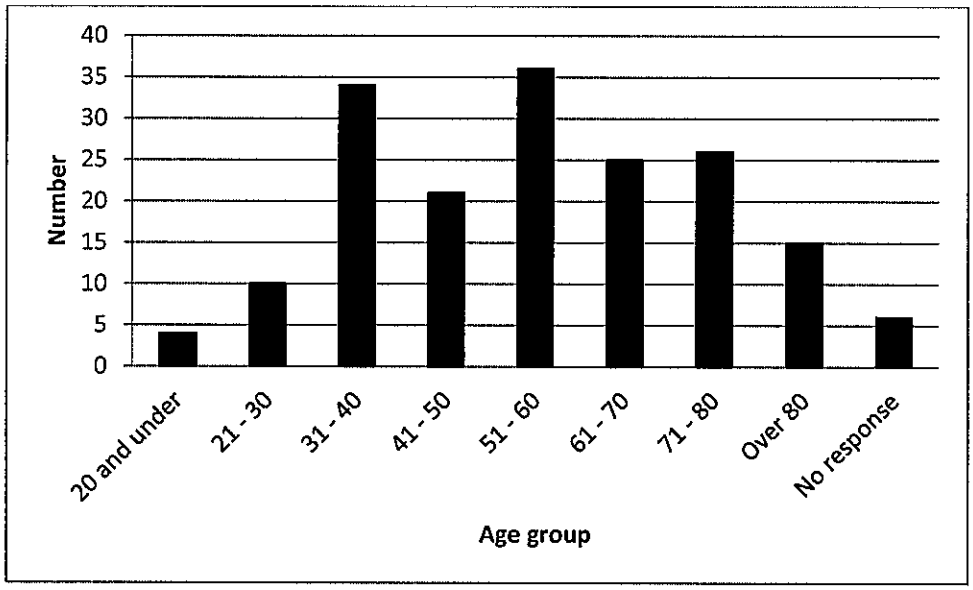
Kent Fire and Rescue Service use a three-part scale for classifying the severity of fires; 'Severe, Moderate and Minor'. These are defined as; Minor – a small domestic fire confined to the room of origin, no casualties and minor damage; Moderate – domestic fire with no serious casualties but serious internal fire damage; Severe – domestic fire where near fatal or fatal injury has occurred. Among the sample, 5% of returned surveys were for fires that were classified as 'Severe', 83% for 'Moderate' and 12% for 'Minor'. With regard to the profile of participants, 60% were female and 40% were male. As can be seen in Figure 3, the largest age group was the 51-60 category (20%), closely followed by those aged 31-40 (19%). Encouragingly, at 23%, there was a relatively high proportion of participants aged 71 and over (a combination of the groups '71-80' and 'Over 80'), a group who it was assumed beforehand would perhaps have been one of the least inclined to have participated in the study. Of those who answered the question, 88% of respondents described their ethnicity as 'White British', with the remainder being spread among 'White – Other' and 'Asian or Asian British – Indian'. The majority of fires occurred in houses (64%), followed by flats/maisonettes (15%), then bungalows (11%). Most fires (53%) were recorded as having started in the kitchen, followed by the bedroom (13%), and then the living room (8%). Based upon the data in the IRS, the three leading causes of fires were 'Fault in equipment or appliance' (25%), 'Combustible articles too close to heat source' (13%) and 'Faulty fuel supplies – electricity' (11%).

When it came to organising the survey timeline data (which was written in free text by participants), all of the task information was categorised into two groups; Information Tasks and Action Tasks. The former comprised four categories of tasks (1. Seek information, 2. Receive information, 3. Communicate information, 4. Call 999 – the emergency services' contact number in the UK) while the latter comprised six categories (1. Latent task; 2. People, pets and items; 3. Fight fire, prevent fire/smoke spreading; 4. Close door to ROO/other internal doors; 5. Enter property; 6. Exit property). Each of these categories then contained up to a maximum of five sub-categories (see Table 2). This collection of Information Tasks and Action Tasks was divided among three phases; Phase 1, Cue

[1] In this context 'relevant ADFs' means those for which someone was present during the fire and thus able to answer a questionnaire survey

