FROM DATA TO DIFFERENCE – CONSIDERING THE APPLICATION OF A LARGE-SCALE DATABASE OF HUMAN BEHAVIOUR IN ACCIDENTAL DWELLING FIRES

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ABSTRACT

This paper outlines six newly developed insight themes designed as a tool to engage the United Kingdom (UK) Fire and Rescue Service (FRS) in a discussion about the importance of human behaviour in accidental dwelling fires (ADFs), a subject that has received limited attention compared to the study of human behaviour in other environments. Central to a wider research programme focussing on the public's perspective of an ADF is an important project, named LIFEBID (Lessons in Fire & Evacuation Behaviour in Dwellings). LIFEBID will create the world's first large-scale database of human behaviour in ADFs. The LIFEBID database will generate new data comprising hundreds (and potentially thousands) of survey responses from members of the public who have directly experienced an ADF. The insight themes provide a means to engage with FRS stakeholders about the relevance of the work for them. Within this paper the insight themes consider the importance of this subject for the UK FRS, which is a key stakeholder, both in the research development and the application of its findings. The insight themes allow logical presentation of emerging and potential applications in a format that is easily understood.

INTRODUCTION

Since the millennium the number of ADFs in the UK has fallen significantly [2]. Preventing fires is of course the ideal achievement and the continued decline in their number has undoubtedly encouraged the significant and sustained investment in prevention activity by the FRS (for this paper all references to FRS mean the UK FRS). However there is another trend within the data which is largely unknown and yet it is of great importance. This shows that once an ADF occurs, the chance of it causing an injury remains unaltered (see Figure 1).
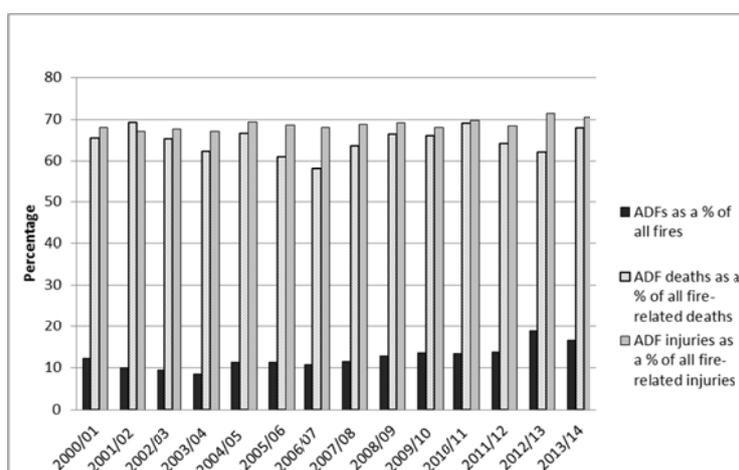

Figure 1. ADFs, Injuries and Deaths as a Proportion of All Fires (Adapted from Source [2])

The evidence of the injury data is persuasive in raising awareness of the need to learn more about the reason for this trend. However that alone was unlikely to ensure that understanding human behaviour would form the focus of any enquiries for the FRS and others. The influence and need to take account of human behaviour in public, commercial and industrial (PCI) spaces is well known but this has not traditionally been the case in dwelling fires [1]. Here, despite the obvious influence the public has during an ADF, their actions, motivations and contribution (current and potential) in resolving incidents were not only poorly recognised but rarely considered by the FRS. There is evidence to suggest the current relationship between the public and FRS is one in which the public are expected to follow generic and often prescriptive advice in the event of an ADF. However the injury trend, use of human behaviour in PCI spaces, and indications that current advice strategies of what to do in the event of a fire were not being followed, supported the need to look at human behaviour more closely.

In response to this a research project was developed of which a key feature is the development of what is believed to be the world's first large-scale database of human behaviour in ADFs. This operates under the name of the LIFEBID database. The UK FRS was identified as a key stakeholder for the research and LIFEBID database. They are the means by which data collection would be conducted, would need to be able to identify their own data requirements during the survey design stage, and will be important end users of the data. As such their early and ongoing involvement is crucial. To achieve this, six insight themes have been developed: The role of the public; occupier response; call handling; casualty care; post-fire; risk – tolerance and continuity.

The insight themes are not presented as a finished vision or blueprint but as a tool to engage stakeholders in discussion of the subject. This paper will present an overview and brief discussion of these insight themes and their relevance. It is hoped they will help the FRS to see potential general applications but also to encourage them to use their knowledge and experience to shape them or add more. In doing so, they will not only continue to invest in the data collection and survey design, but take ownership and provide a commitment to using this knowledge to reduce the impact of ADFs.

