Dwelling House Fires (Scotland)

Investigation, Data Collection, Analysis and Sharing

To Augment the Safety and Well-being of Occupants

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“Do not put your faith in what statistics say until you have carefully considered what they do not say.” ~William W. Watt

A quote by English Professor William Whyte Watt (1912 - 1996) in his book "An American Rhetoric" (Rinehart and Co.; 1958 3rd edition, page 382).

Abstract

Fire deaths and injuries remain higher for the general population in Scotland in comparison to the rest of Great Britain; the instances are mainly attributed to accidental dwelling fires. The main contributor to death or injury for the occupiers is overwhelmingly smoke inhalation from the products of combustion. The smoke from modern fires is more toxic and more volatile than in previous years, due to the increased quantities of plastic materials commonly used.

This thesis intends to provide a meaningful contribution to the professions of fire science, medical treatment, and fire investigation by contributing to the improved health and well-being of not only occupants of dwelling houses, but also firefighters who attend fire incidents. Although individual reports and research publications exist for each of these disciplines very few, if any, address the combined contribution each has towards the improvements in fire safety or life safety in particular.

Research publications, official reports, conference papers, and presentations were used to establish the world's interpretation of the causes of accidental fire deaths and injuries and their preserved shortcomings to current practices towards remedial interventions and strategies.

As an in-depth analysis of the issue, fire deaths within Scottish dwellings via fire investigation and post-mortem reports were examined. This analysis was used to construct a multi-function searchable database for 139 fire fatalities within the three years studied.

The resultant outcomes for this research identified the deficiencies within fire death and injury data both in quality and availability, providing a justifiable case for additional research into both the use of antidotes for an emergency response to fire victims.

Acknowledgements

To the staff at the University of Glasgow for their support throughout the research project from application to submission, in recognition of my initial supervisor Professor Chris Johnson for his direction and his words of wisdom that the research is not a sprint, it is a marathon. With special acknowledgement to my supervisor Dr Timothy Storer, for his years of patience, advice, guidance, and encouragement to conclude, and for keeping me on the right path, to stick to what I can prove and keep my personal bias in check.

Emeritus Professor James Grieve, Forensic pathologist, and lecturer in forensic pathology at Aberdeen University. For taking the time at the beginning of my research to explain the pathology role, the positives, and negatives of the investigation process, and for his professional wisdom and commitment to the research into fire deaths and injuries.

Scottish Fire services, with special mention to Sharon Reid for her, continued support during the freedom of information requests to obtain the data which made the Scottish fire death analysis possible, and to her colleagues in the additional seven fire services for their assistance in providing the data applicable to their fire service area.

My interview participants, from the Procurator Fiscals office, Police Scotland, NHS Accident and Emergency, and the Scottish Fire and Rescue Service, for their contribution to this research project and their honest professional opinions which contributed to the overall conclusions presented.

My long-suffering wife, family, and friends who have supported my progress throughout this very long journey…… I can't thank you all enough.

Thesis Declaration

This thesis is offered as a contribution to research about fire fatalities and injuries from house fires. The paper is presented without professional or personal bias and is submitted in compliance with the codes and ethics expected of such a publication.

The research does include reference to sensitive and confidential information and data, a number of the provided information was given under a confidentiality agreement, and as such limitations were placed on areas of reproduction in print. The restricted data was provided under “private communication” or by a contract of confidentiality via the Freedom of Information, (FOI), application procedure. All data sourced and incorporated into the publication is available for authentication or verification purposes as so required by the inquiring authority.

This research study was a sole project undertaken on a self-funded basis and as such, it has been anticipated that limitations and restrictions to the extent or depth of research which could be undertaken may or may not be evident from this submission.

Author Declaration

As an operational firefighter in Scotland for 30 years, my motivation and commitment to this research study were easy. I wanted to contribute to the topic of saving lives from fire; I wanted to identify any improvements that could influence this and augment current practices and initiatives that are striving to achieve this.

I have been the firefighter who has carried the lifeless child from a house fire, the firefighter who has listened to the screams or crying of families who see a loved one in distress or who see all their worldly goods and personal memories being destroyed by fire, water or smoke. I have been the firefighter who hears the screams of a mother begging us to do something to save their child before the ambulance arrives.

Sadly these scenarios are real and happen all too often. It happens more often in Scotland, I wanted to find out why and what we could do about it.

As firefighters faced with these tragedies, we invariably ask ourselves; could we have done more, could put the fire out quicker, and rescued the occupants quicker, as firefighters we shoulder that burden, although we may not have been able to do more at those fire incidents.

I offer this research as a firefighter who believes this is the “bit more I could do” to try and reduce the pain, suffering, and loss experienced in house fires for the members of the communities that we serve.

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Chapter 1: Introduction

The Aim of the Project

The aim of the thesis is to provide a meaningful contribution and understanding to the different authorities and agencies involved in fire investigation to reduce in the future the number of fire injuries and deaths in the UK and worldwide.

A number of objective questions were raised to address the aim. They included:

- What data is currently available, and where can it be sourced, on fire deaths and injuries from fires?
- How can the existing data sets available from different agencies, relating to fire deaths and injuries be integrated to provide a complete, validated picture of the cause of death or injury from fire throughout Scotland or the UK?
- What additional information, or conclusions, can be obtained from the use of the (integrated data sets) database constructed as part of this research undertaking?
- Does evidence from integrated fire death data sets challenge or endorse assumptions in existing fire death and injury reduction strategies contributing to future well-being?
- What additional data would be desirable in the future to improve fire safety knowledge of dwelling house fires and augment current health reduction strategies and initiatives?
- Could the development of integrated IT systems or applications be an advantage to the data collection, quality, availability and access for future research?

Introduction to Project

Chapter 1 provides an introduction to the main aim of this work. **Chapter 2** presented a short introduction to fire toxins generated from dwelling fires. The understanding of the scale of fire deaths and injuries from around the World, Great Britain, and from the Scottish perspective with a provision of the process and procedure adopted throughout Scotland for the collection, analysis, and publication of fire death and fire injury data is presented in **Chapters 3 and 4**.

Chapter 4 specifically addresses the current practices of fire investigation reporting undertaken throughout Scotland. It highlights the relationship and responsibilities of each agency involved in the investigation and reporting process from the fire scene to the completed report that is submitted to the Procurator Fiscal. The main body of the chapter

presents the fire data publicly available for analysis and provides results and conclusions relevant to fire deaths and then fire injuries within Scottish dwelling house fires. Addressing aspects of fire data relating to the number of accidental dwelling fire deaths and injuries, the cause of death, and the ignition source which led to the fatal fire incident.

Chapter 5 and 6 provides a comprehensive breakdown of the procedures and communication which were necessary to be undertaken to produce a searchable database for Scottish fire fatalities. The creation of the database did take some time, over two years, due to the access provided by the various departments and agencies. This for example includes the team that participates in the fire scene investigation and the medical departments that participate in the post-mortems.

The intention for the creation of the database is to augment the possible advantages from combined sources that would assist in the understanding of remedial interventions as discussed earlier in Chapter 3 to improve the health of occupants in dwelling fires.

Chapters 5 and 6 identify what additional information can be sourced from creating such a database, what "new" information can be provided, and what we now know following the creation of the database. In addition, they provide the advantages of a combined agency information-sharing database relating to fire fatalities and fire casualties for improved analysis to assist future knowledge and understanding of the collective criteria that encompasses fatal fire victims or casualties.

Chapter 7 introduces a proactive project for the combined collection and sharing of fire fatality data and information by adapting to information technology where a single Case file is used by each agency involved in the fire, incident investigation or medical involvement with the post-mortem examination of blood toxicology reports. The case file for each victim would contain all complete information on the fatality, results for analysis would be readily available, populate the main database and be accessible to be shared or printed as a report as required.

Chapter 7 goes on to provide summarised results following peer group face-to-face interviews with professionals who actively participate in or have responsibility for fire deaths and injuries throughout Scotland. Participation from the Crown Office, Police Scotland, NHS Ayrshire, and the Scottish Fire and Rescue Service contributed to the

published responses. Additionally, a narrative contribution from Professor Grieve (Forensic Medicine) was included which provided a professional opinion of Fire Deaths throughout Scotland, current practices, and future considerations.

Chapter 8 will provide the research findings and submit conclusions and recommendations about the different subjects or elements of the research undertaken. The chapter will verify the research aims and objectives and will conclude with areas of suggested additional research which has been identified during this research project.

Chapter 9 will provide future work projects to support the outcomes of this research and concludes the thesis submission with final thoughts.

Chapter 2: Fire Smoke

Fire science is complex from the basic principles of fire and combustion, the triangle of fire, fuel, heat, and oxygen. These three components in the right combination will produce a fire, [1], the combustion process and then the four different stages of fire from the ignition to fire growth to full development, and then it enters the decay stage when the materials within the vicinity have been consumed by fire. Fire becomes more complex as the progression of fire will be different in different situations or environments. This occurs concerning the amount of oxygen available for the fire, will the fire fully develop, and reach flashover, before going into decay, or will the fire be under-ventilated, with insufficient oxygen to sustain burning, which affects the volume of smoke being produced? These conditions along with the actual materials burning will have an impact on the quantity of smoke produced and the toxicity of that smoke which could be inhaled by occupants within the fire location.

Smoke inhalation accounts for over 50% of fire fatalities and fire injuries within Scotland and is reported to account for over 80% of fire fatalities in America [2]. As household materials and furnishings changed the products within smoke from fires changed and the smoke became even more toxic from the burning of synthetic materials, the effects from this smoke on the occupant can be categorised as asphyxiates, irritants or toxicants [3]. The type and concentration of fire gases present in smoke will vary depending on the fire condition and fuel.

Health implications from fire effluent inhalation can be lethal in certain concentrations, but can also produce chronic and acute health effects. Acute or short-term health effects will normally subside when the person is removed from the smoke environment and into the fresh air or given oxygen and the health effects will be minimal. Chronic health effects can lead to heart, brain and nerve damage in cases of high exposure. The symptoms will be worse in a person who already has an underlying medical condition.

The two most common toxins present in fires have been identified as carbon monoxide (CO) and hydrogen cyanide (HCN). Carbon monoxide binds to the oxygen sites within the blood thereby displacing the oxygen from being able to occupy the blood cell whilst hydrogen cyanide cripples the ability of the blood cell to use the oxygen, therefore even if oxygenated blood was present the cell could not use or deliver the oxygen throughout the body, this

warrants further research into the application of oxygen as the initial course of treatment to a smoke inhalation victim. The effects of HCN on the person exposed:

- HCN is 35 times more toxic than CO.
- HCN can enter the body by absorption, inhalation, or ingestion and targets the heart and brain.
- HCN can cause heart attacks and cardiac arrest, then hamper resuscitation.
- HCN can incapacitate a victim within a short time, 300ppm concentration is immediate death.

The name has been given "the Toxic Twins" [4] because of the health implications from inhalation of either toxin but emphasises that it is significantly more harmful to the individual when both are inhaled during the fire. A paper published in 1982, related to the contribution of hydrogen cyanide in the deaths of 139 fire victims in Glasgow, over three years. The study was a good example of smoke inhalation analysis [5], as the subjects were fire fatalities, non-fatal casualties, firefighters at the incident and an independent control group. The results presented higher cyanide levels within the fire fatality group than the fire casualties and less was recorded within the blood of firefighters who had been wearing breathing apparatus at the time, as inhalation of toxic smoke was minimal. A conclusion was that the concentration of smoke inhalation and blood cyanide levels contributed to the death in the fire. This research example was used as it replicates what is trying to be achieved following this research 40 years later, in that it would be positive if we could include different study groups for analysis, fatalities, casualties, firefighters and the public as a neutral not involved with or exposed to the fire or smoke.

However, only fire or soot debris analysis is currently carried out by the scenes of crime investigators. At present, "at the scene" smoke analysis is restricted by the access to fire incidents and with the lack of fire toxicity regulation within the UK or Europe the progress in this area is slow.

Chapter 3: Fire Injuries and Deaths

The motivation for undertaking investigations following an accident or incident is to primarily identify the cause and the circumstances surrounding the event outcome and any associated injuries to people. The results obtained from investigations are to identify remedial measures to prevent the incident from happening again or at the very least to minimise the severity of the outcome. A professional appropriate investigation, analysis, and summation of outcomes can lead to these required reductions.

This chapter will introduce background information on the impact of fires on individuals and communities. Additionally, it will provide a visual comparison of fire fatalities throughout the world and Great Britain.

3.1 Fire Deaths in Dwelling House Fires Around the World

Fire can destroy almost anything in its path and leave social, economic, environmental and personal devastation in its wake. History is peppered with accounts of the impact fire has made on communities and lives; from the Great Fire of Rome (64 AD) [6] the Great Fire of London (1666) [7] and the Great Fire of San Francisco (1849) [8] all of which destroyed large areas of these cities. Building standards and regulations concerning fire safety have been developed to limit the spread of fire between properties. The development and improvements of fire safety measures in buildings remain as topical today as it has been throughout history, such as current fire safety improvements to buildings following the Grenfell Tower block fire in 2017 affecting all aspects of fire safety and fire safety management.

Although the loss of buildings or entire cities has a social and economic impact on communities the ultimate price to pay could be the loss of life or personal injury. Fires such as the Stardust Disco in 1981 which caused the death of 48 people [9], the Rosepark care home [10] fire where 14 elderly residents lost their lives or as recently as 2017 and the fire at the residential tower block at Grenfell where 72 people died [11] from the inferno. The social and economic cost may well be calculated and given a value, but the true personal loss will never be known. Advances in fire science, using techniques such as fire

reconstructions aid modern approaches to the understanding of fires and the development of lessons learned.

High-profile fire incidents that claim the lives of multiple people gain the attention of agencies, such as Government departments, increased media coverage and community groups, and are generally subject to high-profile investigations. However, most fire fatalities in both the UK and internationally occur in domestic dwellings, with each incident often involving only one or two fatalities or injuries. Collectively, these incidents account for a majority of fire deaths but do not receive the same investigation or analysis.

There has been a reduction in fire deaths throughout the world, as can be seen in Figure 1, reproduced from the topical fire report series [12] published by the Federal Emergency Management Agency (FEMA). The reduction in fire deaths occurred from the late 1970s onward, which would coincide with the implementation of reduction strategies as mentioned above, such as flame-retardant furniture, installation of smoke alarms and greater public awareness due to media reporting.

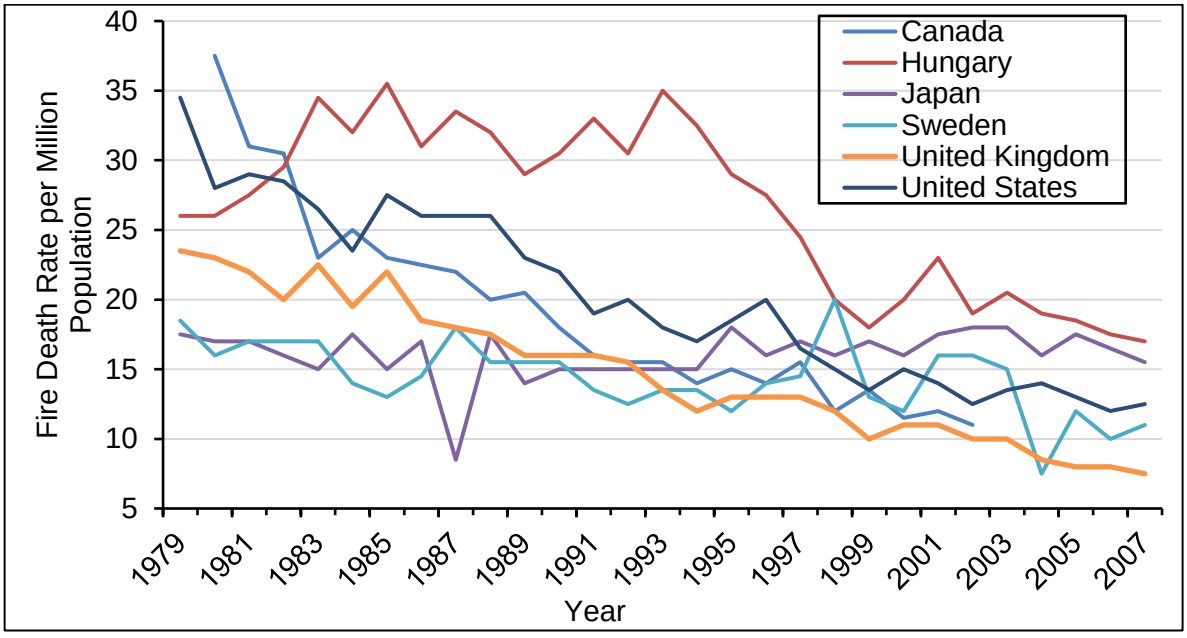

Figure 1: Country Comparison - Fire death rates per million population 1997 – 2007 (graphic was reproduced from the data within Fig3, page 4 of the Topical Fire Report Series, Volume 12, Issue 8, July 2011)

Figure 2 presents the reduction in fire deaths in selected countries. It is noticeable that each country has made significant reductions in fire deaths, with Denmark and Japan less so than the others, the dotted lines indicate the average for each year group (1997 and 2007) and shows that the United Kingdom is the only country to progress from above-average in 1997

to below average in 2007. Whilst the Netherlands, Spain, Austria, Sweden and France remain below the average on both comparisons.