Receipt Phase; Phase 2, Response Phase; and Phase 3, Evacuation Movement Phase. Phase 1 describes tasks relating to the participants receiving the cues of the fire, either environmental or social. As soon as a participant responds to these cues (e.g. to investigate the source or tackle the fire) they can then be considered to have entered Phase 2, the Response Phase. Phase 2 ends and Phase 3 begins when the participant then begins to purposefully move towards an exit in order to reach a place of safety (i.e. exiting the property and not re-entering). If a participant were to exit the property and then re-enter this is still considered to be part of Phase 2. The methodology behind the coding for Information Tasks and Action Tasks was based upon that used in studies of response phase behaviours during the 9/11 World Trade Center evacuation[20,21] and was deliberately adopted in order follow a standard approach that may allow the possibility for future comparison between behaviour in residential fires and behaviour in fires occurring in public, commercial and industrial spaces.

Figure 3: The number of participants in each age group



An overview of the frequency of participants' reported activities showed that upon becoming aware of the cues, a considerable proportion quickly moved to investigate the source of those cues, with a majority reporting entering the ROO after becoming aware of a fire (53%). In addition, almost half of the participants (45%) stated they made some attempt to either fight or mitigate the fire. Also noteworthy, was the fact that 20% of participants re-entered the property at least once before the arrival of the fire and rescue service. Finally, 58% of participants reported that they evacuated the property (thus entering Phase 3). Table 2 displays the frequency with which each of the Information Tasks and Action Tasks were cited by participants (Freq). It should be noted that in some cases participants cited the same task more than once; e.g. a participant may have made more than one separate attempt to fight the fire, with each attempt being punctuated by different activities. Also displayed are the proportions of participants who reported performing each of these tasks at least once (% participants).

As can be seen, a greater number of Action rather than Information Tasks were undertaken (395 vs. 367). However, if Phase 3 (Exit property) is removed, the number of Information Tasks becomes greater (367 vs. 293). The most frequently undertaken Information Tasks were (somewhat unsurprisingly) 'Receive information from the environment' (e.g. smell/see smoke, hear smoke

alarm), cited 98 times; 'Investigate cues from the environment', cited 97 times; and 'Call 999' cited 84 times. With regard to Action Tasks, apart from 'Exit property' (EMP – Phase 3), the most frequently undertaken were 'Attempt to extinguish fire', cited 61 times; 'Re-enter property', cited 40 times (this is of course accompanied by 'Exit property' RP – Phase 2, which was also cited 40 times, as a participant would first have to exit in order to be able to re-enter); and 'Gather dependent children/those unable to evacuate on their own', cited 31 times. With Response Phase activities the number undertaken by each participant ranged from zero to 12 tasks (within this were participants who undertook the same task more than once), the mean number of tasks undertaken was 4.09 (SD = 2.30).

Table 2. Comparison of Information Tasks and Action Tasks

INFORMATION TASKS	Freq	% participants
IT1 Seek information (Response Phase – PHASE 2)		
IT1.1 Investigate cues that are explicit fire-related warnings from others	18	10
IT1.2 Investigate cues that are not explicit fire-related warnings from others	7	4
IT1.3 Investigate cues from environment	97	50
IT1.4 Seek information from others in property	1	1
IT1.5 Seek information from others outside property (non-emergency services)	11	6
IT2 Receive information (Cue Receipt Phase – PHASE 1)		
IT2.1 Receive information from non-professionals (e.g. family, neighbours) in the property	2	1
IT2.2 Receive information from non-professionals (e.g. family, neighbours) outside the property	1	1
IT2.3 Receive information from professionals (e.g. emergency services) in the property	0	0
IT2.4 Receive information from professionals (e.g. emergency services) outside the property	0	0
IT2.5 Receive information from the environment (e.g. smell/see smoke, hear smoke alarm)	98	54
IT3 Communicate information (Response Phase – PHASE 2)		
IT3.1 Inform others of the situation	30	16
IT3.2 Instruct others to evacuate	4	2
IT3.3 Instruct others to fetch items to tackle fire	3	2
IT4 Call 999 (Response Phase – PHASE 2)		
IT4.1 Call 999	84	47
IT4.2 Instruct others to call 999	11	6
TOTAL	**367**	