The use of a timeline (see Figure 2) has been a central feature of the research methodology and has been developed into an innovative online tool as part of the LIFEBID survey [3]. The value of appreciating the full sequence of events during an ADF also led to the timeline featuring as an integral component of the insight themes, with four of the six themes being linked to specific stages. In this way it has been possible to ensure individual themes can be considered but they are appreciated as part of, and having a relationship to, the entire experience of the public during an ADF.
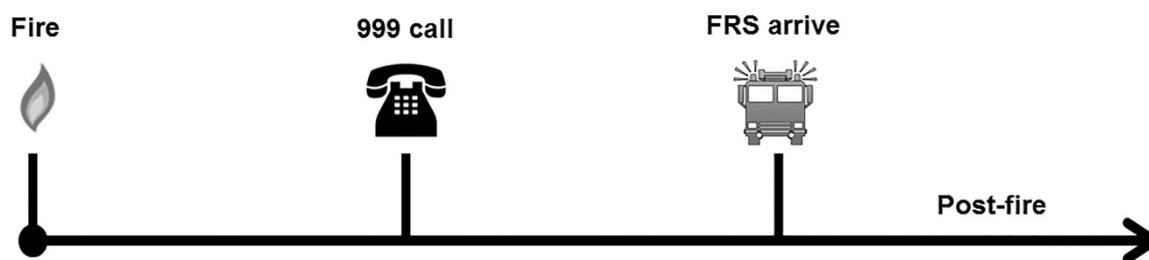
Figure 2. Timeline of an ADF Developed for Use as a Feature of the Insight Themes

INSIGHT THEMES

Insight Theme 1 – The Role of the Public

It is within the scope of this research project to consider the current and potential contribution that the public make in respect of resolving ADFs. This concept is important in a number of ways and has been placed as the first insight theme as it sets the context against which the services or support the public need from the emergency services, including the FRS, must be considered. Understanding what

ability and expectations they have for taking their own actions identifies the type of services the FRS should provide to support or assist them. Arguably, it may also question who decides and what a successful outcome looks like if there are differences between what the public and FRS is trying to achieve. This is especially true if it is accepted that the FRS do not and cannot attend the majority of ADFs or be there as soon as a fire is discovered. It appears in many ways the significant knowledge and contribution of the public make is poorly understood, recognised and under-utilised by the FRS.

Non-Attended Fires. It is believed that the FRS attend just under one third of all dwelling fires in the UK and yet little is known about the other two thirds which are not attended [2]. It is perhaps generally assumed the non-attended fires are typically small in size and self-extinguish, or are dealt with safely by those present without the need for emergency assistance. As such they have not attracted much attention from the FRS or researchers. And yet they are important. In the UK each FRS is responsible for fire safety within a defined geographical area and undertakes extensive risk mapping and planning based on a range of data including community and individual risk information. This allows it to meet its duty in terms of preventing or responding to fires. However no reliable data exists about the actual incidence and nature of non-attended fires nationally or locally. This is surprising given they represent the largest and most common source of dwelling fires, and ADFs in turn represent the most likely source of a fire-related injury. Neither, as will be discussed later in this paper, does the size of a fire on its own indicate the severity of its indirect or subsequent impact.

As such is it reasonable for the FRS to assume they have no responsibility for, and there is nothing of value to be gained by understanding these fires? If current knowledge of fire causes (type and frequency) and fire prevention strategy is based only on the dwelling fires attended by the FRS (comprising less than one third of all dwelling fires) it risks being significantly different from the true picture. Knowing more abut non-attended fires would also help improve risk management by providing a useful ability to understand the relationship between the likelihood of a fire occurring and any factors which may serve to mitigate or limit the risk. For example it is possible that a dwelling with a high occupancy may be considered as having a high risk of a fire starting but the same factor also means it is likely to be observed and extinguished in its early stages, reducing the resultant risk of it causing any harm. It would also be instructive to know what influenced people's decision not to call for emergency assistance, whether it was an informed decision, whether they were deterred from doing so by real or perceived barriers or whether they never thought to do so. Given the FRS position is to typically advocate the public should call 999 and not attempt to tackle the fire themselves then the fact that so few people do but there has been no attempt to understand why, the consequences of these fires, or whether there are other forms of help that could be offered, seems a major omission. These fires also represent an obvious gap in service provision between prevention activity and a fire severe enough to need an operational response and yet it is not obvious why the needs of this group, forming the majority of people experiencing an ADF, have not been more fully considered.

The number of ADFs the FRS in the UK attends has fallen significantly, and for a prolonged period, which raises the question of whether the total number of ADFs (attended and non-attended) occurring has also fallen in line with this trend. Or it may be possible that there has been some displacement with people that would previously have called the FRS now choosing not to do so. It is also possible that some people never even consider seeking help at all. It has to be appreciated that for most people they are trying to respond to an unfamiliar and dynamic event and it is not yet clear what guides their decision making process and knowledge of the services the FRS could provide, currently or possibly in the future.

Filters. 'Filters' within the context of this research is used as a term to represent the messages, direct or implied, that govern whether the public call the FRS and potentially what expectations they have of the range, nature and quality of the service provided. In practical terms they also effectively regulate the demand for its operational response. Examples of the filters may include formal advice from the FRS or other agencies, general media (both factual and fictional), and the experience or beliefs of individuals. For any organisation it is important to understand the potential market or demand for its

services. This allows it to then manage this demand in line with its stated aims and resources. The two thirds of non-attended fires represent the foreseeable scope of potential additional demand for the FRS. And yet it is not clear the extent to which the filters are fully known and their individual and collective influence understood. Without this knowledge there is a risk that something outside of the FRS control or knowledge causes a significant and sudden change in demand either way. With the non-attended fires representing a potential 200% increase in demand it is clear that this could be put a significant strain on resources.