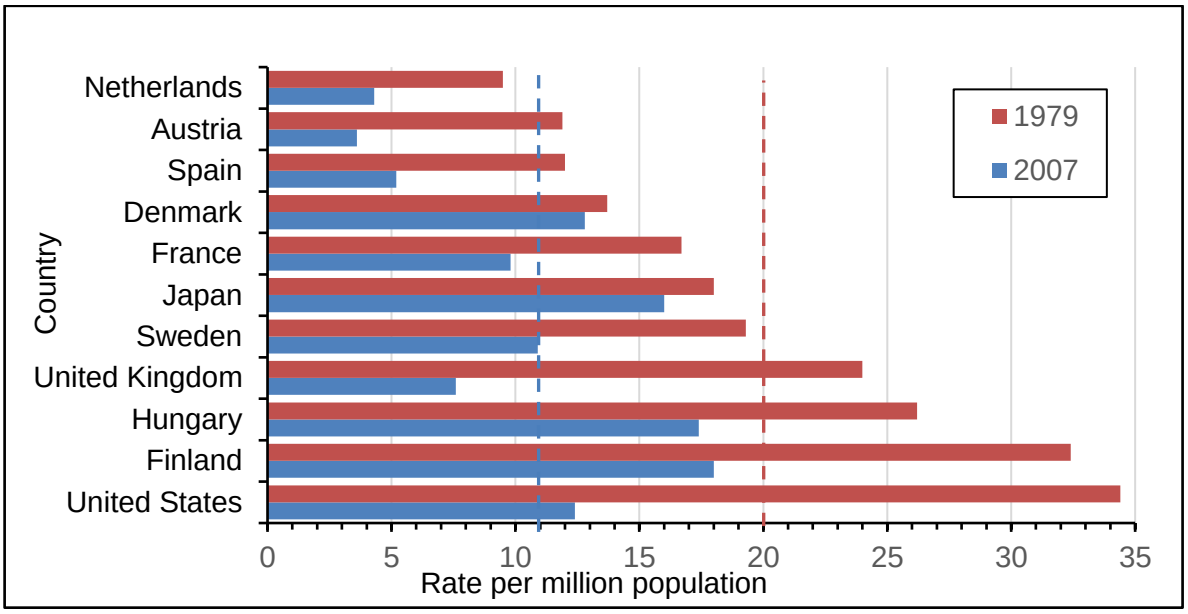

Figure 2: Country fire death rate comparison 1997 & 2007 (this graphic was reproduced from the data within Fig2, page 2 of the Topical Fire Report Series, Volume 12, Issue 8, July 2011)

It is recognised that each country has its methods and criteria for fire death data collection and production, It is assumed that the combined publication within the Topical Fire Report Series has taken recognition of this before publication.

3.2 Fire Deaths in Dwelling House Fires in Great Britain

Great Britain: England, Scotland, and Wales have witnessed reductions in fire deaths and injuries as with other countries throughout the world. Figures 3 and 4 show the corresponding statistics, reproduced from National fire statistics [13] available online fire statistics data tables.

Figures 3 and 4 present the fire fatality statistics for Great Britain, fatality rates are given per million population.

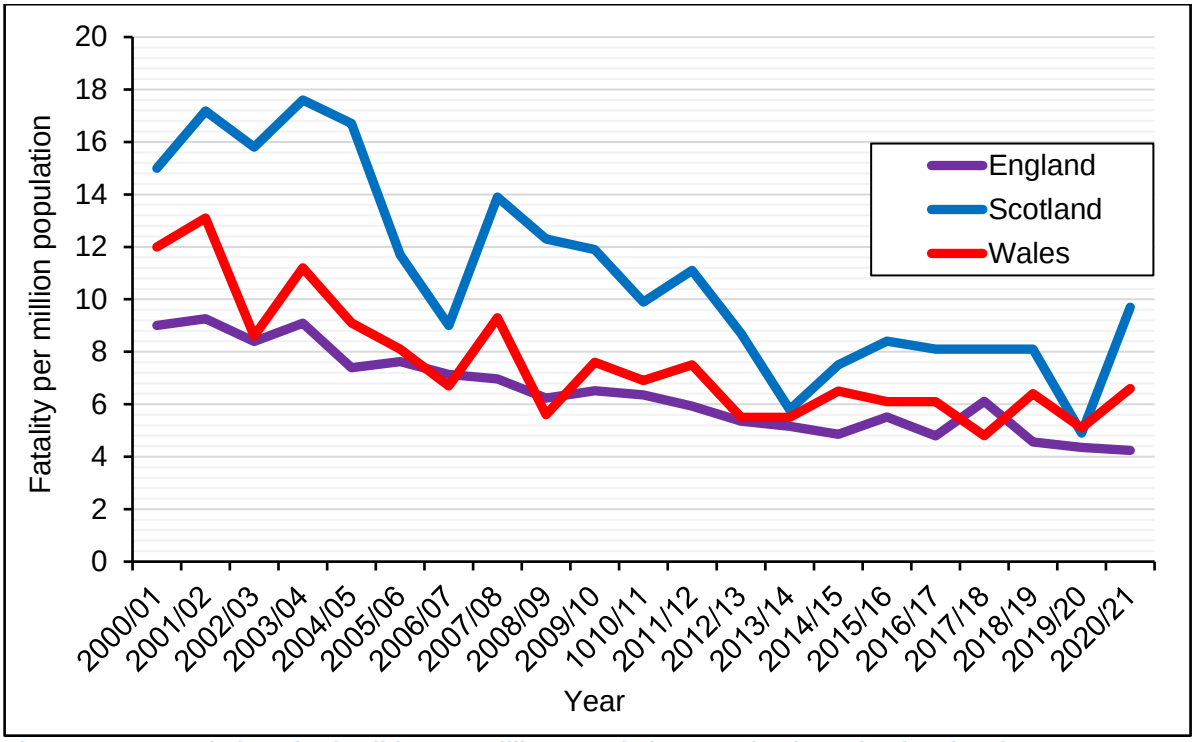

Figure 3: Great Britain - Fire fatalities per million population, Scotland, England and Wales. (source - www.gov.uk/government/statistical-data-sets/fire0501-previous-data-tables)

The figure also shows that there is a plateau of the numbers of around 5 or 6 fire fatalities per million in England and Wales and around 8 per million in Scotland, with around 40 fire deaths per year in the country. There has been no significant reduction in fire incident fatalities throughout Great Britain since 2005. There was no recorded accumulative data applicable to Great Britain for the years following 2015/16.

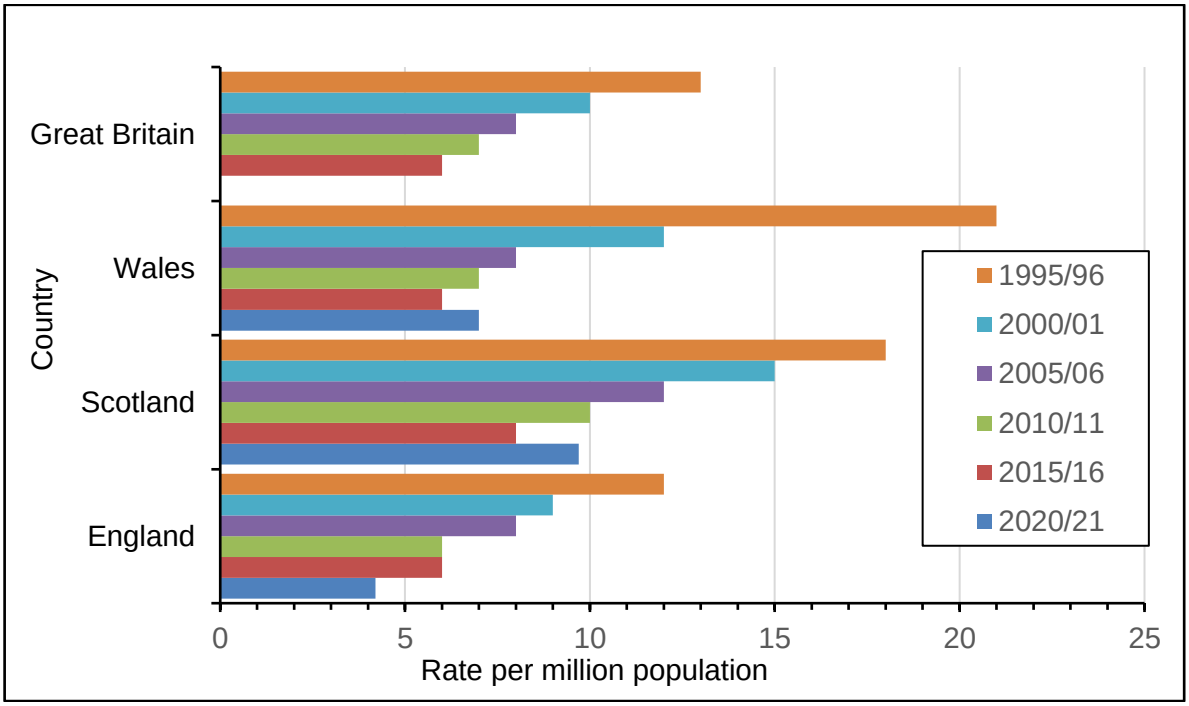

Figure 4: Great Britain 5-year Comparison - Fire fatalities per million population

Over the past 25 years, Scotland has continually recorded a higher fire death rate than our neighbouring countries and in comparison with the collective data for Great Britain. There has been one exception in 2015/16 when Wales recorded the highest fire death rate. This continual higher rate of fire deaths in Scotland will be researched and analysed further throughout this thesis.

Aside from fire deaths, fire injury rates also provide insight as to the effectiveness of fire safety initiatives, legislation or remedial interventions regarding social health care and wellbeing. Figure 5 and Figure 6 present the results that fire injuries have reduced alongside fire death rates and also shows that the last few years have shown the number of injuries to be fluctuating up and down for Scotland and Wales with a noticeable continual decline within England. This recent fluctuation could be the replication of the fire deaths and be related to the number of fire incidents occurring, this theory and the additional information and data required to confirm will be subject to this research. There remains the Scottish trend that the country has always had more fire injury victims, per population, than England and Wales.

Figure 5 presents fire casualties compared throughout Great Britain countries for the previous 20 years, with results presented as fire casualties per million population for each country.

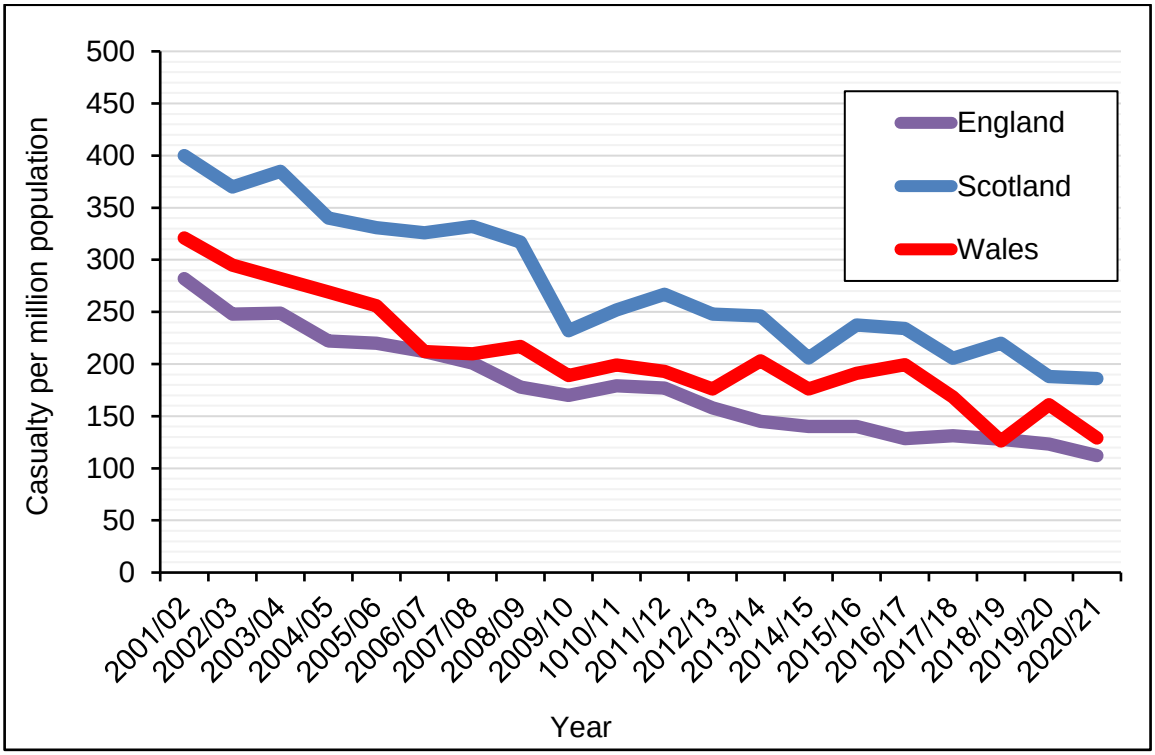

Figure 5: Great Britain - Fire casualties per million population.

Figure 6 presents Great Britain's fire casualties in a four-year comparison.

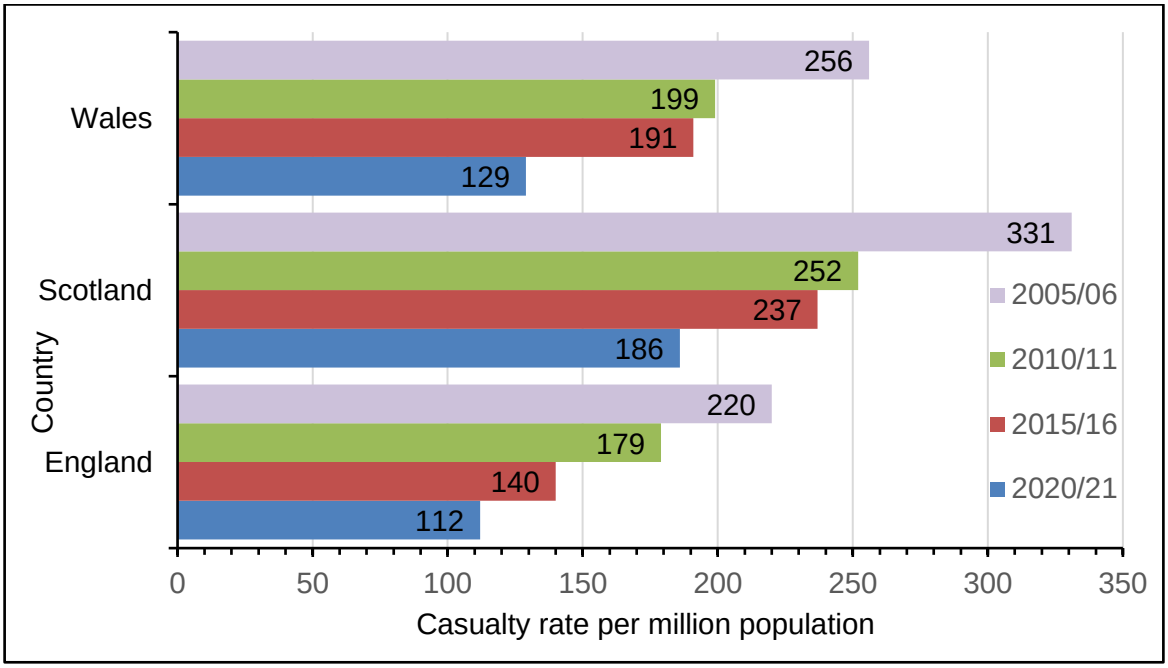

Figure 6: Great Britain 4-year Comparison - Fire casualties per million population

Figure 6 clearly shows that Scotland records the highest fire injury rate of the Great Britain countries and has consistently done so over a considerable period of at least fifteen years, Wales records the second highest fire casualty rates consistently.

Chapter 4: Fire Injuries and Deaths in Scotland

The research motivation was to demonstrate the potential for an improved understanding of the causes of fire fatalities and injuries in Scotland. The quality and quantity of fire investigation data provide additional insight to augment future fire safety interactions within buildings.

4.1 Fires and Fire Fatalities Investigation in Scotland

The investigation of fires and fire fatalities throughout Scotland comes under the duty and responsibility of several public agencies primarily the Police Service, assisted by the Scottish Fire and Rescue Service (SFRS), the Scottish Police Authority (SPA) Forensic Services. The Procurator Fiscals Office, particularly when the outcome has resulted in death [14] or the fire occurred as a result of a criminal action, may also be a participant. This partnership [15] involving the Police, Fire Service, and Forensic scientists, determines the level of investigation appropriate to the incident. Each authority produces reports and submits them to the procurator fiscal for the area in which the incident occurred. Although the reports generated to meet the requirements concerning the cause of fire being accidental or deliberate and as such if a criminal case should be brought or not regarding the incident, except for these reports being used for the National publication of fire statistics, little or no evidence has been identified to suggest that they have been subjected to further analysis.

Current Fire Investigations carried out in Scotland are dictated by a level system as described by the Scottish Fire and Rescue Service, Fire Investigation framework [16] 2013-2016. A Level 1 investigation is carried out by the Officer in Charge (OIC) of the attending fire appliances. These are generally low-key incidents and the OIC will make brief notes regarding the incident and complete an online report in the Information recording system (IRS), on return to the fire station. This online system is in the format of drop-down boxes and the data is used by the Fire Service for annual statistical reporting requirements. Level 2 investigations apply where a crime is suspected, a fatality has occurred, or some other extraordinary fire activity has occurred as a result of building construction for example. This will upgrade the incident investigation to involve Police Scotland, the Fire Investigation department of the Fire Service, and if required, Forensic Scientists, through the joint working protocol agreed upon with the different agencies.

Police Scotland appoints a Crime Scene Manager to these incidents, and it is their responsibility to ensure the scene investigation meets with procedures and protocols. Police officers will undertake the task of interviewing witnesses and any follow-up necessary for occupants who attended the hospital because of the fire. The witness interviews from individuals who were inside or outside the property at the time of the incident are crucial information that can assist fire and forensic investigators to ascertain and provide confirmation of the outcomes of the incident. Due to various procedures and ethics such as confidentiality, these statements are not always readily available to the investigators and seldom available for research purposes.

The Fire Service has around 30 uniformed officers in the role of fire investigators. There are no formal qualifications or previous experience required in taking up such a position. Entrants do however receive a two-week induction course and further short-duration courses are made available to assist their knowledge development. As they have all served as operational firefighters, they have first-hand knowledge of the fire environment and are expected to gain specific fire investigation skills from their peers by attending investigations. The commitment of the officers is evident in their approach to the role; however, their competencies may be harder to quantify with the lack of nationally recognised qualifications and acknowledged experience of the specialist subject. A report produced by Andrews (2018) was published [17] regarding the improvements and standards of the expected competency of fire investigators, a sentiment also provided by a prominent American fire investigator, John Lentini advocates for competency and qualification of fire investigation procedures and investigators. within his book *"Scientific protocols for fire investigation"* [18] the final chapter refers to competence and the publication a year later of the NFPA 1003 Standard [19] for the professional qualifications for fire investigator was introduced.