ACTION TASKS	Freq	% participants
AT1 Latent task (RP – PHASE 2)		
AT1.1 Ignore/not respond to cues	0	0
AT1.2 Unable to respond to cues	0	0
AT2 People, pets and items (RP – PHASE 2)		
AT2.1 Gather dependent children/those unable to evacuate on their own	31	17
AT2.2 Collect pets	27	13
AT2.3 Collect items	15	8
AT2.4 Collect items with which to fight the fire	24	13
AT3 Fight fire, prevent fire/smoke spreading (RP – PHASE 2)		
AT3.1 Attempt to extinguish fire (e.g. putting the flames out by smothering, beating, or other extinguishing media)	61	32
AT3.2 Attempt to mitigate the fire, prevent the fire/smoke spreading (e.g. remove burning item/item from hob, turn off power to appliance, close oven door)	29	16
AT4 Close door to ROO/other internal doors (RP – PHASE 2)		
AT4.1 Close door to ROO/other internal doors	16	9
AT5 Enter property (RP – PHASE 2)		
AT5.1 Enter property	10	6
AT5.2 Re-enter property	40	20
AT6 Exit property (RP – PHASE 2)		
AT6.1 Exit property	40	20
AT6 Exit property (EMP – PHASE 3)		
AT6.1 Exit property	102	58
TOTAL	**395**	

Using data from the 177 completed surveys, regression analysis was undertaken on the question 'what predicts whether participants were influenced by the flames/smoke and therefore considered retreating from the ROO'. If participants got as close to the fire as being in the same room (ROO), did the

flames and/or smoke affect them and make them consider retreating from the ROO? It was hypothesised that participants would be more likely to have been affected and consider retreating from the ROO if: 1. There was a longer time from ignition to discovery of the fire, as there would be more chance that the fire would be worse by the time a participant reached the ROO; 2. Participants had a pre-existing medical condition of some sort; 3. Participants perceived the fire as being more serious. A binary logistic regression was run with 'Affected' (No vs. Yes) as the dependent variable and the following three variables entered simultaneously as predictor variables in the model: 1. Ignition to Discovery Time (Immediately vs. Under 5 minutes vs. 5 minutes or longer); 2. Medical Condition (No vs. Yes); 3. Perceived Seriousness (rated on a scale of 1-7, with 1 = Least Serious and 7 = Most Serious). Dummy coding was applied to 'Ignition to Discovery Time' and 'Perceived Seriousness' with the first category in each variable assigned the role of reference category. Checks were conducted and no violations of assumptions of logistic regression were detected.

Table 3. Results of a binary logistic regression predicting being affected by flames/smoke

Predictor	**B**	**SE**	**Wald**	**df**	**Odds Ratio**
Constant	-0.60	0.89	0.45	1	0.55
Ignition-to-Discovery Time					
Under 5 min vs. Immediately	-0.82	0.80	1.07	1	0.44
5 min or Longer vs. Immediately	-0.20	0.82	0.06	1	0.82
Had Medical Condition	1.00	1.01	0.97	1	2.71
Perceived Seriousness					
2 vs.1	2.46*	0.98	6.31	1	11.75
3 vs.1	1.63*	0.75	4.74	1	5.11
4 vs.1	2.25**	0.86	6.76	1	9.45
5 vs. 1	2.29**	0.86	7.14	1	9.83
6 vs. 1	1.67	1.11	2.26	1	5.33
7 vs. 1	2.15*	0.85	6.34	1	8.57

Notes: *$p < .05$, **$p < .01$; Nagelkerke $R^2 = .24$; Missing cases = 48%

The test found the model to be statistically significant (X^2 [9] = 17.84, $p < .05$). As shown in Table 3, of the above hypotheses only the third was supported by the results; that is to say that participants were more likely to have been affected by the flames/smoke and consider retreating from the ROO if they considered the fire as being more, rather than less, serious. Neither the time from ignition to discovery of the fire nor having a medical condition significantly predicted being affected. It seems that there are other significant predictors that have yet to be identified as the model only accounted for 24% of the variance in being affected in this sample. It should also be noted that the odds of being affected if the seriousness of the fire was rated as anything greater than 1 (i.e. least serious) did not increase in a linear fashion. This might be due to the point in the event at which participants were asked to rate how serious they perceived the fire to be. They were asked to make their rating based on when they discovered the fire. However, it is possible that several of the participants may have stayed in the ROO for a period of time after discovering the fire. Consequently, the fire could have worsened significantly before the participants considered retreating meaning that their rating may not actually reflect how severe the fire was at the point at which they were affected.