In respect of this theme we have started to identify the source of people's fire safety knowledge and some of the issues that people consider when deciding whether to call 999 but more work is needed. LIFEBID and its associated research programme will continue to enhance understanding of the filters' sources and impact and support ways in which the FRS can manage these.

Giving the Public a Voice. Given their extensive experience it also the case that the public offer a rich source of direct knowledge of an ADF which has been largely ignored by the FRS and researchers. Yet their contribution is crucial to ensure the relationship between them and the emergency services is effective, informed and one based on a shared understanding of each other's aims, expectations and ability. A greater appreciation of this subject may lead to a different relationship, partnership even, with the public in order to continue to improve their safety when encountering an ADF. By extending that thinking it might be beneficial to consider whether those that have experienced an ADF could even be invited to have a formal role in providing a customer perspective when planning fire service equipment, processes and care from conception through to implementation and evaluation. They are best placed to describe how it feels to experience these.

Insight Theme 2 - Occupier Response

The second insight theme relates to the initial stages of a fire and considers the actions of those present, (for this paper collectively referred to as occupiers) and the current guidance given to them. When an ADF occurs, the ability of a person to recall or immediately access good quality and relevant advice can play a crucial role in keeping them safe before the arrival of the FRS. For the many people who have a fire but do not call the FRS, the provision of general public information is quite simply the only chance the FRS has to ever influence them in the event of an ADF. As previously outlined, this is especially important when recognising that the majority of ADFs are resolved without the attendance of the FRS. Understanding the actions and motivations of the public are the necessary foundation from which to consider advice provision or any other role for the FRS. However it appears that there may be important differences between what the FRS advises (or expects) and what the public does. As such it is possible that this limits the relevance or effectiveness of the advice.

Public Behaviour During an ADF. LIFEBID, and the preceding studies [4,5,6,7], have already established a set of the most common tasks people describe undertaking in the early stages of an ADF. These are often self-appointed and unlike the long standing FRS advice to "Get out, Stay out and Call 999" do not seem to be purely based on a desire to avoid the fire or its effects. In fact the opposite is often exhibited in that people will investigate initial cues, at that stage possibly not knowing for certain it is a fire or its severity. Even confirming the presence of a fire does not then routinely lead to them directly leaving the property. Actions taken include warning or rescuing others (including pets), gathering possessions and taking steps to tackle or mitigate the fire. These may knowingly involve various degrees of continued exposure to the effects of the fire. Many people often feel particularly in the early stages of the fire that they can, or would prefer to, deal with the fire without assistance. Some are reluctant to call the fire service due to embarrassment and other factors.

Within this range of tasks there are likely to be accompanying variations in the levels of motivation or attachment (based on the expected reward or outcome). In simple terms it is expected that people will take different levels of risk in line with the intended aim with more risk knowingly taken to rescue a person or pet than for low value or replaceable possessions. When considering the role of the public,

there also needs to be an objective and evidence-based appraisal of how their actions relate to other variables present (for example the building features, individual ability and fire development), the outcomes and any benefits achieved. It may be the case that some of the actions taken by the public are sufficiently advantageous to them personally, the fire service crews and/or society that incurring a minor injury is reasonable. For example, re-entering a property is regarded as an undesirable action by the FRS ("Get out, Stay out"), and yet it is possible that this re-entering a dwelling may be responsible for an unknown number of rescues being carried out before the FRS arrives. If that is the case, then if the advice were followed fatality or injury rates could rise. At this stage it is only a possibility but it confirms the need for further knowledge and more recognition of the need to take evidence and not assumption-based approaches. As such an understanding of, and calculation based on, 1) the actions (real and not assumed), 2) degree of attachment to the task and 3) the reward (intended or achieved) must sit at the heart of developing relevant advice in its range, content and style. Robustly translating that type of calculation from paper into policy and practice will be a difficult area but objectively assessing this with the right data will be important. It will also influence the general FRS culture regarding how they view public actions, including when advice is given in person (call handling) or how the public are treated (at incidents or when describing their actions in the media).

FRS Advice Strategy – Current. During this research some of the current advice strategies and specific messages given out by the FRS and other agencies, both directly and indirectly, have been considered. This focussed primarily on advice in relation to that given to the public for actions in the event of a fire rather than advice designed to prevent a fire from occurring. Typically the FRS advocates a singular and directive message for an ADF that people should "Get out, Stay out and Call 999". This style of authoritative guidance may suggest a belief that people will and should do as they are told by the FRS, and inferring the FRS knows better than they do what is in their interest. There are indicators that this approach has limited effect, evidenced by the number of ADFs the FRS is not called to and some of the described or observed actions of the public. The advantage of the singular message is of course that it avoids the need to consider any of the variable or dynamic features of an individual incident and, if it were followed, it would in theory provide the safest course of action in most cases. However the recognition that it is not followed by so many people [5,6] and that the likelihood of incurring an injury at an ADF has not altered strongly suggests a need to revisit this approach and message. Current FRS advice provides little or no help for the public to make an initial and on-going assessment of the risks presented to them by an individual fire, preferring instead to provide list-based actions to follow. Interestingly this generic and "one size fits all" strategy contrasts with the approach the FRS employs for prevention work where segmentation and targeting methodologies provide a range of ever more tailored and relevant messaging options (recognising group or individual risk profiles and needs) to prevent fires. Another feature of the current advice provision is that typically it offers the public a simple and often stark choice of following the guidance or not with nothing in between suggested as a viable or safe option. Established health and safety methodologies recognise it is not always possible to entirely avoid harm and where that is the case a hierarchical approach can be used to incrementally reduce exposure to the risk or the severity of any harm. This process is widely used within the FRS to safeguard its own employees and may provide a solution to offering choices to the public when undertaking tasks they cannot be deterred from.