The fire investigation department undertakes its scene investigation, determining the potential source and cause of the fire, and where possible reconstructing the fire events due to fire spread patterns and scene visual evidence. The Fire Service's Fire Investigation (FI) officers will also interview the fire crews who attended the incident with particular emphasis on the firefighters who entered the premises to obtain what they have seen, firefighting actions and the location of any victims encountered. The completed reports are then submitted to Police Scotland for their inclusion in the file delivered to the procurator fiscal for their direction. These reports are also used as part of the fire data reporting system used by the service to provide data on fires for annual and statistical reporting requirements.

Although not involved in the joint working protocol for investigating fires other professionals have a crucial role in the investigation process. A fundamental contribution to the investigation of fatal fire victims comes from pathologists and post-mortem examination results. The outcome of these tests will be shared with the police before final submission to the procurator fiscals for their determination. The pathology report will confirm the cause of death, including whether the individual died because of the fire or was deceased before ignition. This determination may influence assessments of the accidental or deliberate theory regarding the incident.

Although additional tests, such as toxicology screening of blood and tissues may be carried out, it is considered best practice rather than a mandatory requirement for the post-mortem of fire victims, and at the discretion of the pathologist. When toxicology results are provided to the reporting authorities, such as blood alcohol level present in victim(s), there are no procedures defined for integrating these results into wider investigation findings. The guidance from the procurator fiscal for pathologists includes the recommendation that a full blood screening analysis for every fire death should be undertaken and a blood toxicology report produced, a sentiment agreed with by Lentini within his book, Chapter 4 and presentation (2018) to the American Academy of Forensic Sciences (AAFS) [20] advocating the usefulness of full blood screening to confirm the cause of death but can also assist in finalising conclusion for the investigation relating to the fire of the victim before death.

This witness information can direct or confirm the investigation actions and outcomes. The survivors of a fire incident hold key information about the actual events. Additionally, if occupants must attend hospital because of the fire, medical records of toxicology results could provide crucial evidence regarding the fire conditions at the time and would also provide a comparison of exposure limits to fire gasses compared to other fatal victims and casualties. This area is somewhat controversial when related to fire incident victims, disclosure of personal information, confidentiality, and respect, although a previous MORI poll [21] of NHS patients found that the majority of people are positive about their information being used for research purposes.

4.2 Fire Data Within the Public Domain

The main source of information following fire investigations throughout Scotland are the annual publications produced by the fire and rescue service, these publications provide a basic summarised account of fire statistics from the previous year whilst providing previous years' data for comparison. The completed fire incident reports and fire investigation reports are submitted to the fire service, and the content within these reports is reproduced/replicated to be included in statistical publications. The fire service publication department can only generate publications on the information/data provided by the fire officer completing the fire incident report or the fire investigation officer submitting the conclusions of the details about the fire of fire fatality circumstances. If any other additional information is required for analysis or research purposes, then specific Freedom of Information (FOI) requests have to be submitted to the relevant authority or agency.

The annual publications from the Fire Service are publicly available from their website and are free to view or download as required [22] However, access to more detailed raw reports is more involved and requires contact with numerous agencies. For individual investigation reports, the fire service requires a Freedom of Information (FOI) request to be submitted. If access to a fire investigation report was being made, any requests for additional information about the Police investigation or Forensic Science results require an FOI request to the relevant services. Any information required which relates to the post-mortem reports including the cause of death or identified contributory factors require an FOI request to the procurator fiscal (Crown Office) and subsequently the pathologist to release the information.

Publicly available statistical reports were reviewed for the following criteria:

- The number of fires and dwelling house fires – the publication provides numerical values for the number and type of fires the fire service attends.
- The number of fire fatalities and injuries within dwellings – the publication gives numerical values for the total number of fire fatalities and fire injury victims and provides for fire fatalities and injuries from within dwellings and associated with accidental dwelling fires; a table format is used to provide detail for comparison with previous years.
- The causes attributed to dwelling house fires, a table format detailing the potential cause (ignition source) of dwelling fires, the publication refers only to the year that the publication is addressing.

- The causes attributed to death or injury of fire victims - a table format detailing the potential cause of death from fire is produced, broken into headings such as smoke inhalation, burns, burns and smoke inhalation. The publication refers only to the year that the publication is addressing so for comparison studies each publication would have to be viewed.

Figure 7 presents 20 years of fire fatality data, divided into five-yearly trends. The figure presents the total fire fatalities within Scotland during this period, the fatalities that occurred within dwelling houses and the fatalities that occurred within dwelling house fires recorded as accidental.

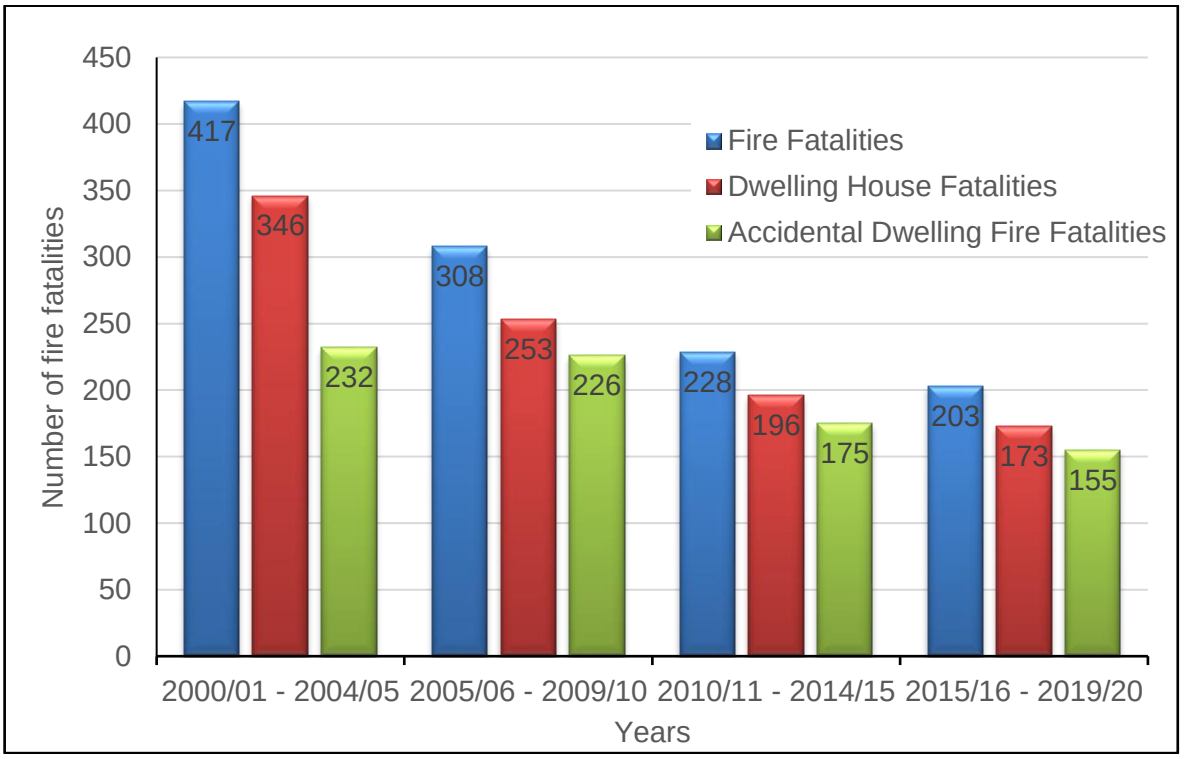

Figure 7: A 5 yearly trend of fire fatalities in Scotland.

The chart demonstrates that the trend and relationships for fire incidents in dwellings have similar results. Accidental dwelling house fires account for the majority of fire deaths and have done so consistently over the years. As the number of fire deaths continues to reduce as identified worldwide (Chapter 3) the scope of this research is to analyse the additional information to further identify the cause and effect of dwelling house fires. The quantity of data sourced from public access and represented is considered appropriate in scope and depth, and further additional data would not be considered a necessary advantage to the outcomes and conclusion being presented from this research. There has to be a line drawn on data collection to undertake the analysis and record the findings and conclusions.

Table 1 presents a list of the documents analysed, with references [23] – [44], which were available from the Fire Service and Scottish Government websites and were sourced for this research to obtain the statistical outcomes used. It has to be recognised that the reporting process for the fire service has undergone changes over the years, from calendar year to fiscal year format, and then restructured entirely due to the formation of the amalgamated fire brigades into a single Scottish fire and rescue service in April 2013. The reports are published and made publicly available towards the end of the year, usually October, and provide provisional data for the previous accountable year and any revisions made to previous publications. The specific data for 2008 [31] was not published for public access due to format changes but was provided for this research under private communication.

Scottish Executive National Statistics Publication		
Statistical Bulletin - Criminal Justice Series http://www.gov.scot/Topics/Statistics/Browse/Crime-Justice		
Publication Period	Published	**REF.**
Fire Statistics Scotland 2000	July 2002	[23]
Fire Statistics Scotland 2001	May 2003	[24]
Fire Statistics Scotland 2002	April 2004	[25]
Fire Statistics Scotland 2003	March 2005	[26]
Fire Statistics Scotland 2004	February 2006	[27]
Fire Statistics Scotland 2005	March 2007	[28]
Fire Statistics Scotland 2006	April 2008	[29]
Fire Statistics Scotland 2007	August 2009	[30]
Fire Statistics Scotland 2008 (Tables provided for this study only)	Private Communication	[31]
Fire Statistics Scotland 2008-09	October 2010	[32]
Fire Statistics Scotland 2009-10	June 2011	[33]
Fire Statistics Scotland 2010-11	October 2011	[34]
Fire Statistics Scotland 2011-12	October 2012	[35]
Fire Statistics Scotland 2012-13	October 2013	[36]
Fire and Rescue Statistics Scotland 2013-14	December 2014	[37]
Scottish Fire and Rescue Service www.firescotland.gov.uk		
Fire and Rescue Incident Statistics Scotland 2014-15	December 2015	[38]
Fire and Rescue Incident Statistics Scotland 2015-16	October 2016	[39]
Fire and Rescue Incident Statistics Scotland 2016-17	October 2017	[40]
Fire and Rescue Incident Statistics Scotland 2017-18	October 2018	[41]
Fire and Rescue Incident Statistics Scotland 2018-19	October 2019	[42]
Fire and Rescue Incident Statistics Scotland 2019-20	October 2020	[43]
Fire and Rescue Incident Statistics Scotland 2020-21	October 2021	[44]

Table 1: Scottish fire statistics from annual publications, with reference.

Table 2 presents data that has been published relating to dwelling house fires, fire fatalities, and fire injuries throughout Scotland over 21 years. In line with the changes to reporting periods mentioned, there was an important change for the recording of fire statistical data from 2008/09 when the fire service moved from the previous national system of Fire Damage Reports, (FDR(1)) recording system onto the electronic Information Recording System (IRS).

This change in recording provides a "caution" in that it may not be directly possible to compare statistical data [45] from yearly publications before and after the introduction of this system.

Scottish Government, Statistical Bulletin, Fire Statistics Scotland:- by year (Research Summary)							
Scottish Fire Statistics	Dwelling House Fires	Accidental Dwelling Fires	Fire Fatalities			Non-Fatal Casualty	Non-Fatal Casualties in Accidental Dwelling Fire
			Total	In Dwelling Houses	In Accidental Dwelling Fire		
2000	9,303	7,214	75	67	64	2,263	1,999
2001	8,836	6,834	96	86	81	2,091	1,799
2002	8,504	6,525	77	65	63	2,045	1,759
2003	8,043	6,253	80	61	57	1,625	1,349
2004	7,420	5,837	99	76	72	1,637	1,337
2005	7,054	5,685	65	58	50	1,461	1,215
2006	6,972	5,591	52	45	35	1,419	1,115
2007	6,684	5,424	59	43	40	1,530	1,211
2008	6,775	5,491	70	61	55	1,513	1,237
Scottish Fire Statistics are now produced in Fiscal Year Format for Publication							
2008/09	6,705	5,397	64	54	49	1,648	1,188
Major Statistical Recording Change – Moved onto IRS system away from FDR(1)							
2009/10	6,573	5,379	62	53	48	1,042	892
2010/11	6,300	5,214	52	45	43	1,101	975
2011/12	6,160	5,121	59	51	44	1,133	982
2012/13	5,836	5,003	46	40	36	1,125	1,014
2013/14	5,334	4,681	33	29	25	1,118	986
Scottish Fire & Rescue Service produces and publishes Fire Statistics for Scotland							
2014/15	5,574	4,953	40	31	27	940	826
2015/16	5,673	5,068	45	39	33	1,093	925
2016/17	5,540	4,922	44	36	31	1,053	940
2017/18	5,311	4,751	44	37	34	935	797
2018/19	5,145	4,635	44	40	36	1,008	886
2019/20	4,890	4,365	27	21	21	860	743
2020/21	4,661	4,141	53	44	36	861	751

Table 2: Scottish fire incident data from annual publications for research summary

There is an obvious similarity and expectation that the reduction of fire fatalities and injuries would also be less with fewer fire incidents to cause death or injury, with accidental dwelling house fatalities reduced to around 31 per year, (7-year average) and injuries being around 838 annually (7-year average).

It is evident from the national statistics and world reports that the overall number of fire deaths and injuries has declined. This section presents an assessment of these statistics relating to Scotland. The figures and tables below were reproduced for this study from the National publications produced annually [23] – [44] by the Scottish Fire Service. Until 2008 the national fire statistics were recorded in calendar year format but changed to fiscal year format as of 2008/09. This change in recording format can give the researcher difficulties when summarising comparison results relating to several years. There are sufficient

comparisons with the data collected for publication which makes the analysis of the different records viable.

The information provided within the national publications for the cause of death of a fire victim in Scotland is limited to the initially recorded cause and as it is recorded as a statistical total there is no way of linking specific fatal victim circumstances to individual criteria.

4.3 Scottish Fire Casualties (2000 – 2021)

Fire casualties or non-fatal fire victims are also a statistical recording requirement for fire services.

Figure 8 presents the pathways of fire casualty data and information applicable currently throughout Scotland; the figure was reproduced from research information on where the information is sourced and how this information is shared and made available for analysis or research purposes. In Figure 8 - The solid lines represent confirmed information provided to the relevant other authority and the dotted line confirms information can be provided but not in all cases.

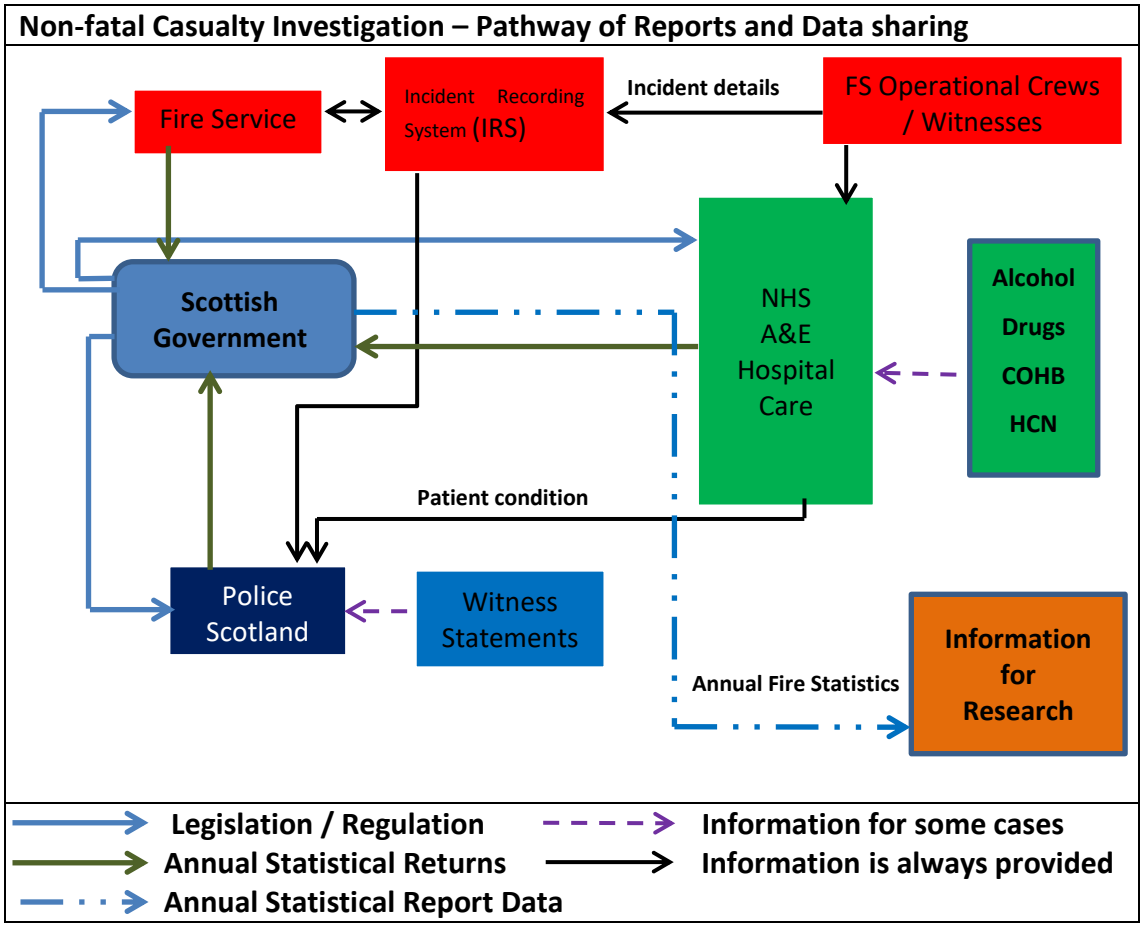

Figure 8: Fire casualty investigation - Pathway of reports and data sharing

If compared with Figure 14, fire fatality data, it is clear to see that limited information is currently made publicly available for research or which is shared between authorities who are responsible for fire investigations of fire casualties. The only publicly available source at present is the statistical data that is published by the fire service in their annual fire incident statistical publications. There are potential reasons for the lack of or availability of fire victim information. Less information is collected at the fire incident if the outcome is a casualty rather than a fatality. Level 1 investigation is undertaken by the officer in charge of the incident, not escalated to Level 2 for fire investigation report or police intervention and unlike a fire fatality, the fire casualty has additional protection for their personal information from their medical records or just through respect and confidentiality of personal information. This area of access to personal data and sharing is addressed within Chapter 6.