When considering the high proportion of fatalities and injuries occurring in ADFs compared to other fires it is important to determine what factors are predictors of whether people are seriously injured or killed. Several factors could play a role in determining these injury and fatality rates: 1. Those related to the hazard, e.g. What type of fire? How severe was the fire? 2. Those related to the participant, e.g.

Did they have a pre-existing medical condition that could be aggravated by the fire or prevent them from escaping the fire? Were they older? Were they initially asleep? Were they intoxicated? Was their first response to undertake certain activities in the property, thereby delaying evacuation? How close did they get to the fire? Did they re-enter the property before professional help arrived? 3. Those related to the emergency services, e.g. How long did the fire and rescue service take to arrive on the scene?

Participants were asked directly if they sustained any injuries or smoke inhalation. Out of the 177 participants, 42 stated they had (7 did not answer). IRS records suggest these injuries were not too severe. However, the precise nature, severity and timing of these self-reported injuries could not be verified in all cases thus no inferential statistics were run to investigate predictors of being injured. Nevertheless, it is possible to describe a suggested methodology for examining this issue in the future. First, it would be advisable to initially include only 'severe' fires in the analysis as these are, by definition, the ones where there were serious casualties (a comparison could be conducted subsequently with 'moderate' fires and less serious casualties). Second, the IRS records include the time taken (in minutes) from the 999 call being made to the fire and rescue service arriving at the scene. These data could be used to examine the relationship (if any) between attendance time and sustaining a serious injury or even fatality. It would also be of great value to obtain data on when during the incident any injuries were sustained and, where appropriate, if this was before or after the fire service was alerted. Regarding self-evacuation, previous surveys of emergency survivors have asked for estimates of the time taken by participants to begin evacuating the structure upon discovering there was an emergency[20] . These estimates may be vulnerable to under- or overestimation but might be improved by asking participants to recollect the sequence of their activities in the period in between. To return to the issue of attendance time, a quicker attendance might be immaterial to injuries being incurred if participants were very close to the source of the fire at ignition, or participants undertook a series of activities resulting in their initial injury being obtained before they contacted the fire service.

Table 4. Injury-related factors

Factor	All injured (n = 42)	Injured, attendance time 5 min or less (n = 15)
Proximity to fire when it originated		
In ROO	12%	13%
In same building but different room	64%	67%
Building between	24%	20%
Had medical condition	24%	20%
Age		
16-20 years old	5%	0%
21-60 years old	50%	67%
61 years old and older	40%	27%
Age not specified	*5%*	*7%*
Re-entered property	24%	33%

N.B. All figures rounded to nearest whole per cent

In the ADF survey dataset, attendance times ranged from 2 to 30 minutes and were most frequently 5 minutes (Mean = 7.78, SD = 4.40). As stated above, it was not possible to conduct an inferential statistical analysis of predictors of being injured but the cases of self-reported injury for attendance

times of 5 minutes or less (n=15) were looked at further (Table 4). Only 13% of these participants were in the ROO when the fire originated. Two-thirds were in the same building as the fire but not the same room, while the remaining 20% started off with a building between them and the fire. Thus the majority of these injured were not intimate with the start of the fire and so it is possible that their injuries could have been avoided had they taken appropriate actions. Moreover, only one-fifth had a pre-existing medical condition; 27% were aged 61 or older and none of these injured were under the age of 18. Thus, most were not in high risk categories and so had a good chance of avoiding injury. Finally, one-third re-entered the property before KFRS arrived.

This may suggest a situation in which several people are quickly receiving injuries through the rapid investigation of fire cues and entry into the ROO. Furthermore, the data suggest that a high number of the injured were in a position to avoid injury had they undertaken appropriate actions. Whilst stressing these figures are based on very small numbers, the data nevertheless suggest that some participants reporting injury were perhaps in a position to have avoided physical harm if they had withdrawn from the danger, immediately self-evacuated to a place of safety and, where appropriate, contacted the fire and rescue service earlier. Furthermore, it is important to consider that, rather than automatically assuming an intervention must only take the form of physical attendance, the 999 call itself offers the possibility for intervention and exercising a degree of positive behavioural influence. Indeed, the importance of the ability of the 999 call to influence callers' behaviour and actions was tragically highlighted in a negative way during the recent Coroner's Inquest into the Lakanal House fire in London in 2009, where the telephone advice given by London Fire Brigade to some callers to remain in their flats during the fire and await rescue by the fire crews was identified as contributing to the six deaths that occurred[21,22]. This offers a clear argument for considering the 999 call (when made by those in the property or presence of the fire) as a form of intervention that is clearly different from, but in some instances no less important than, physical attendance by the crews.