FRS Advice Strategy - Alternative Options. From the above it appears that to address any limitations of the current advice provision it may be necessary to in some way better recognise and accommodate the public's range of described actions and motivations. It may also be useful to determine the extent to which some people may be capable of performing some tasks safely and what factors dictate this. In common with fire prevention strategies, resources can then be more usefully and effectively directed at those at higher risk. This may result in an approach in which more relevant and tailored advice is provided to specific target groups although this will still have some limitations in reflecting an individual set of circumstances. Another and perhaps more controversial approach may be to consider the benefits of equipping the public with the underpinning information that would allow them to perform their own risk assessment. This has merit when considering that an effective risk assessment for an individual ADF would need to include specific knowledge of a) the building

(including layout and contents), b) persons present (including their ability) and c) the fire (location and development). Those persons present at an ADF are likely to have a good knowledge of a) and b) but may have insufficient knowledge of c). This contrasts with the FRS who have extensive knowledge of c) but until called or in attendance cannot know a) and b). In this respect there seems to be a case for considering the value of directly educating the public better about fire (flames, smoke, heat and toxicity, etc.). Smoke behaviour in particular seems poorly understood by the public and is a leading cause of injuries at an ADF. In conjunction with this the public would require information about performing basic risk assessments. It is interesting to note that FRS personnel use risk assessments and not lists of actions to ensure their safety and it may provide a way to allow the public to do the same in the absence of any contact with the FRS.

Fatal and Injury Profiles. An emerging but potentially significant idea is that there may be a different risk profile between those at risk from dying in a fire and those who may risk minor injuries through actively mitigating the effects of the fire [8]. Much is known about the typical profile of fire fatalities and what makes them vulnerable [9,10,11,12]. This often involves factors which limit their ability to respond effectively to fire cues. It is not unusual to hear the view that all fire injuries are near misses (in terms of being potential fatalities). Whether that is the case is far from clear and certainly the evidential source for this is not clear. It may be the case that some members of the public are prepared to accept the possibility of a minor injury to achieve certain tasks as previously described, or that its incurrence is the trigger for them to exit the property. If true this has important implications for understanding and communicating risk with the public. It also again suggests the need to move away from generic and broad approaches during an ADF.

It is clear that the occupier response includes a range of factors, some of which will be dynamic but are currently insufficiently known either individually or in combination. Within this, those present will assess or instinctively act to achieve certain tasks and respond to an event which few will have previous experience of. With further research it will be possible to more reliably understand the factors and relationship between the nature of the task, the level of risk and what is achieved. In turn it will be possible for the FRS to have evidence-led approaches and develop risk appropriate strategies and services to help occupiers be safe in the absence of a physical fire service presence.

Insight Theme 3 - Call Handling

Referring to the ADF timeline makes it possible to see that, where made, the emergency call represents the next phase of an ADF, and a chance for the fire service to have its first direct, albeit remote, influence on the incident. For the FRS, the function of the call will typically be limited to gaining sufficient information from the caller to be able to mobilise the appropriate appliances. However a direct line to a dynamic incident also potentially provides a chance to routinely maintain contact until the appliances arrive, giving advice, influencing the actions of those at the scene and gaining additional information from the caller. Despite these potential benefits the opportunity to keep the line to the caller open until the crews arrive appears very much under-utilised. This is particularly the case given that ADFs represent the greatest risk and most likely source of a fire-related injury.

What is the Risk? In order to consider the case for taking a different perspective on the role of the 999 call it is useful to start by recognising the significant amount of data, resources and time invested in fire prevention activities. Even using sophisticated and targeted approaches this still tends to identify relatively large groups of people potentially at risk of a fire, the vast majority of whom thankfully will never have one. This valuable and successful investment in prevention activity is undertaken because the potential effect the fire can have is well known. Against this when someone phones to say that risk has been realised and a fire is present right then in their home (a specific and identifiable location) it could be assumed that same underpinning knowledge of the risks involved would mean that the call and live link to the scene would be highly valued until the appliances arrive. A further factor which suggests the importance of this stage of the process is the general

acknowledgement that a fire is significantly influenced (positively and negatively) by events in the early stages, hence the associated FRS focus on getting appliances to a scene as quickly as possible.