Figure 9 presents the number of fire injury victims in dwelling fires and accidental dwelling fires over 21 years. It is evident casualties have also reduced in a similar trend to fire fatality statistics. From a high of 2263 in the year 2000 to a low of 743 in 2019/20.

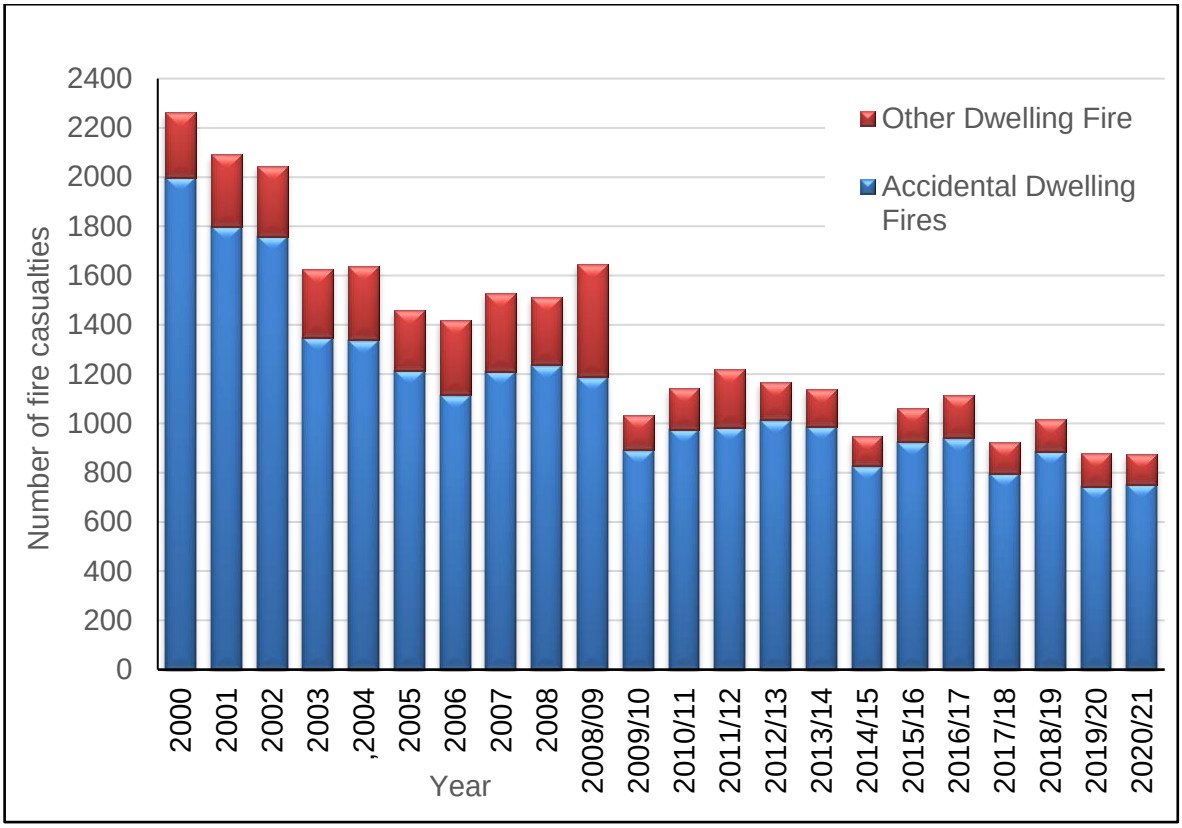

Figure 9: Fire Casualties in Scotland (2000 - 2021) within dwellings

This research and analysis of fire victims from dwelling house fires are represented in the same format as fire fatalities within the publications. The results are cumulative, and the different criteria cannot be interrogated to permit analysis of an individual who was injured in a particular dwelling house fire. The reduction trend has levelled off over the last 12 years analysed, with a high of 1221 and a low of 743, with an average over the 12 years to be 994 fire casualties per year.

If fire deaths in Scotland provide a dataset for research, approximately 40 victims per year, the introduction of fire injury victims for research purposes could expand the potential research dataset to around a thousand victims per year.

Figure 10 presents the recorded source of ignition that led to the fire and the occupier being injured over ten years in Scottish dwelling house fires. Data recorded uses 10 potential ignition sources to categorise how the fire started and like the previous observation, the use of "other" or "unspecified" is used when the source could not be identified or was not recorded. There was a change in recording for the source of ignition, as of 2014/15 the national statistics refer only to accidental dwelling house fires and do not provide a source of ignition specific for fires involving injuries Figure 10 or fatalities Figure 17.

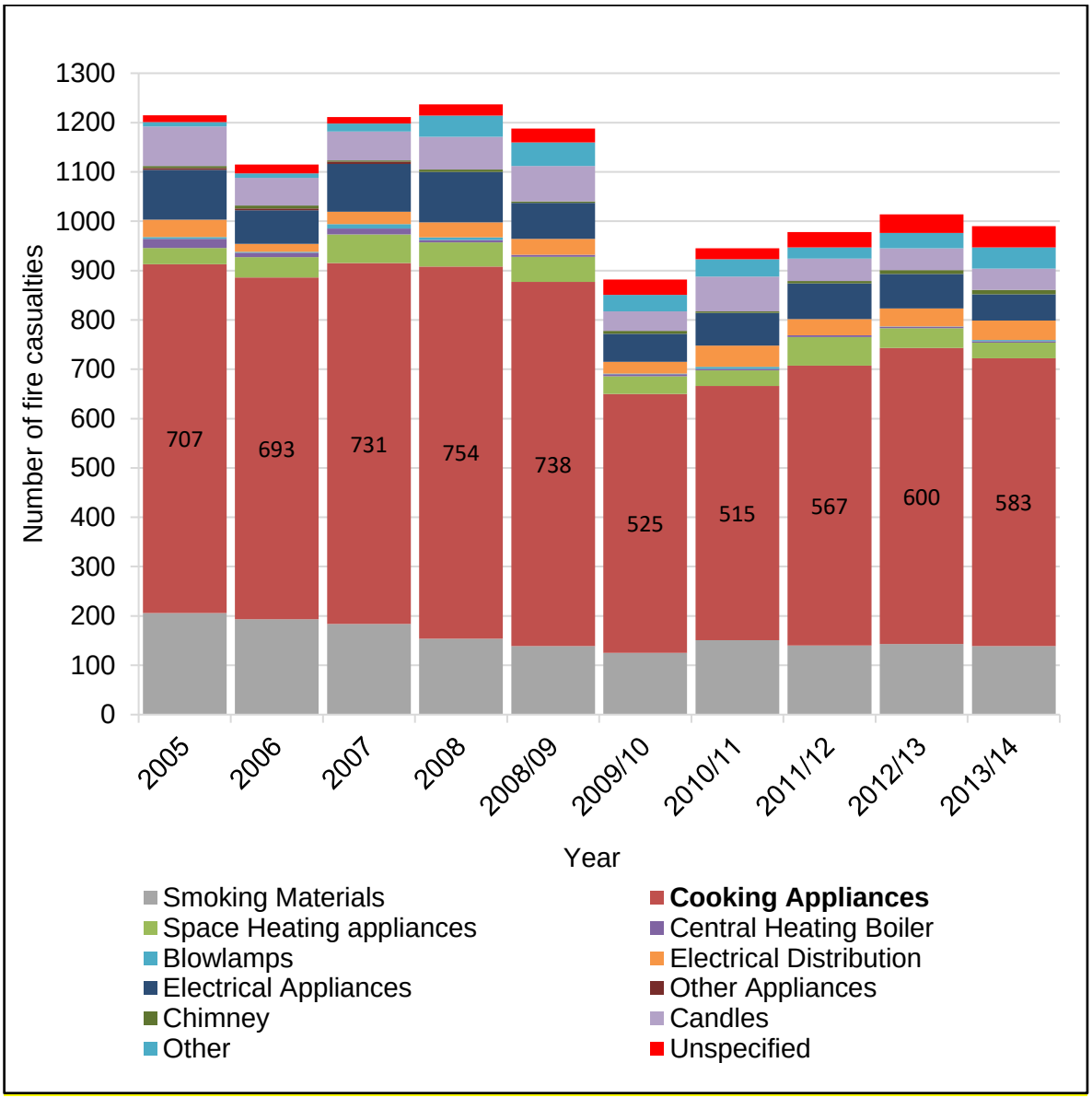

Figure 10: Scotland fire casualties in accidental dwelling house fires - Source of ignition (10 years)

For fires that result in injury to the occupants, the cause of fires is unquestionably being recorded as cooking appliances with smoking materials second highest cause, this is a reversal of fatal fires when smoking materials preceded cooking appliances. The minimum contribution from cooking appliances to fire injuries was 54% in 2010/11 to 62% contribution in 2006 and 2008/09. It is unclear what specific cooking appliances are being attributed to causing the fire and assumptions would have to be made (but not confirmed) if these fires were down to chip pans, grill pans, or other fat/oil frying appliances, and whether the fuel source, gas or electric were predominant.

Figure 11 presents the cause of the injury sustained by the occupant in their dwelling house fire. The same criteria to record against for injury are used as were for fire fatalities. If the cause of injury could not be confirmed the use of "other" or "unspecified" was recorded.

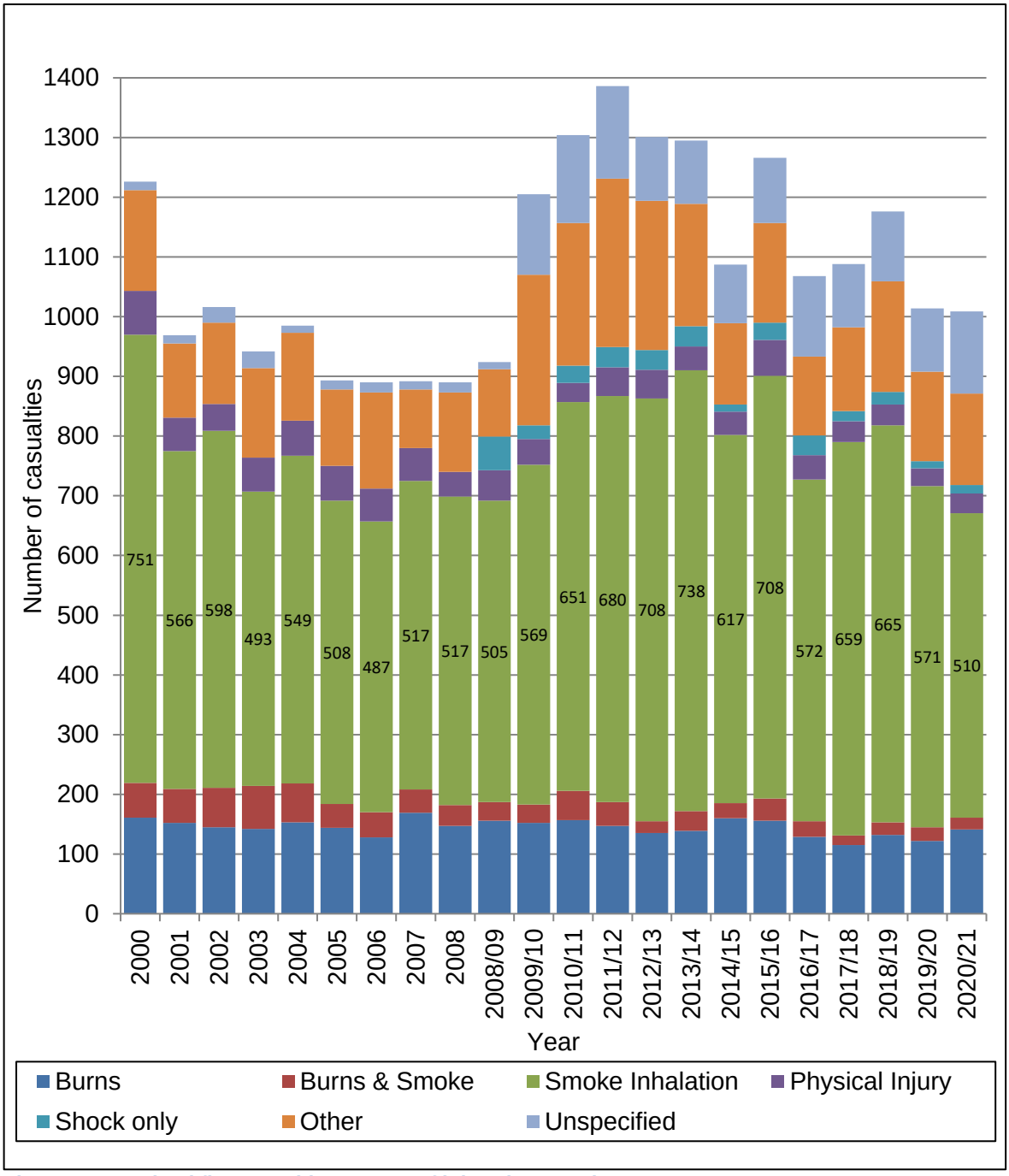

Figure 11: Scotland fire casualties- Cause of injury (21 years)

The results almost replicate the cause of death from fire data, Figure 18, presented; in that the vast majority of fire victims are injured from the inhalation of smoke at the fire incident, with fewer victims suffering from burns and smoke inhalation, again the categories of other and unspecified gives the research missing data to analyse concerning how did these victims get injured at the fire?

In 2011/12 there were 437 people injured as a result of a house fire with nothing specific recorded regarding how these people were injured, the latest data for 2020/21 is unconfirmed for 291 casualties, this deficient data could lead to assumptions being made and would have to be verified or accounted for in finalised data analysis for justified research outcomes.

Figure 12 presents the cause of injuries as a collective number for the total 22,650 fire casualties within the researched 21 years.

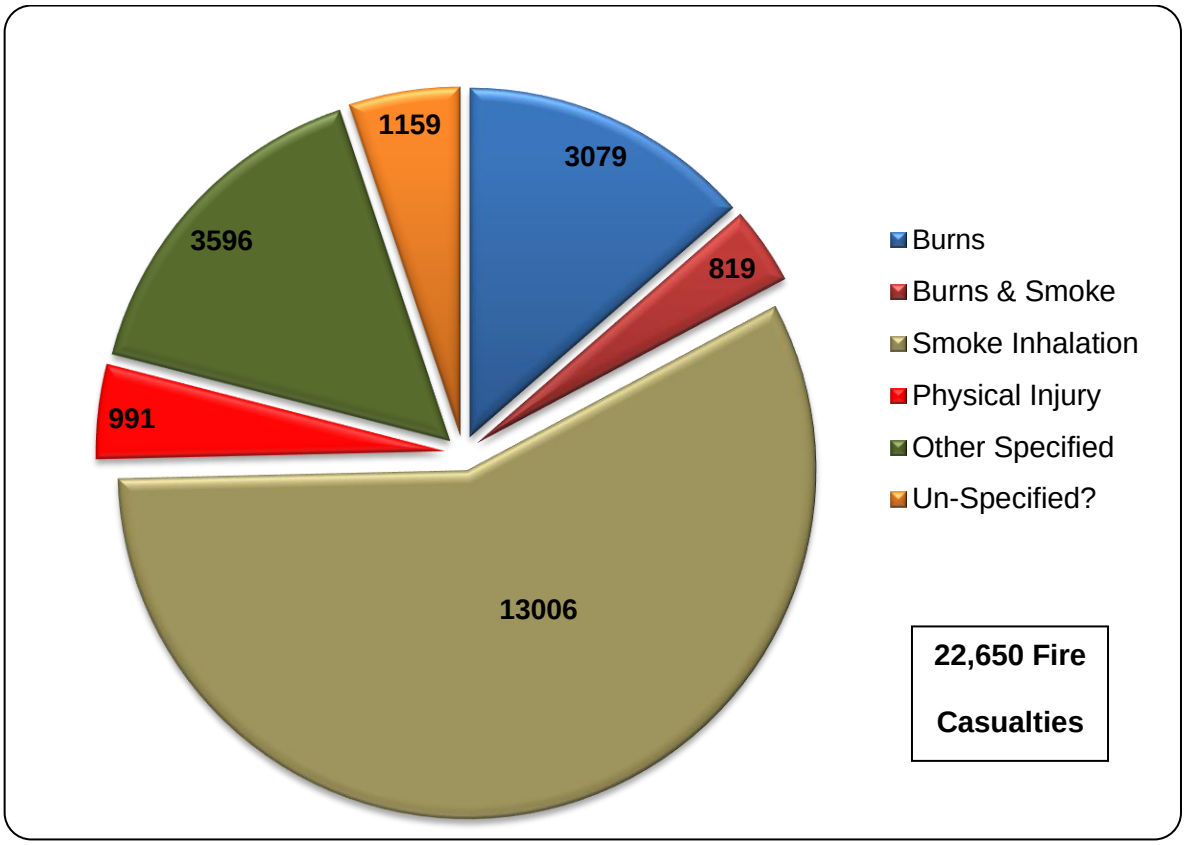

Figure 12: Scotland fire casualties - Cause of injury, Collated data by cause. (21years)

Using the presented data collectively would present injury from smoke inhalation being 57% and the potential to be higher if some of the burns/smoke inhalation 819 casualties were verified to be included. Again it's the "other" and unspecified categories of 4755 casualties (21%) that lead to assumptions being made to understand what is causing the injuries to occupants of house fires, just over a 1/5 of the data did not directly contribute to this analysis.