The importance of this is further emphasised if one looks at the data on when participants chose to make the 999 call. The coding frame of Information Tasks and Action Tasks used in this study allows for identification of the type, sequence and total number of tasks undertaken by participants. The data from this study suggest that when an ADF occurs, a large proportion of people investigate the cues (often without a recognition that the cues represent a fire), enter the ROO, attempt to tackle or mitigate the fire, evacuate the ROO and then call 999. What is also noteworthy is that the majority of those who called 999 did so towards or at the end of their sequence of activities. Of the 83 participants who called 999, almost three-quarters (74%) stated that making the 999 call was either the penultimate or last activity they undertook. Although the sample is fairly limited, this suggests that, in the majority of cases, the decision to call 999 comes at the end of what can be for some participants a fairly long series of activities. It must be pointed out that the numbers are small, but additionally of those who were injured and called 999 (n=15), 73% stated calling 999 was their last or penultimate task. Furthermore, as shown in Table 4, a quarter of all those who were injured had re-entered the property at least once.

It goes without saying that attendance times are an important part of any incident response. However, the data from this study also highlights that, when faced with a fire in a property, considerable proportions of people are undertaking activities that may increase their risk of being injured and choosing to contact the fire service after this point. It is very clear that when a fire occurs in a dwelling – apart from instances where occupants are sleeping or have a physical or cognitive impairment – in the majority of cases those present are anything but passive bystanders. This study has shown that a majority of those adults who experience such a fire undertake a varied and, at times,

large number of activities, where in the majority of cases the act of calling 999 comes at, or just before, the end of the sequence of activities. It raises key questions about, and underscores the importance of, the decisions made and activities undertaken by those experiencing the fire.

CONCLUSION

As an area that has not yet received the same level of focus as fires in public, commercial and industrial spaces, the study of human behaviour in dwelling fires offers the opportunity for researchers and others working in the field to develop a more comprehensive understanding of a key, yet overlooked, aspect of human behaviour in fire. The importance of this area is demonstrated by the high proportion of injuries and deaths that are caused by fires in the home. This study sought to develop an understanding of the main activities undertaken by those experiencing an ADF and develop a standardised coding frame for those activities – one that could it is hoped be applied to future studies.

In general terms this study showed that, upon becoming aware of the cues, a considerable proportion of respondents quickly moved to investigate the source of those cues, entered the ROO after becoming aware of a fire and attempted to tackle the fire. Also noteworthy was the fact that, after evacuating, one-fifth of respondents re-entered the property at least once before the arrival of the fire and rescue service. The results of the binary logistic regression test found that people were more likely to have been affected by the flames and smoke and considered retreating from the ROO if they perceived the fire as being more, rather than less, serious. Yet the fact this is not an objective or standardised assessment, and in all likelihood a risk assessment that is not based upon prior experience, is an interesting point as it may imply a situation whereby people are unwittingly increasing the potential risks to which they are exposing themselves. The fact that the model only accounted for 24% of the variance in being affected suggests that there are other predictors that remain to be identified – something that would be a valuable area for future study. Combined with evidence that, among those who called 999, almost three-quarters did so at the end of their sequence of activities, suggests people may be engaging in activities that could be increasing the potential risks of injury and damage to property.

Of course, any assessment of the value of a study would not be complete without an awareness of its limitations – which within this piece of work were principally the fact the study did not distinguish between the severity of participants' injuries, when injuries occurred, the fact participants' injuries were self reported and not necessarily those recorded on the IRS, and the relatively limited data set. Nevertheless, in addition to the value of the questions raised by the results themselves, it is hoped that this paper has also presented a methodology that demonstrates a feasible means of collecting, coding and analysing data on human behaviour in dwelling fires, something that will act as a useful step for further study into this important area.

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