And yet despite this, typically a caller will only be routinely kept on the line if they are identified as being trapped by the fire when most FRS will provide fire survival guidance. For the majority of people though it is presumed if they are not trapped at the time of call they will continue to keep themselves safe until the appliances arrive. In fact the priority is often to quickly end the call in case there is another emergency call. When considering the average response time in England is 7.4 minutes (but can vary significantly) it is obvious that much can happen in this period [13].

Public Actions and Needs. The apparent lack of focus on actively managing the period between a 999 call and appliances arriving may in part be due to very little being known about what happens during this time. It is known that many people will re-enter the property, potentially after the 999 call has been made although further work is needed to understand their actions and the consequences (positive and negative) [4,6]. We also know that by the time someone calls 999 they or another person is likely to have approached and directly experienced the fire with knowledge of value to oncoming crews in terms of the fire location and development, the building and content features and people present [4,6]. It is also possible that, when the person called, they had information they wanted to tell the call handler but were initially prevented from doing so as they were quickly moved on to the fire service script to gather the information required for dispatching fire appliances. This is entirely reasonable but without then providing a later opportunity for them in the call important information may never be passed and the caller may not feel they have been listened to. During an unfamiliar event just having someone to speak to and provide reassurance may be a useful but rarely offered service. The call is also the first chance where it is possible to learn about the concerns and intentions of those present which may significantly determine the scene, risks and operational priorities when the crews arrive. In common with the approach to advice discussed earlier there may be a need to move away from a directive approach to one in which an influencing relationship and style is adopted.

Remote Help for Non-Attended Fires. Developing the concept further also offers potential not only in relation to incidents where an appliance is sent, but also to consider whether for the many incidents the fire service do not physically attend could it offer telephone-based support and advice. This may be during the fire, to help someone determine whether they need emergency assistance at the scene, or later to help them confirm whether they have extinguished the fire or whether there are any further actions they should take or to offer some advice about what to do next following the fire. This would also serve to provide the FRS a means by which to learn more about the frequency and nature of non-attended fires in their area.

The Role of Technology. Another aspect which supports greater exploration of this phase as a more active intervention is the emerging widespread access and quality of devices such as smartphones and other mobile devices. These offer further ability to enhance information gathering from the scene by supplementing audio information with high quality live images between the caller, call handler and possibly appliances.

LIFEBID will contribute to this theme by building a comprehensive knowledge of the actions and risk profiles during this phase of the ADF. The data generated has potential application not only as a static source of knowledge for call handling, but also as a way to allow call handlers to make evidence-based and dynamic risk assessments in conjunction with the caller.

Insight Theme 4 - Casualty Care

The arrival of a physical response from the FRS is the third stage of the ADF on the timeline, and the first that allows for them to have a direct influence on the incident. Even here human behaviour factors will affect the ability to gain information and generally manage the scene effectively. However the particular interest within this paper is to consider the nature of casualty care at an ADF.

Defining a Casualty. It may be useful to start by considering what is a casualty? Those with physical injuries arising from the fire are usually readily identified at the scene. Their details are recorded by the FRS and so they form the common means to understand and define fire-related casualties. However, there are a number of factors which affect the accuracy of the assessment of the injury at the scene and how it is recorded. In addition it is possible that the injury assessment at this stage differs to a later assessment by medical personnel. Equally the lack of knowledge about non-attended fires mean there may be additional injuries the FRS is unaware of. A possible area for clarification is in relation to smoke inhalation which is promoted by the FRS as lethal after three breaths and yet is recorded as a minor injury. Another perspective is to consider not only the nature but the impact of an injury. The same injury can have very different impacts on different people, potentially determined by factors such as age or other health conditions. If any trends of groups vulnerable to a disproportional affect from minor injuries were identified through research, the FRS may need to adapt its advice, call handling and operational response to recognise this and avoid minor injuries having serious consequences. Certain groups may also be more vulnerable than others to being ill equipped to deal with the event generally and adversely affecting their ability to recover from it.

Psychological Harm from an ADF. Another obvious and potentially very significant omission is to consider the psychological experience of an ADF and whether the event has an impact on mental wellbeing or quality of life as a result It is normal for many people to experience and exhibit short-term distress following events such as an ADF but for some, without appropriate support or access to services, the effects could continue and be the cause of further avoidable consequences. This may influence how the FRS delivers some if its services (during and post-fire) to avoid any distress, and take reasonable measures to safeguard their psychological wellbeing at the fire. It may also be well placed to ensure those who have witnessed the event are provided with information about normal responses and sources of advice where required. From the above it is clear that current data on ADF casualties may only tell part of the story and further research is required to fully understand it and ensure the FRS reflects any findings in its services.