Figure 13 presents the published data concerning the cause of injury in various formats relating to the data, in that it shows the recorded cause as a figure or percentage for the total recorded fire injury victims. It remains a constant that smoke inhalation accounts for the majority of fire injury victims, this remains consistent with the previous data recorded. The

results are similar even when the different criteria for recorded data as introduced in 2009 are applied.

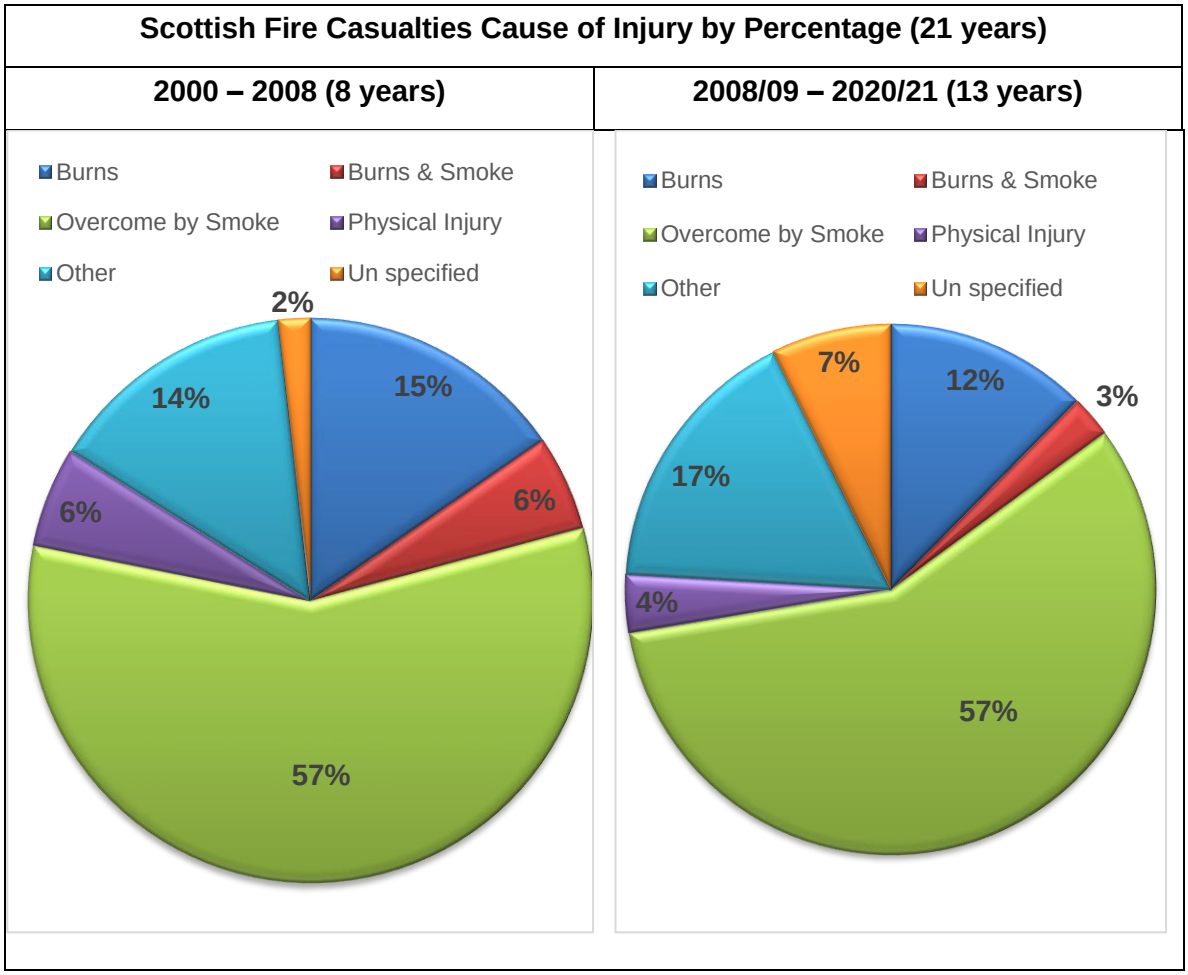

Figure 13: Scotland fire casualties - Cause of injury by percentage (%) over 21 years

The similarity of the recorded cause of injury is smoke inhalation at 57% of cases, the main difference is that the recording of information within the newest format (2008/09) of data collection has made significant increase numbers for cases unspecified or categorised as other which does not provide sufficient information for analysis or determining outcomes. It provides for victim injuries not recorded at 24% = 3399 injuries. This could be attributed to the collection of data or recording systems, as the other datasets and provided information is comparable.

Several areas which require further research or additional information have been highlighted within these sections, applicably to both fire fatalities and fire injuries. The data made available and the accuracy of missing fields, “unspecified or other” are areas to improve on, and the availability of additional personal information for fire casualties, if enthusiasm to

shared data was embraced, could improve research data quality and scope for future studies, particularly into the area of smoke inhalation and contamination.

4.4 Scottish Fire Deaths (2000 – 2021)

The fire fatality data available and data sharing pathways are depicted in Figure 14 below, the figure was produced by the researcher to show the current information sources applicable to each authority involved with fire deaths and investigations. The graphic presents the data about a fire fatality as held by each authority and what information is shared or made public and is available for research. The graphic also shows where additional data is available but not shared but has the potential for future research purposes if additional requests were to be made.

The figure presents the different authorities who produce reports on each Scottish fire death victim, from the fire service, the police investigation, and the post-mortem examination provided to the procurator fiscal who in Scotland receives a report on ALL fire deaths throughout the country.

The solid lines represent confirmed information that is available and shared by providing to the relevant other authority who required the fire death details.

The dotted lines confirm information can be provided but not in all cases, it represents that the ability to obtain the information is not always applied by the agency involved e.g., blood screening for toxicology report is not always carried out or passed on to another agency.

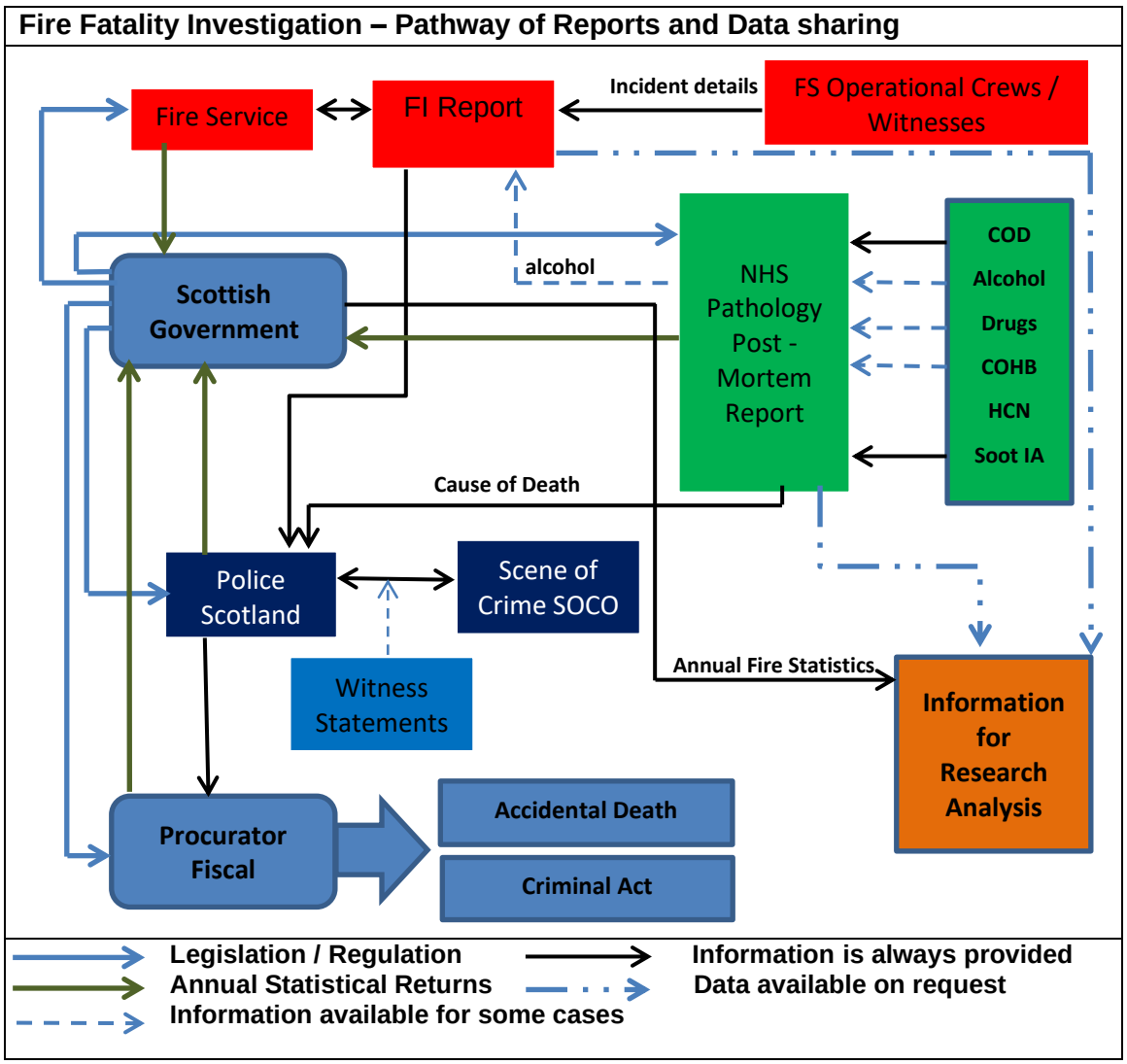

Figure 14: Fire fatality investigation – the pathway of reports and data sharing

The figure shows that in the public domain the information available on fire fatalities for awareness or research purposes is solely from the annual publications of statistical fire incident data. These documents provide good baseline data from fire incidents on the number of fires or the number of victims and the cause of the fires, what is shown is that to be specific of the criteria surrounding individual fire deaths and the fire incident, conditions which led to the fatal outcome, it is necessary to obtain by request, information from the other agencies.

Victim-specific information such as the fire investigation report or the post-mortem results is subject to information sharing protocols or Freedom of Information (FOI) requests. The additional information collection, availability and sharing protocols were discussed with each authority during the research interviews undertaken and presented within Chapter 7.

Figure 15 presents the number of fires attended by the Fire and Rescue Service over 21 years. The data source accounts for fires in buildings with specific data for dwelling house fires and those acknowledged as accidental fires.

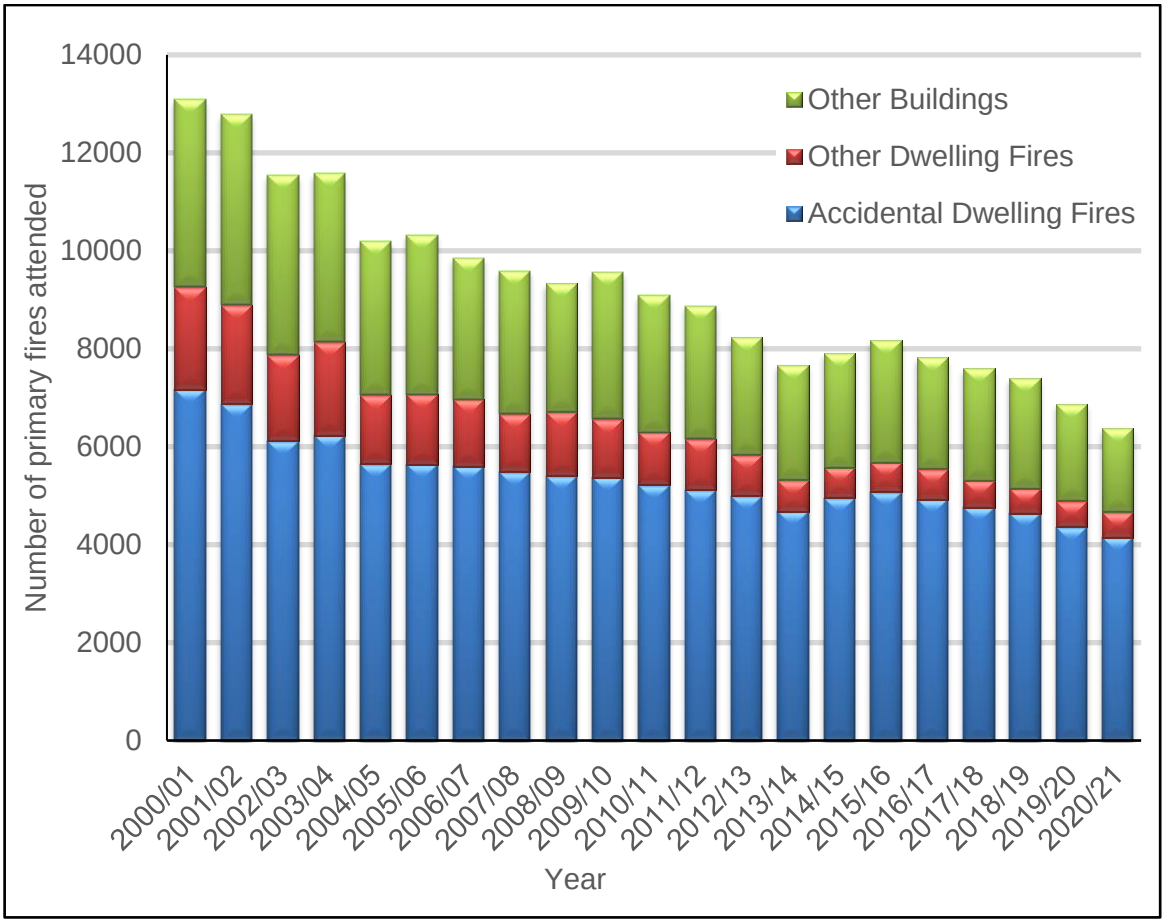

Figure 15: Scotland's primary fires (Buildings) attended by Fire Service (21 years) [Other Buildings: All buildings, including those under construction, but excluding those meeting the definition of dwelling, and excluding derelict buildings or those under demolition]

The number of fire incidents in buildings has reduced throughout the country over the last 21 years, from a high of 13,250 in the year 2000 to an overall low of 6379 in 2020/21. Other dwelling fires have reduced from a high of 2089 in the year 2000 to a recorded low of 510 in 2018/19, these would be what was determined as deliberate fires or perceived to have been a result of wilful fire-raising. Accidental dwelling house fires had a high of 7214 in the year 2000 and a record low in 2020/21 of 4141.

The results do provide evidence of fire incident reduction, but with the different reduction of fires in buildings, deliberate and accidental dwelling fires in different years. It requires more scrutiny of the available or additional data to determine relationships or direct comparisons with the different locations of the fires.

The higher incidence rates from the early 2000s (7214 in 2000 - 6526 in 2002 - 6263 in 2003) have started to reflect a slower reduction with accidental dwelling fires and the last represented seven years from 2010/11 averaging 4997, so around 5000 accidental dwelling fires occur throughout Scotland every year.

The reduction in loss of life or injury in a fire is the fundamental fire safety objective adopted by all fire services and remains a constant in all fire statistical reports or performance indicators for the service. Scotland consistently has a higher number of deaths and injuries, particularly from dwelling house fires, than our neighbouring countries of England and Wales. As there are collective positives regarding the reduction of fire deaths over the years there are possible negatives, particularly in Scotland which mean that the number of people dying or being injured in house fires is not being reduced at a similar rate to other countries.

The incidences of fire deaths in dwellings do not directly relate to the number of dwelling house fires attended by the fire service, Figure 15 presented evidence of the gradual decline in the number of accidental dwelling house fires, with a slight increase over the last three years.

Figure 16 presents fire deaths throughout Scotland for 21 years, the results suggest that the number of fire deaths fluctuates over the period, from a high of 79 deaths in 2001/02 to a low of 21 deaths in 2019/20. What the data does tell us is that the majority of fire deaths throughout the country have always been from within accidental dwelling fire incidents compared to deaths from deliberate fires or fires in other structures or vehicles.

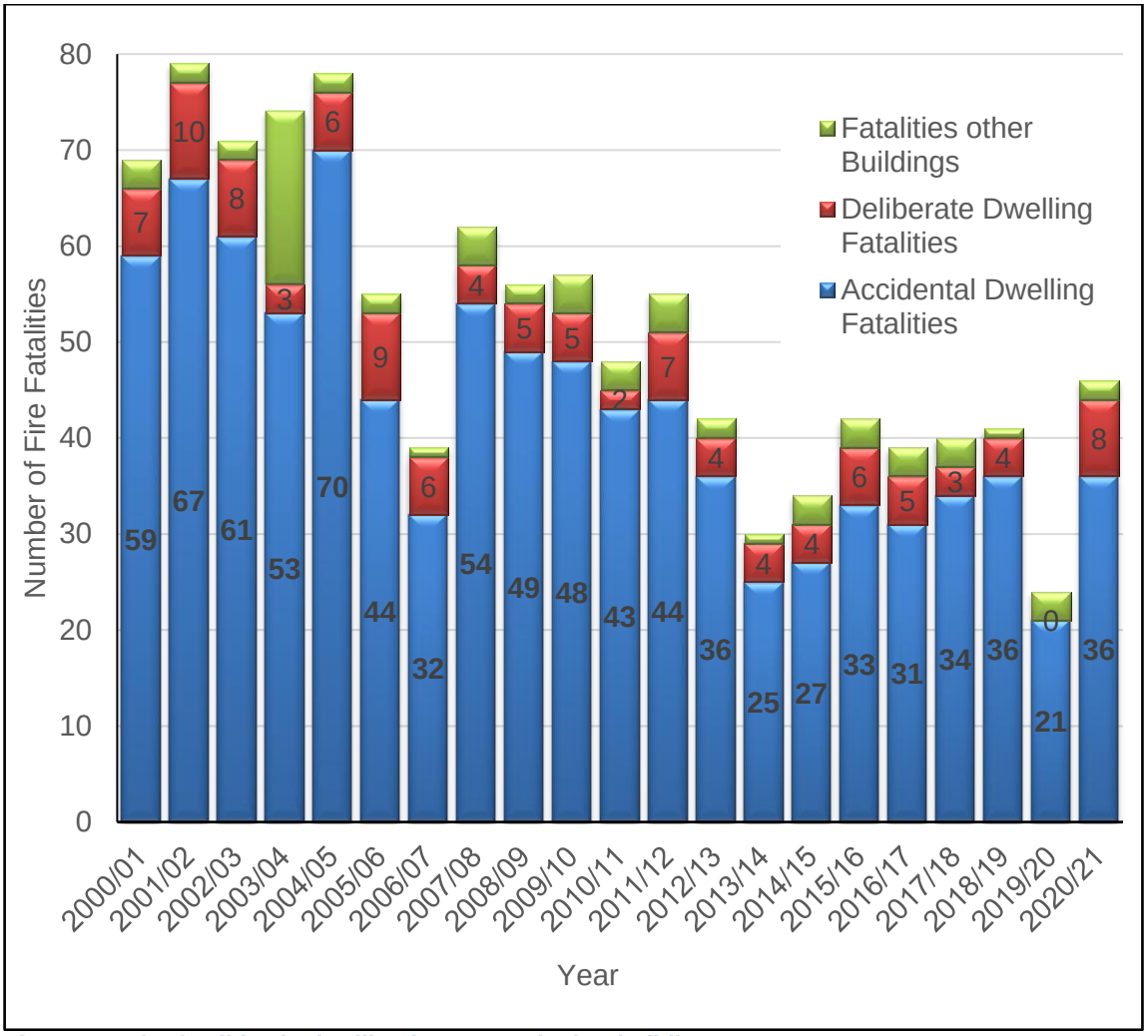

Figure 16: Fire fatalities in dwelling houses and other buildings.