Saving Lives and Casualty Care. It is of course a well-known aim of the FRS to "Save Lives" although what this means when observed in practice is perhaps less obvious. Removing someone from a place of harm (within a dwelling that is on fire for example) to a place of safety is of course a fundamental role of the FRS. However that differs from the wider concept of casualty care as a culture and continuous process. Rather than a singular act, casualty care may be considered to be actively seeking to ensure the best possible outcome throughout the period they are within the care or influence of the FRS. For example there are a number of distinct stages during which casualty care can be considered – the provision of remote advice or help during the call prior to crews arriving, care between crews locating a casualty in a property and removing them to outside (does maintaining FRS personnel safety compromise the wellbeing of the person being rescued?), treatment at the scene, any information that should be passed to others providing care later on (for example surgical teams often require information about the scene and means by which an injury was incurred) and what, if any, post-fire support they may be able to offer. It is beyond the scope of this paper to discuss in detail but there is evidence that the nature of delivering casualty care varies significantly, which may be expected and reasonable. However there does not seem to be an authoritative and comprehensive source of evidence-based information readily available to guide decisions about casualty needs and the standards of service provision. This differs from the approach to road traffic collisions (RTCs) where evidence-based medical and technical evidence underpin single service and inter-agency arrangements to ensure a common ability to focus on achieving the best possible outcome for the casualty. At an RTC fire service resource allocation is visibly directed at casualty welfare and needs, with specialist equipment provided to protect them from operations and personnel dedicated to their care. It is hard to find evidence of the same underpinning research, resource allocation and sustained focus on a casualty for an ADF. In this respect it is suggested that there is a need for relevant research to be established and an inter-agency and casualty-centred model to be developed.

Casualty Care and Inter-Agency Reviews. Assessing how the actions of anyone involved in the casualty pathway influenced the care and final outcome for the casualty is important. Where this involves, through direct contact or indirect relationships, a number of agencies it is obvious that they should all contribute openly and honestly to a review in order to continually learn lessons and improve casualty care and outcomes, both as individual agencies and collectively. The main focus of all this activity is of course the casualty and their view must equally be important to identify whether the system is actually working and the general experience is as good as possible. Despite this, there currently appears to be little to suggest that inter-agency reviews of casualty care for ADF victims are being routinely conducted or that the casualty is able to contribute beyond individual agency feedback processes. In the absence of structured and routine reviews there is a risk that not only do casualties not get the best possible care but that harm may unknowingly be caused at one or more stages.

Insight Theme 5 - Post-Fire

Typically the FRS has limited involvement in the post-fire phase of an ADF beyond offering generic advice to those affected or running prevention campaigns in the surrounding area. However a better knowledge of the post-fire period for those directly affected does suggest other ways it could help.

The Impact of an ADF. Some issues in relation to the understanding of a casualty (physical and psychological harm) have already been discussed. However other impacts from an ADF are sometimes less obvious but have a very real and sometime sustained impact on quality of life. Examples include: grieving for people or pets; loss of housing (temporary or permanent); loss of possessions; distress and time involved in dealing with agencies including travelling for appointments. As such the true cost of an ADF seems to be poorly and under-estimated. The focus on physical fire damage may mean that those with minor fires are not recognised when assessing what help or assistance they require or are entitled to. A range of variable factors will dictate the scope and severity of an individual ADF and as such an approach based more on assessing the human impact may be required to understand and address this hidden cost.

Post-Fire Recovery. There are many organisations that can potentially become involved through choice or necessity at various stages, following an ADF. Each will have its own systems and requirements, which can be daunting to navigate for many people still struggling to deal with the aftermath of the fire and lacking familiarity with what to expect. Recovering from the effects of an ADF can span a wide time frame, from a few days to potentially years. With a few exceptions, there appears to be little general awareness or formal co-ordinated service provision between the various organisations involved post-fire. This can cause unnecessary delays, distress, conflicting advice or even lead to people missing out on available help. Whilst the period of time involved may vary there is a reasonably predictable series of stages of help that may be needed, and services could be offered against. For example for many the immediate concern will be to establish where they will stay, provision of food and contacting family/friends. One solution may be to develop a customer focussed and co-ordinated post-fire pathway or package which actively aims to get people back to normal as quickly and effectively as possible. Failure to do so means for some a fire, however minor, will be the first step along a line of further and avoidable consequences having very real financial and societal effects possibly extending to impacts on employers, families and friends unconnected with the fire.

In this respect it is useful to also consider the burns sector of the health service which adopts a sequential approach in which prevention is not a single, but ongoing, activity. At each stage of the patient pathway steps are actively taken to prevent the potential for the current situation to worsen. This differs from the fire service where prevention as an activity is generally confined to efforts to avoid a fire from occurring in the first place but not to subsequent phases. It may be useful to consider how this concept would influence FRS services during and after an ADF.

Post-Fire Visits. During pilot testing for the LIFEBID survey many people were very grateful for the chance to have someone who understands an ADF listen to their story. It offered a chance to seek

clarification and make sense of events. They were typically surprised and very pleased for someone from the FRS to return and ask how they were getting on. Often, after completing the LIFEBID survey, the conversation continued informally and the interviewee offered valuable feedback on the FRS operational response and also self-identified support they would like. Generally this whole process took little more than an hour and was very valuable for both parties providing information that would not otherwise have otherwise been volunteered to the FRS.

Insight Theme 6 - Risk – Tolerance and Continuity

Risk-based approaches are in widespread and common use within the fire service and underpin its approach to prevention, protection and response. As a general concept risk is easy to recognise and yet there is a wide range of opinion and practice on the subject, which in the absence of reliable and relevant data can be greatly influenced by individual experience and beliefs. However it is useful to also consider the notion of risk from the public perspective.