The gradual increase over the last three years gives this research project scope for further analysis of the outcome of fire investigation reports and publications. Given that no direct correlation can be ascertained from the number of deaths relating to the number of fires, 2004/05 was the fifth-highest recorded accidental dwelling house fires (5642 incidents) but had the highest rate of accidental dwelling fire fatalities recorded at 70 deaths. It is considered that additional information from the incident or victim will be the criterion that provides a better understanding of the circumstances specific to Scottish fire deaths.

The total number of fire deaths has fallen over the years, as has the number of victims of accidental dwelling house fires from the high at the beginning of this century with recorded fire deaths of 70 or 80 occurring to the lowest recorded annual fatality incidence of 21 deaths in 2019/20. The fluctuation may also be reflected by the low numbers being recorded when just a single fire incident with 2 fire fatalities could influence the statistics. The current level of fire fatalities throughout the country would appear to be remaining around 30 deaths per year within dwelling house fires.

Figure 17 presents the ignition sources that were responsible for the fire that led to the loss of life from fire over these ten years. To identify what is causing the fire, the recording system permits 8 subjects to be associated with the ignition source of the fire with an option of "other" if the suspected cause is not on the list and a final option available which could be recorded is "Unspecified" this could be used as a result of an unknown cause of fire or that investigation or information was not collected from the fire incident to permit the information to be recorded.

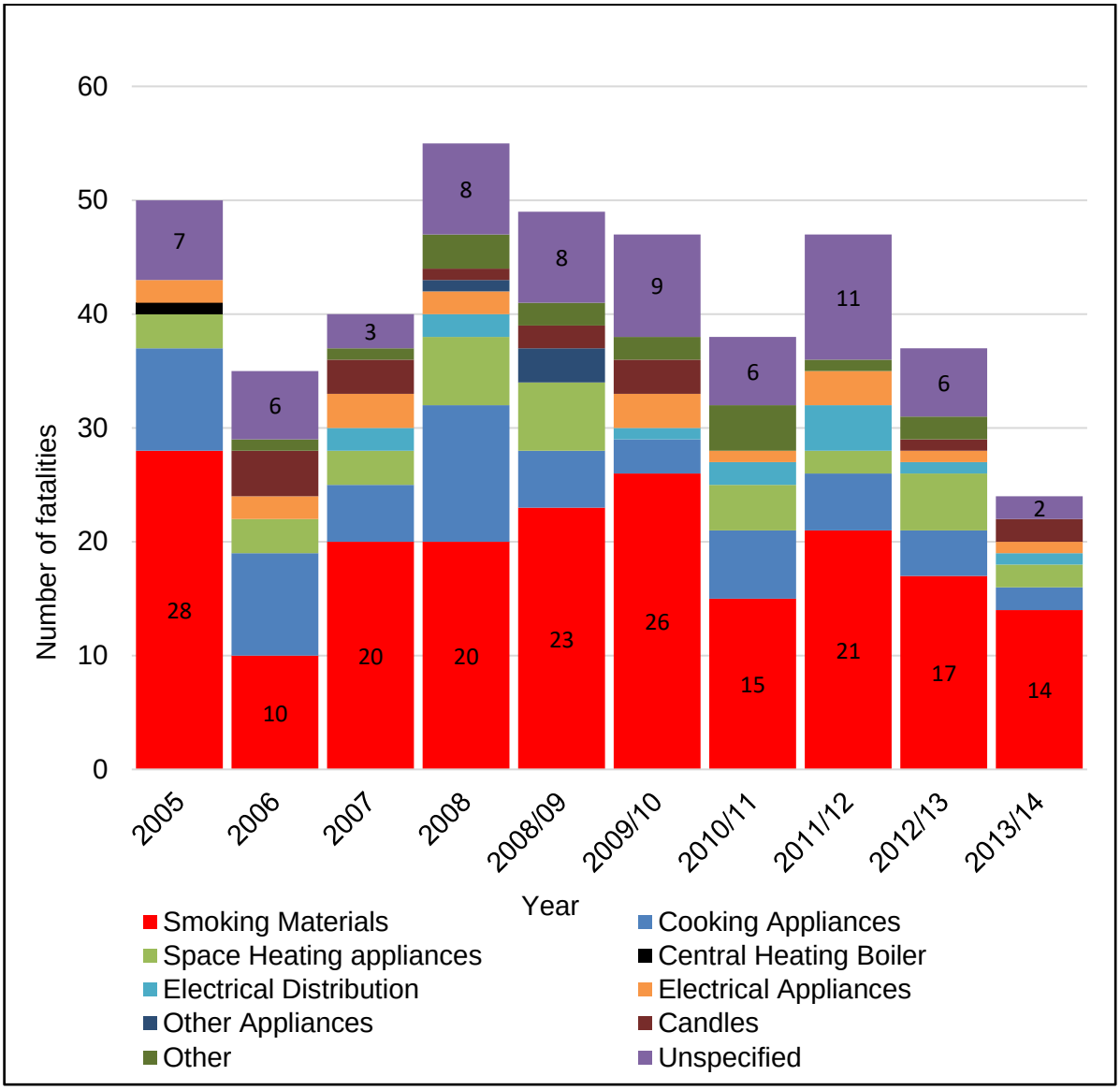

Figure 17: Scotland fire fatalities in accidental dwelling house fires – Source of ignition (10 years)

From Figure 17 it is evident that the inappropriate use of smoking materials is accounting for the majority of accidental fires which have led to the occupant dying in the fire. Over the years, more than half of fatal fires have been attributed to smoking materials. If the incidence of people smoking is reducing throughout the country, it may be assumed that the fire incidents may also reduce. This cannot be inferred at this time with the information available

as there are other relationships to be considered, such as social deprivation and lifestyles. Cooking appliances were a high contributor to fatal fire ignition, no further details are available to suggest what type of appliances e.g., chip pans or grill pans or whether gas or electric made a difference.

Of the 422 fatal fire incidents, 194 (46%) were attributed to smoking materials and 60 fires (14%) were caused by cooking appliances. The incidents recorded as other 16 fires (4%) and unspecified 66 fires (16%) do not contribute to the analysis of research data at this time. There are 82 fires (19.5%) in which someone died, and we do not know what caused the fire. This is an area in which this research study is trying to identify remedial measures.

Figure 18 presents the national data analysed relating to the recorded cause of death for fire victims over the previous 21 years. The cause of death is recorded under 6 topics Burns, smoke inhalation, burns and smoke inhalation and physical injury again the options of "other and "unspecified" is available to be recorded for cases where the cause of death could not be confirmed, or the information was not available.

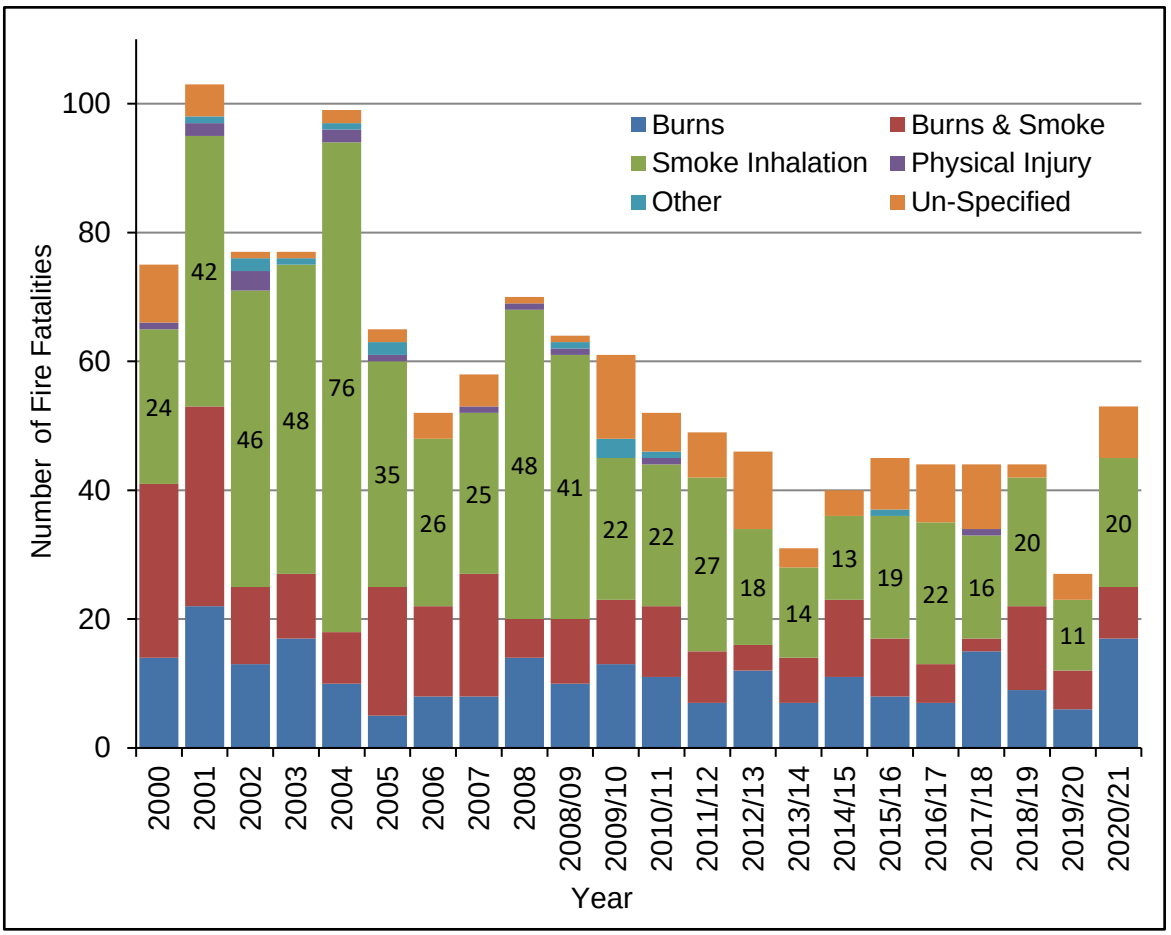

Figure 18: Scottish fire fatalities - Cause of death, 2000 – 2020/21 (21 years)

The results indicate that the predominant cause of death in fire victims has always been recognised as smoke inhalation. There is also the additional recognition of a recorded data set as burns and smoke; it is not evident from the information provided if the cause of death was from the burns or the smoke inhalation as there is also a category related primarily to death from burns. There are two other categories recorded where no additional information is provided, "other and unspecified", so it is unclear what these individuals died from, as this is not listed previously as recorded as fire deaths. One possibility is that this could be an example of a missed collection of information or an inaccurate recording of the data.

Figure 19 presents the cause of death recorded for 1276 fire deaths that occurred in Scotland between 2000 and 2020/21. The 1276 people who died have been categorised within the statistical data tables under the available 4 causes; burns, smoke inhalation, burns and smoke inhalation or physical injury. As in the previous figures, the use of other and unspecified is also recorded.

The fire fatalities cause of death has been recorded as a total number against the recorded cause as a total of 1276 deaths.

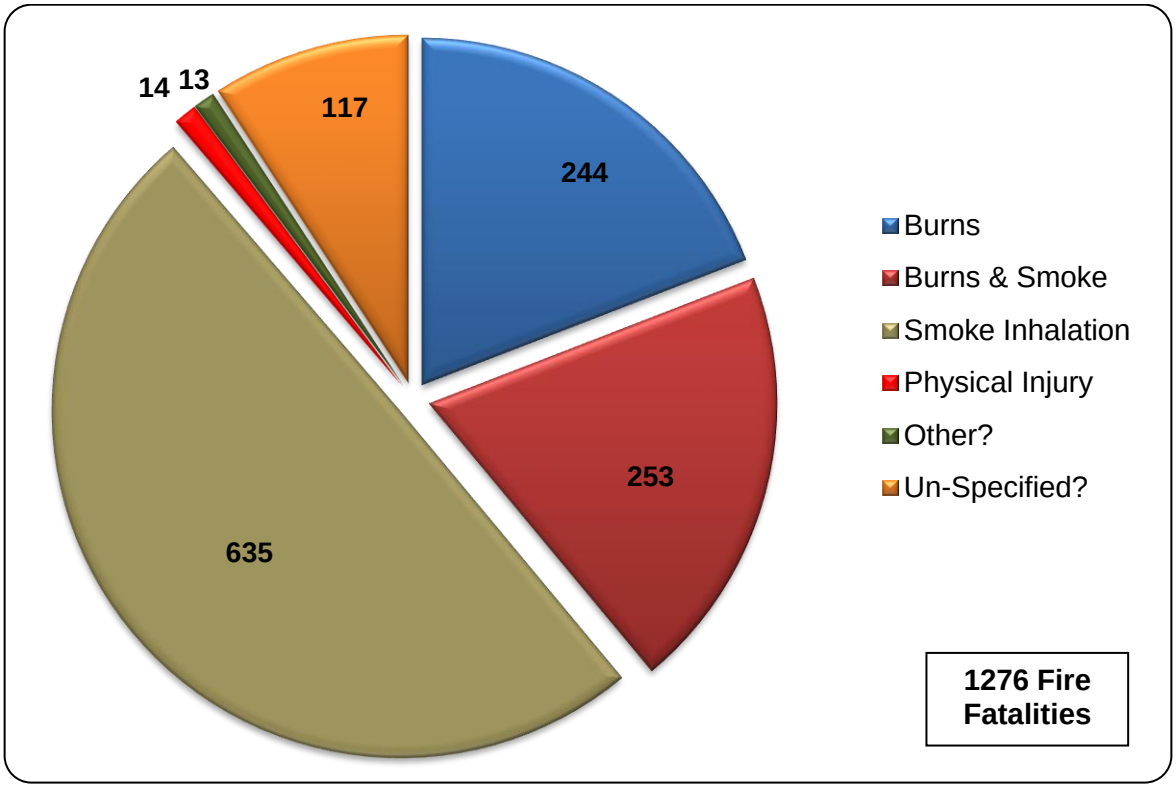

Figure 19: Scottish fire fatalities by cause of death (21 years)

It is evident that the majority of people are dying in house fires from the inhalation of smoke, with 49.7% of victims being recorded as such; this figure may be higher as it is unclear what

was the contribution to death from the individual cases that were recorded as burns & smoke 253 (19.8%)? Or indeed what if any was the reason for the 130 (10.2%) fire death victims where it was unspecified or recorded as “other”?

Figure 20 presents the recorded cause of death expressed as a percentage of all 1276 fire deaths. What is noticeable is that there is a difference in the figures if the published statistics are displayed in the two categories of the calendar and fiscal year publications, although this relates to the changes in recording fire statistics from 2009, it is still evident the outcome of the vast majority succumbed to smoke inhalation.

The noticeable research observation would be that the number or percentage of fire fatalities where the cause of death is unspecified has increased from 4% to 15%. On additional review of the criteria being investigated and recorded, does the increase relate to a poorer standard of data collection or that some criteria are not collated and therefore not recorded within the newer recording templates or proformas used at incidents by the fire service, a conclusion to be highlighted.