As may already be clear the perception and acceptance of risk amongst the public seems different to fire service beliefs of the same [14]. Some members of the public appear willing to incur a degree of personal injury to achieve self appointed tasks and often, even after the event with full knowledge of the trade-off between the cost (in terms of sustaining a minor injury) and benefit of their actions, state they would do the same again [4,7]. It is possible their knowledge or projection of the longer-term impact of the fire for them personally may in part sit behind this willingness to take some risk to tackle it, save lives or retrieve possessions. It seems likely that even during their actions most would have recognised to some degree the potential for personal harm from the effects of the fire rather than being completely unaware of the possibility. In contrast it appears the assumption or desire of the fire service is the public should or will want to simply avoid personal harm and be less concerned with the other non-injury effects of the fire. Even escape plan guidance by the FRS rarely assumes anything other than a desire to directly egress from the building.

Risk Tolerance. For the purpose of this paper the term "Risk Tolerance" is used to refer to the degree of harm that someone is prepared to accept in pursuit of their actions. As described earlier this may not be a fixed personal threshold but may, within some limits, vary in line with the nature of the task and reward. However, as an organisation the FRS appears to have a single level of risk tolerance, which it assumes on behalf of the public, and is reflected in its services. This is based on trying to prevent them incurring any harm and whilst understandable does not reflect reality which is more complex. This difference between the singular FRS position and the multiple and dynamic thresholds of the public may undermine effective communications and risk reduction initiatives. If the public's actions, intentions and risk tolerance are not fully understood and accepted as legitimate (if not always believed to be desirable) any FRS guidance or advice services risk being dismissed as irrelevant and overly risk adverse. It appears it cannot be assumed that the "authority" of the FRS advice is sufficient to dictate an individual's actions. As such greater use should be made of underpinning evidence to demonstrate the nature of risk within an ADF and more openly share this with the public to create a common understanding. Whilst this on its own is unlikely to prevent the public continuing to take certain actions in response to an ADF, it should ensure the FRS is better placed to exert an influence on how they can avoid or reduce the associated risk more effectively. As such the FRS may need to do more to recognise and reflect that personal ability and risk tolerance vary, and then develop risk appropriate strategies and services to reflect these.

Risk Continuity. Risk continuity, within this paper, describes the degree to which risk is managed throughout the entire period of an ADF. It will be readily appreciated that the risk during an ADF is dynamic and includes considerations of the risk posed by the fire development and introduced elements such as the actions of those present (public and emergency services). FRS crews undertake an ongoing process of formal and personal risk assessments to ensure their continued welfare against this changeable environment. Findings from these inform the choice of resource and systems of work but as all FRS personnel use the same methodology and language they are easily shared.

It is not yet known how the public assess risk at an ADF, however there may be considerable benefit, as discussed earlier, in equipping the public with an ability to use the same methodology and language (albeit possibly in a reduced or simplified form) as the FRS. This would give the public tools and ability to manage their own safety but, if required, to also share their knowledge of the risks with the FRS in a meaningful way from the moment they call 999. For the FRS the process of developing a formal risk assessment would then start at the call handling stage and would support intelligent mobilising practices where used and give the crews valuable extra time to consider and prepare for their actions prior to arrival. It would also reduce the potential for errors from misinterpretation, particularly when assessing or describing something unfamiliar and dynamic such as smoke/flames. Overall, it should improve risk continuity and management throughout the duration of the ADF.

DISCUSSION

The creation of the insight themes is intended to provide a logical and easily conveyed method for explaining and discussing the importance of human behaviour in relation to an ADF. If successful as an engagement tool it will allow all FRS personnel, even with limited familiarity of the subject, to consider how current and future knowledge of human behaviour at an ADF could be used, either generally or within their specific area of influence, expertise or activity. The themes have been designed where possible to broadly reflect existing work streams within the FRS. This means that, without losing a sense of the whole, information of relevance to a single subject can be provided to existing forums or lead personnel, again easing utilisation of the findings.

As the LIFEBID database builds and analysis is undertaken it will provide a unique and robust evidence base to directly inform future understanding of actions and motivations during an ADF, as well as the design and evaluation of any interventions. Before then, the use of the insight themes allow for the ground to be prepared intellectually and early consideration be given to how it may influence future FRS strategies and planning. Whilst allowing the FRS to consider its own beliefs and services the insight themes serve to keep the focus of these in relation to the public. Each theme can be considered in isolation but its relationship to other themes, generally or within the timeline, is easily appreciated. It is clear that too little is currently known about the real impact of an ADF, financially and societally and the absence of this means their impact is probably greater than believed and the public experience avoidable effects as a result.

The themes as outlined in this paper discuss some of the main issues arising and so the specific points will not be repeated here. However it is clear they generally demonstrate some significant differences between FRS beliefs or expectations and those of the public. Resolving these and finding common and effective ways of communicating and managing the risk during an ADF in partnership with them will be important. There may also be work to be done to consider what a successful outcome looks like and how some of the established risk and profiling methodologies, widely used in fire prevention strategies, can be employed to better reflect individual vulnerability and needs during an ADF.