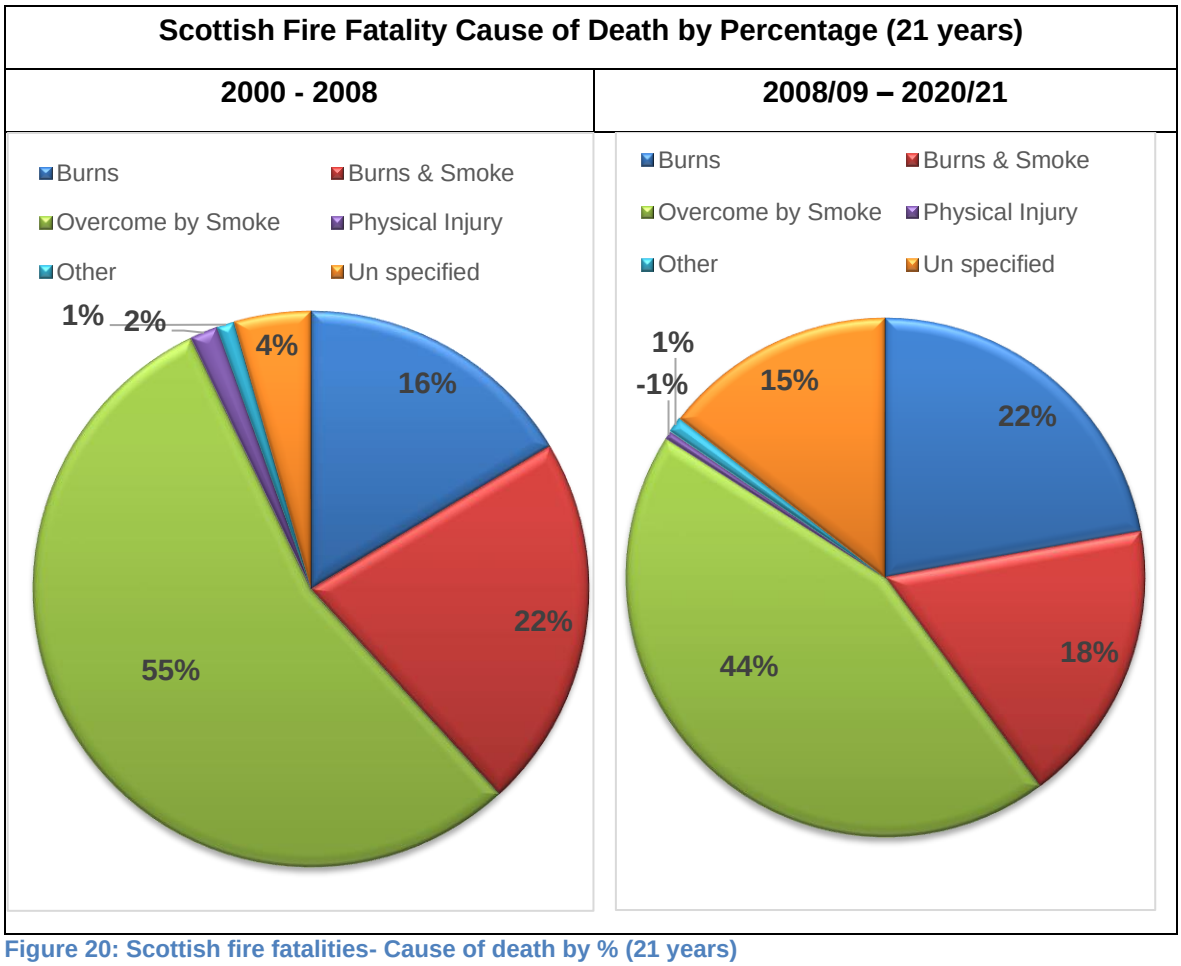

Figure 20: Scottish fire fatalities- Cause of death by % (21 years)

What is evident is the proportion of deaths attributed to the inhalation of smoke at the fire incident and that this specific area is worthy of further investigation and analysis regarding what information is being collected, or not collected at the fire incident or from the fire victim that would provide for future research analysis of the contribution to fire deaths from smoke inhalation.

Chapter 5: Fire Fatalities Research Database

This Chapter provided described the procedures, processes, and different communication formats that were adopted to obtain fire fatality data from the different authorities involved in the process, from fire investigation through to post-mortem examinations and finally at the access stage to obtain the data for research.

The objective was to source available data, from fire investigations, post-mortem reports and medical interventions pre-hospital and emergency care, relevant to the specific incidents for the fatal fire victims. The gathered data would then be assessed for factors relevant to the ignition source of the fire, the cause of death and any contributing factors that may or may not have a bearing on how the individual died or was injured, in the fire. The data provided from both aspects of how the person died, such as burns or smoke inhalation together with identified contributing factors such as alcohol impairment and or underlying previous health conditions would contribute to the analysis of how fires affect individuals.

5.1 Introduction

The data presented within the database was sourced from the publicly available publications from the Fire and Rescues Service, as referred to and referenced within Chapter 4, Table 1.

Some additional information such as post-mortem reports could be obtained, through a freedom of information request, but fire victim data (patient records) remain "protected" within patient confidentiality and was not available for this research. Additional data is presented from "private communication" with the fire service and other agencies involved in fire fatalities and fire victims within the fire investigation process. All communications provided privately via e-mail and e-mail attachments have been retained and indexed for verification, and confidentiality for some personal data exists within this information. The communications are indexed from 001 – 113, within the date range of 1st January 2010 to 14th October 2011, (Appendix A).

To test the feasibility of populating and potential use of such a database a decision was taken to concentrate on a three-year target for fire fatalities throughout Scotland. The creation of the database commenced in January 2011. Annual fire statistical reports typically take two years to be published after the reporting period, so the years for research selected were 2006

– 2008 inclusive. The three-year data set range was selected for research as the previously published report, the "Scotland Together Report" [46] had identified this research period as suitable for trend analysis.

The fire fatalities being researched would all be those attributed to accidental dwelling fires, this restriction was chosen due to the legal and moral difficulties, of obtaining information on a fire or fire death which could be subject to criminal proceedings (criminal cases, disclosure of evidence, moral and ethical understanding of a wilful fire raiser and the reasons for starting the fire). Additionally, the understanding of remedial intervention measures to address deliberate or wilful fire-raising is beyond the scope of this research project.

The database categories would permit specific research to be undertaken concerning fire incidents – geographic location, building type, social deprivation categories, working smoke alarms at the property and the source of ignition of the fire itself.

The data and information about fire fatalities and fire victims are currently not restricted to a single source of authority such as the Fire Service, the current data is spread across different authorities such as the fire service for fire incident information and victim overview, the post-mortem examination for the defined cause and contributing factors leading to death and the National Health Service (NHS) concerning information about patient care, at the incident, and medical intervention within the hospital environment.

5.2 Data Request Sequence

The first step in the research was to determine how many fire deaths occurred in dwellings throughout Scotland in the years being studied and what geographic location did these fire incidents occur. This information was sourced from the annual publications published by the fire service and government statistical tables. The following numbers were extracted from these sources: -

2006 = 35 fatalities **2007 = 40 fatalities** **2008 = 55 fatalities**

The fire deaths occurred in every fire service area throughout Scotland: Central Fire Brigade, Dumfries & Galloway Fire Brigade, Fife Fire Service, Grampian Fire Service, Highlands & Islands Fire Service, Lothian & Borders Fire Service, Strathclyde Fire Brigade and Tayside Fire Brigade. (This research was undertaken before the amalgamation of these services into the single Scottish Fire and Rescue Service in 2013). This confirmed that the dataset would

comprise approximately 130 fire deaths and that data and information would require to be sourced from each fire service throughout Scotland.

Each fire service used the same Pro-forma (Appendix B) for the recording of information obtained at a fire scene during the investigation of the incident following a fire death. The information fields on the form were used as the list of initial data that would be requested regarding the incident or fatal victim.

Table 3 lists the identified information fields requested and for what purpose the data would be required and used within the database. A single-page template form was produced to populate with requested data about the Fire Investigation report (Appendix C). The list provides the most common data fields filled in by Emergency Responders following their attendance to fire incidents.

Fire Fatality – Data Requested for the Population of the Database	
Date: - Incident & Fatality	Date of Fire Call, Date of Fatality Death (if Different) – required to record day month year, weekdays or weekends and will acknowledge if fatality died at the scene or later in the Hospital
Time of Call	Time of Call to Fire Service Control – Used to record if more fires occur day or night
Address	Used to Record, Geographical and Health Board Area. Can assist in obtaining Post Code
Post Code	Required for online search http://www.gov.scot/SIMD Social Index of Multiple Deprivation, the correlation between fire victims and social deprivation
Property Type	To analyse types of property most likely to have fatal fires; Houses, flats etc.
Owner / Occupier	Confirm analysis regarding if fatal fires are predominantly in private or rented accommodation
Victim Gender	The statistical result of fire fatalities is male or female
Victim Age	Statistical reports provide age-by-group data and the individual age will permit closer analysis of at-risk groups
Cause of Fire	The source of ignition and the criteria that led to the development of the fire
Origin of Fire	In which room did the fire start
Location of Fatality	Which room was the fatality located in, enabling an understanding of the circumstances of death, proximity to the fire, smoke etc?
Contributing Factors	Were there any specific conditions or personal criteria that assisted the progress of the fire or which contributed to the death, such as medication or mobility
Alcohol/Drugs Suspected	Evidence for the use of alcohol or drugs
Smoke Detection	Was there smoke detection within the premises, was it working and did it raise the alarm? Did the occupant act on its operation?
Number of Occupants	Gives possible witnesses to events, and permits investigation of why some occupants survived and others did not
Post-mortem to confirm	
Cause of Death	The confirmed actual cause of death; died before or as a result of the fire
Contributing Health factors	Any medical conditions which could have contributed to the death or contributed to the inability to escape from the fire
Alcohol/drugs Confirmed	Blood test results, confirmed toxicology levels; if present were the levels sufficient to hinder awareness of the fire or to escape
Medication Confirmed	Was the victim on any medication which could have impaired their ability to be aware of the fire or escape
Full Blood Screening	Toxicology Results available concerning CO include carboxyhaemoglobin, hydrogen cyanide, other Chemicals or Carcinogens

Table 3: Data fields requested for the population of the database

Written communication was sent to the 8 individual Chief Fire Officers for the different services throughout Scotland. Sent to All Chief fire Officers for Scotland on 14th January 2011. (Appendix D) The letter explained the purpose of the research project and requested cooperation from their service to provide the requested data. All services confirmed acceptance of the communication, either written or by e-mail communication and all expressed their willingness to assist with the research and appointed a direct contact within their service for further communication. Communication with the appointed persons was done by e-mail, and telephone and several services accepted face-to-face meetings to discuss the research and data requirements further.

Figure 21 presents the map of Scotland with the geographic regions as applicable to the eight fire services and eight police forces serving the country.

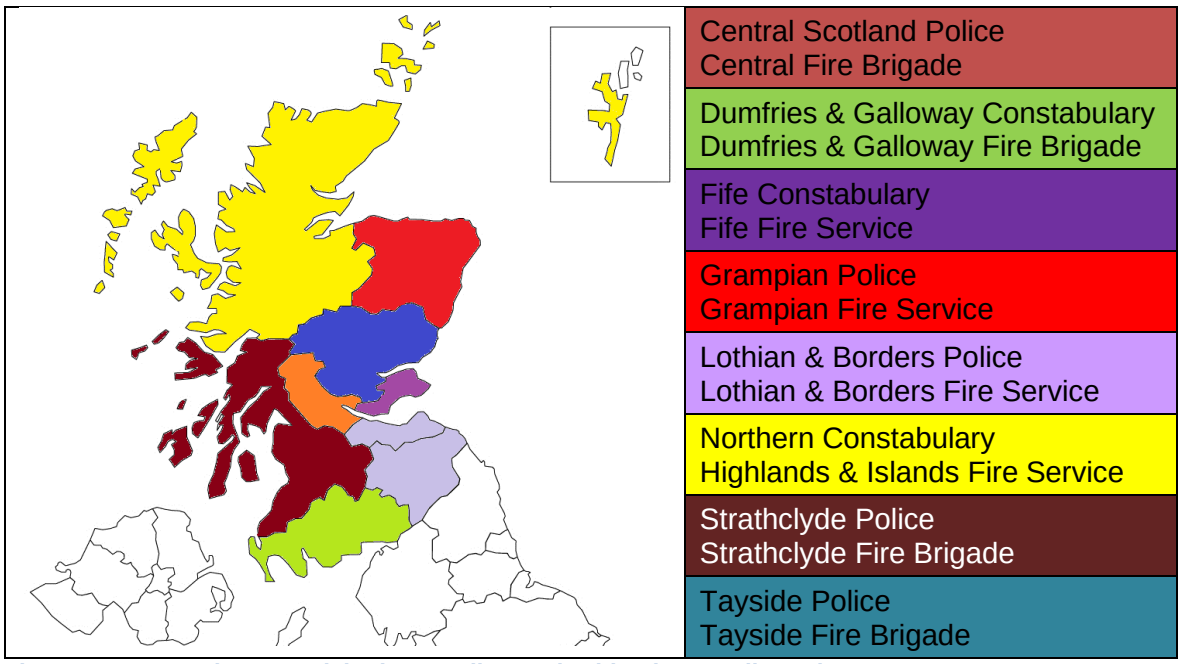

Figure 21: Antecedent Scottish Fire & Police Authorities (pre-April 2013)

As most of the information was confidential, the different services had different approaches to releasing the data, confidentiality contracts to be signed, and data was anonymised for personal data and some accepted the guarantee of confidentiality clause provided by the researcher in the written communication. There are differences in the use or request of data if the subject requests relate to persons who have died or are still living, confidentiality and respect for the individual remains but Data Protection and Freedom of Information (Exemptions under Section 40 and 41) laws do not apply to the individual once they are dead.

Every Fire Service and Police force throughout Scotland acknowledged the research project and participated by providing the data and information they had and could release, for their area of jurisdiction for the fire incidents in the years being researched.

The application of legislation for the freedom of information (FOI), [47] was adopted by each service, and an application was made in the format requested, in writing and or sent via e-mail. At this research stage, the individual fire and police service's freedom of information officers became the principal point of contact for the provision of the requested data.

The information provided by each service was provided under "private communication" in that the data could be extracted and used within the proposed database and that adherence to confidentiality and respect for the fire fatality would be provided throughout the research, although some personal identifier details will remain within the database, age, gender, postcode etc, the provided names of the victim will be excluded from public access out of respect but will be available under the agreement as required for data verification as required.

It would be intended that the database could be available for future research purposes or as a template for consideration of future fire fatality data collection and sharing protocols. No data about "living persons", as controlled under the Freedom of Information Act, is included within the collated data, or research data available for public access.

The information made available from each service was provided either in word format, pdf format or within an excel workbook. The format adopted by each Service and Authority is recorded within the Excel document, private communication, and database source index (Appendix A). Due to the fire fatality data being provided in these different formats by each contributor, it was a very time-consuming process to manually transcribe the information into the fire fatality database being created, to assist in the information transition an excel workbook was created with each fire service being assigned an individual TAB, within each tab, every fire fatality is listed with the information provided by each fire service for the individual fatality and named "Research Results FRS fire fatality data summary".

The data provided by each service contained Personal Information relative to the person who died in the fire. Personal identifiers such as name, address, postcode, gender, age cause of death and any underlying medical conditions or addictions. This requested information was important for determining additional information relating to fire deaths such as common

geographic locations or house types, what age groups are most likely to succumb to fire and if any personal contribution from the influence of drugs or alcohol could be recorded and related to the fatal outcome. Personal information was necessary to access additional fire fatality data such as accessing post-mortem reports.

Although information concerning fire deaths was provided, from the Government and Fire Service Annual publications (previously referenced) and from the individual Fire services throughout Scotland and applicable post-mortem reports provided via the procurator fiscals the request for incidence or fire injury victim information was declined at this time due to the release of personal information relating to a person who was still living.

The result is that access to information about specific fire victims e.g., age gender cause of injury etc is available, within individual NHS patient records but is protected under the interpretation of data protection as currently interpreted by the NHS and other public authorities. Access to this information is a fundamental part of the research objectives about progressing health and well-being for occupants in house fires, but its non-availability must be acknowledged and alternatives identified if possible.

The interview outcomes within Chapter 7 specifically with the procurator fiscal refer to future research possibilities for obtaining fire injury data which would enhance the understanding of deaths and injuries within dwelling fires when both fatality and injury data could be combined.

Table 4 presents a summary of the data fields provided by each fire service, extracted from the information provided within the Fire Investigation report template as provided in Appendix B. For each service, a field is labelled as being consistently available (**Yes**), was not recorded on any fire fatality report (**No**) or instances wherein some reports the subject data was presented but not consistently within all reports (**Partial**).

Scotland 2006-2008 Fire Fatality Investigation Data Being Recorded by Fire Service								
Data Recorded	*Central*	*Dumfries & Galloway*	*Fife*	*Grampian*	*Highlands & Islands*	*Lothian & Borders*	*Strathclyde*	*Tayside*
Date	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time of Call	Yes	No	No	No	No	No	Yes	No
Address	Yes	Yes	Yes	Yes	Partial	Yes	Partial	Yes
SIMD -	No	No	No	No	No	No	No	No
Property Type	Yes	Yes	Partial	Yes	No	Yes	Yes	Partial
Owner/Occupier	No	Yes	No	No	No	No	Yes	No
Fatality Gender	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Fatality Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity	No	No	No	No	No	No	Yes	No
Cause of Death	No	Yes	No	No	No	Partial	No	Partial
Contributing Factors	Partial	Partial	Partial	No	No	Partial	No	Partial
Location of Fatality	Yes	Yes	Yes	No	No	Partial	Yes	Yes
Alcohol Confirmed	Yes	Yes	Yes	No	No	No	No	Yes
Alcohol Level	No	No	No	No	No	No	No	No
Cause of Fire	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin of Fire	Yes	Yes	Yes	Yes	No	Yes	Partial	Partial
Smoke Detection								
- Present	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Yes
- working	Yes	Yes	Yes	Yes	Yes	Partial	Partial	Partial
- Siting	Yes	No	No	No	No	No	No	No
Number of Occupants at the time of the fire	Yes	Yes	Yes	No	No	Yes	No	No

Table 4: Fire incident & fire fatality data being recorded by individual fire services.

The quality or completeness of the data provided varied amongst the different services, although the use of the fire investigation Pro-forma for incident information was uniform throughout the country. The fire service data provided related primarily to the incident investigation with limited data offered concerning the fatal victim. No supplementary fire fatality information regarding the cause of death, toxicology or other contributing factors was offered by the fire service data.

5.3 Data Collection

The research required additional data relating to the fire fatality. The initial communication undertaken was with the procurator fiscal, head of the Scottish Fatalities Investigation Unit (SFIU). The unit is responsible for the collation of all Scottish fatalities in line with the requirements in Scots law that all fire fatalities must be reported to the procurator fiscal.