The importance of understanding the full timeline of the ADF for the public is also important. Otherwise the FRS and the many other agencies that may be involved during or after an ADF are unlikely to provide and deliver relevant and co-ordinated services, at the point where they are most effective or required. Even where an agency does not provide a service directly it may need to satisfy itself that someone else is doing so and that its own actions do not compromise later stages of the care or recovery. Without that it is difficult to know the service being delivered offers the best and appropriate care. That it is preferable for the agencies to pre-plan and manage the co-ordination of services and care, rather than leave it to someone already struggling to deal with an ADF to navigate each one individually, seems to have obvious merit. By using the timeline and insight themes as a guide it should be possible to consider not only the right services for each individual stage but recognise how they are influenced by previous activity and how they in turn influence later stages. In that way a tiered model may develop in which each stage represents an opportunity to resolve or

mitigate the incident at that point, but where it moves to the next stage it does so smoothly, building on the previous phase and anticipating the next.

CONCLUDING COMMENTS

The ADF injury trend and other indicators suggest that more needs to be done to improve outcomes during an ADF as the chance of having an injury has not changed for some time. Establishing this to be the case may not necessarily, on its own, be sufficient to demonstrate the need for further research or to acknowledge human behaviour as a key feature in any solutions adopted. The insight themes identify gaps in current knowledge and potentially where assumption rather than fact is the driver. They then provide a way for the relevance of human behaviour in ADFs to be readily conveyed and discussed. It also identifies that there is more we need to know about human behaviour in ADFs to build the evidence base for new approaches. In this way it is preparing the way for the LIFEBID database, which will offer a world first large-scale repository of surveys from people describing their experience of an ADF. Ultimately the success of the insight themes and LIFEBID will be if they engage and persuade members of the FRS (and other stakeholders) that more should be done to reduce the impact of dwelling fires and that knowledge of human behaviours sits at the heart of being able to do so. In that way they will turn this important subject from data to difference.

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REFERENCES

[1] Babrauskas, V., 2013. Some neglected areas in fire safety engineering. *Fire Science and Technology (Tokyo),* 32(1). pp.35-48.

[2] Department for Communities and Local Government, 2015. *Fire Statistics Great Britain: 2013 to 2014.* [online] Available at: <https://www.gov.uk/government/statistics/fire-statistics-great-britain-2013-to-2014> [Accessed 30 June 2015].

[3] University of Greenwich, 2014. *LIFEBID research project and survey.* [online] Available at: <http://www.lifebid.co.uk> [Accessed 30 June 2015].

[4] Wales D and Thompson OF (2012) 'Behaviours, Motivations and Timescales: Towards the Development of a Comprehensive Database of Human Behaviour in Dwelling Fires', *Proc of the 5th Int Symp on Human Behaviour in Fire,* Interscience, London. pp.218-2294.

[5] Wales, D. and Thompson, O.F., 2013. Human behaviour in fire: should the fire service stop telling and start listening? *International Journal of Emergency Services*, 2(2), pp.94-103.

[6] Thompson OF, Hulse L, Wales, D and Galea ER (2013) '"Get Out, Stay Out" versus Occupier Independence: The Results of an 18 Month Study of Human Behaviour in Accidental Dwelling Fires in Kent', *Proc of the 13th Int Interflam Conference 2013*, Interscience, London. pp.943-954

[7] Thompson, O.F. and Wales, D., 2015. A qualitative study of experiences, actions, and motivations during accidental dwelling fires. *Fire and Materials,* 39(4), pp.453-465.

[8] Nilson, F., Bonander, C. and Jonsson, A., 2015. Differences in determinants amongst individuals reporting residential fires in Sweden: results from a cross-sectional study. *Fire Technology,* 51(3), pp.615-626.

[9] Brennan, P. and Thomas, I., 2001. Victims of fire? Predicting outcomes in residential fires. In: *Proceedings of the 2nd International Symposium on Human Behaviour in Fire*. London: Interscience Communications. pp.123-134.

[10] Miller, I., 2005. *Human behaviour contributing to unintentional residential fire deaths 1997-2003* (New Zealand Fire Service Commission Research Report Number 47). Wellington: New Zealand Fire Service Commission.

[11] Squires, T. and Busittil, A., 1996. Can child fatalities in house fires be prevented? *Injury Prevention*, 2, pp.109-113.

[12] Harpur, A.P., Boyce, K.E. and McConnell, N.C., 2012. An investigation into fatal dwelling fires involving children aged five years and under. In: *Proceedings of the 5th International Symposium on Human Behaviour in Fire*. London: Interscience Communications. pp.230-238.

[13] Department for Communities and Local Government, 2014. *Fire incidents response times: England.* [online] Available at: <https://www.gov.uk/government/statistics/fire-incidents-response-times-england-2013-to-2014> [Accessed 26 June 2015].

[14] Lawson G, Sharples S, Clarke D, Cobb S (2009) The Use of Experts for Predicting Human Behaviour in Fires. *4th Int Symp on Human Behaviour in Fire, Conf Proc*, Interscience, London. pp. 493-500