Initial communication by email was followed up by a meeting with the Procurator Fiscal, Mr Mike Bell Procurator fiscal, for the Scottish Fire Fatalities Investigation Unit, dated, 2nd March 2011 (see appendix A reference 030), to discuss the research objectives and publication intentions. Support and assistance were given towards the research project by the procurator fiscal, who assisted in obtaining fire fatality victim post-mortem reports for the victims identified for research. The procurator fiscal head of (SFIU) contacted the Crown Office on behalf of the research project to obtain the required permission to request the personal data for each fire fatality and Crown Office approval (Appendix A -reference 039) was confirmed. This resulted in written communication to the different procurator fiscals' offices throughout Scotland which had jurisdiction over the area in which the victim died in the fire.

The general response from the procurator fiscal offices was positive and offered assistance to access the fire fatality data. Having provided victim names, addresses, and date of fire incident to the appropriate procurator fiscal, they were unable to identify the post-mortem reports for the fire victims because the system of file storage is categorised by police case number and not names or addresses of the individual.

To progress the request for post-mortem reports it was necessary to contact each police force throughout Scotland to identify the police case number concerning the specific fire fatality and the fire incident. Eight police forces were serving the country; Central Scotland Police, Dumfries and Galloway Constabulary, Fife Constabulary, Grampian Police, Lothian and Borders Police, Northern Constabulary, Strathclyde Police and Tayside Police, who had to be contacted. The individual forces aided this research and were able to confirm the police case number applicable to most victims. Responses were provided by returning the document sent by e-mail with the appropriate numbers inserted by the police information data officer.

Requests for post-mortem report for fire victims was re-submitted to the appropriate procurator fiscal, who were able to identify the reports from their files by the police numbers provided. There were responses provided for each fire victim however the quality and quantity of data provided varied between the pathologists carrying out the examination. The responses varied from full reports with the cause of death noted (e.g. smoke inhalation) with some blood screening toxicology results and a victim's previous medical history to a limited report provided for 20 fire fatalities which recorded" death in Fire".

Table 5 presents the list of fire deaths not detailing the specific cause of death by fire brigade area and the representing number within the completed database.

Fire Fatality Database Available : (Ethics approval No.300130024)			
Fire Service Area/Pathologist	**Date**	**Recorded Cause of Death**	**Research Database Victim number ( )**
Strathclyde	2006	Death in Fire	8
Grampian	2006	Death in Fire	22
Grampian	2006	Death in Fire	29
Fife	2006	Death in Fire	33
Grampian	2006	Death in Fire	35
Fife	2007	Death in Fire	51
Tayside	2007	Death in Fire	60
Tayside	2007	Death in Fire	62
Grampian	2007	Death in Fire	69
Grampian	2007	Death in Fire	70
Tayside	2007	Death in Fire	73
Tayside	2007	Death in Fire	75
Fife	2007	Death in Fire	77
Strathclyde	2007	Death in Fire	79
Grampian	2008	Death in Fire	91
Grampian	2008	Death in Fire	99
Grampian	2008	Death in Fire	112
Central Scotland	2008	Death in Fire	116
Fife	2008	Death in Fire	118
Strathclyde	2008	Death in Fire	130

Table 5: Pathology, Recorded Cause of Death for Fire Fatality

This latter type of report is contrary to the procurator fiscals guidance [14], for fire victim post-mortems, fire fatalities will be treated as accidental deaths, and as such a full post-mortem examination has to be undertaken by the pathologist and reported to the procurator Fiscal, the use of a "view and grant" examination will not be acceptable for fire deaths. This issue of limited data provided from the post-mortem was confirmed in an interview with the Procurator Fiscal, (recorded in Chapter 7, 7.5.1), and is an area that the Crown Office for

Scotland is currently addressing to improve data quality. Unfortunately, this level of post-mortem data does not provide the research information for analysis such as death due to smoke inhalation or alcohol could be considered as a contributing factor.

The data was provided to the researcher in different formats, full copies of post-mortem reports, and handwritten extracts and on occasion, the reports were submitted in the first instance to the SFIU to be forwarded to the researcher.

Several different agencies and authorities record fire fatality data and information, and each is required to be contacted to access the different data or information for either the fire incident or the individual (personal details and post-mortem reports).

Table 6 presents a summary of the different agencies that were required to be contacted to get the provided data to populate the database. Appendix A provides a full index of communication for this research, which lists communication dates, and the systems/formats used by each authority to provide their information.

Source	Communication undertaken
The full information index is contained in Appendix A	
Fire Service	Establish from Statistical Reports size of the data set being requested for the three years of fire fatalities being researched
Fire Service	Establish from provided Statistical reports fire death locations (Fire Brigade) to request fire fatality data relevant to their service area.
Fire Service	Written Communication to 8 Scottish fire brigades, introduction to research, requests their cooperation and assistance for data
Glasgow University	Glasgow University Ethics – Complete application to ethics regarding research data being requested, (personal data confidentiality) – Application No.**300130024**
Fire Service	Submit formal Freedom of Information (FOI) requests to the 8 Fire Brigades, and request fire fatality data for the identified Years (2006 – 2008)
Procurator Fiscal	Written communication with Procurator Fiscal, Scottish Fatalities Investigation Unit (SFIU), introduce research, requested assistance
Fire Service	Attend meetings with Several Fire Brigades to discuss data requests and access to data providing confidentiality agreements
Procurator Fiscal	Attend meeting with procurator fiscal to discuss research and clarify assistance required.
Procurator Fiscal	Obtain Crown Office approval via SFIU, to make requests for pathology post-mortem results for fire fatalities, PF got this agreement
Area Fiscals	Identify and provide a written communication to Procurator Fiscals within the jurisdiction of each fire fatality.
Police Forces	Communication with the eight Scottish Police Forces to obtain Crime Scene Numbers for each fire fatality incident. Pathologists reference their cases with police incident number
Area Pathologist	Identify and provide communication with Area and Health Board pathologist (via Procurator Fiscals), requesting post-mortem reports for fire fatality.
ALL	Continual communication with each Authority, confirming all available data has been provided and the request is complete.

Table 6: Sequence of Data Request for Fire Fatalities Database Creation

In the preceding six years of this research data zone, on three occasions fire fatalities in dwellings increased from the previous year. The fluctuation of dwelling fire deaths may be due to several variables, this study identifies and discusses these variables. The publication of any reduced statistics must be based on the confirmation of changes in personal habits or the justifiable success of initiatives or intervention programs and not because of the administration's changes to reporting and recording protocols or the selective use of accumulative years or averages to show reductions.

5.4 Data Set Integration and Construction of Database

The data provided by the various agencies were in different formats, e-mails, spreadsheets, word documents, pdf files or handwritten notes, which were used to create an excel

workbook. It was decided that the database headings (columns) would relate to the initial fire investigation Pro-forma in that this could be the expected information that would be available for each fire fatality.

Figure 22 presents a graphic of the different agencies that were contacted and the information that was requested for the production of the database.

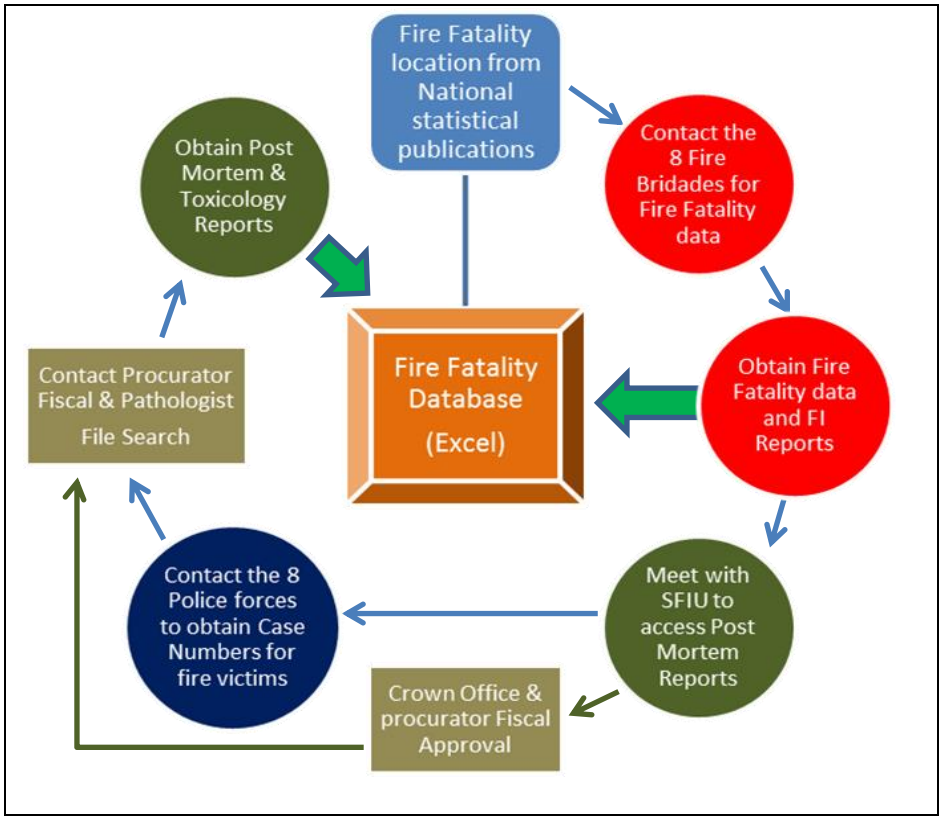

Figure 22: Information Sources for Database Generation

It was necessary to physically read the data provided and insert it into the database manually, there were no compatible data recording systems or styles amongst the providers and the provided data could not be electronically integrated into the database. This was a time-consuming phase of the research project which established the recommendation for the consideration of an electronic recording system that is populated by the different authorities and can be accessed and updated as required and used as a source of combined data for research purposes, see Chapter 7, 7.6.

The database was created in Microsoft Excel 2010. As an excel workbook. The database consists of 30 columns aka 30 variable pieces of data relating to the fire incident (date & time & location) the type of property and the identified cause of the fire and circumstances regarding ignition sources, additionally the information about the fire fatality victim such as age, gender, and where they were located within the premises. Specific health data is

recorded which includes cause of death, alcohol/drugs present and any toxicology blood screening results, primarily for alcohol consumption. Each column has a filter that enables the end-user to filter as many of the data variables as required.

Figure 23 presents a computer screenshot of the database created for this research; the database has 30 variable filter datasets for the 139 fire deaths recorded information.

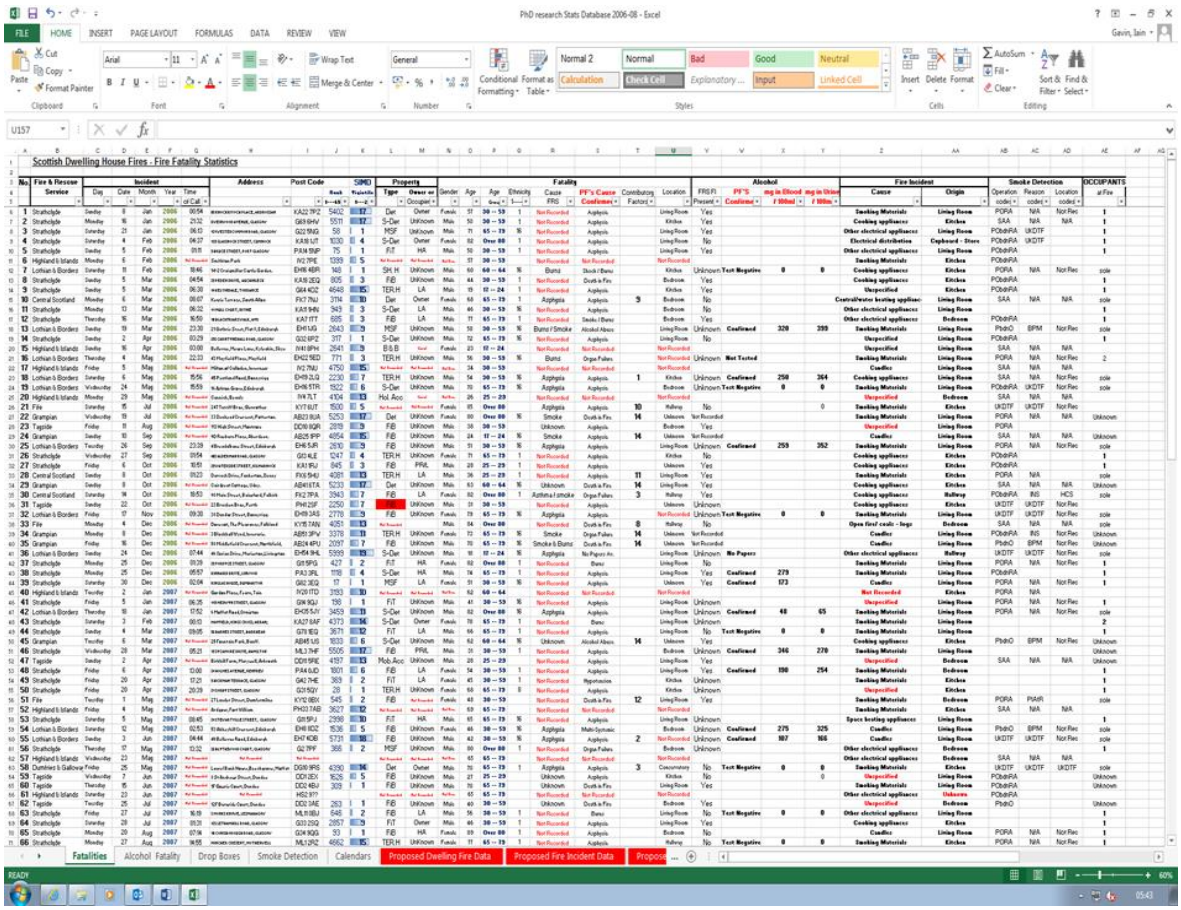

Figure 23: Scottish Fire Fatality Database, created for this research, Excel Program, Screenshot

The created database is in the sole protection of the researcher at present, although the names of the fire victims are not included within the database other personal information, such as age, gender, date of the fire and the postcode of the premises involved are present. Due to the confidentiality of the potentially identifiable data, the access to view or use the database will be on a strictly agreed confidentiality requirement.

5.5 Fire Fatality Database

The excel workbook database was created for this research, the database was populated from fire fatality data and information provided by fire services throughout Scotland and some post-mortem examination results which provided medical information regarding the fire

death, initially, the cause of death and whether alcohol or drugs or another form of medication may have contributed to the fatal outcome for the person who died.

The database has been made available via the University SharePoint directory and can be accessed via the following link
https://glamy.sharepoint.com/:f:/g/personal/i_gavin_1_research_gla_ac_uk/Evi6hc_komhGq95Nu8xKd4wBm56-Sy9AAc44Oj7yaqeYNQ?e=UZ9bY8

The database records up to 30 datasets that may be appropriate to each fire fatality and the columns can be filtered to provide a collective result analysis of each dataset or combination of criteria. The database was an extensive piece of research work to obtain the data and manually populate every piece of data individually from the information provided. The database has also been used throughout the research to validate statistical annual reports and to provide justification and verification regarding the research conclusions and recommendations

Chapter 6: Research Database Quality and Efficacy

This chapter will evaluate the dataset and compare the analyses with the original data available in the form of national fire data annual publications.

6.1 Datasets

The data source, for this research, validated against the national annual publications for the years 2006 - 2008 was provided via a variety of private communications and an agreement towards the dignity, respect, and confidentiality of the fire victim. Although the content of the provided data cannot be verified and accepted on trust, the access to it for use within this research can be validated.

Table 7 presents the administration provided by each fire and rescue service for the fire fatality data contribution to this research, the reference number coincides with the main data listed in Appendix A, the format was the presented data, and the date that it was provided.

Fire Fatality Data provided for this Research – Index			Appendix A
Reference	Fire & Rescue Service	Format	Date Provided
019	Fife	Research Request Form	15th February 2011
028	Central	Excel Spreadsheet	22nd February 2011
035	Tayside	Excel Spreadsheet	7th March 2011
036	Highlands & Islands	Excel Spreadsheet	10th March 2011
057	Central	FI Reports	5th April 2011
066	Central	Fatality Personal Data	12th April 2011
069	Lothian & Borders	Excel Spreadsheet	14th April 2011
073	Strathclyde	Excel Spreadsheet	19th April 2011
090	Strathclyde	Fatality Personal Data	28th April 2011
092	Fife	Fatality Personal Data	3rd May 2011
098	Grampian	Excel Spreadsheet	6th July 2011
100	Lothian & Borders	Excel Spreadsheet	7th July 2011
101	Dumfries & Galloway	Research Request Form	7th July 2011
Reference	Scottish Fatalities Investigation Unit (SFIU)	Post-mortem Reports / Toxicology Results	Date Provided or Via SFIU e-mail
102	Dumfries Galloway	Post-Mortem & Toxicology	Via SFIU E-mail
103	Central	Post-Mortem & Toxicology	Via SFIU E-mail
104	Fife	Post-Mortem & Toxicology	Via SFIU E-mail
105	Lothian & Borders	Post-Mortem & Toxicology	Via SFIU E-mail
106	Strathclyde	Post-Mortem	Via SFIU E-mail
107	Strathclyde	Toxicology Results	21st July 2011
109	Strathclyde	Toxicology Results	12th September 2011
111	Tayside	Post-mortem & Toxicology	Via SFIU E-mail

Table 7: Fire fatality data provided for research via confidential private communication

On freedom of information, the Crown Office of Scotland made the stipulation that certain post-mortem reports or toxicology results would be passed in the first instance to the procurator fiscal within the Scottish Fatalities Investigation Unit and passed on for this research. Due to the confidential nature of some of the data, it cannot be open to public access, the data has been extracted sensitively to respect the fire victim and their families. The information is referenced and can be provided for verification or justification of the content within this research project. These communications provided the source data to create the dataset of fire fatalities in accidental dwelling house fires in Scotland.

The structure of the database in the excel workbook enables each data set collated to form a separate column within the database. The program permits each of these columns to be sorted and filtered which allows criteria to be set concerning the fire incident or the fire fatality.

The 30 columns provide data concerning the geographic area, the time of the fire call, property type, and the cause of the fire, additionally, the database has information on the fatality; age, gender, cause of death, and if alcohol/drugs were a contributing factor.

The first distinct advantage of the database is the visual representation of the completed data fields, on a single page (screen) and it is almost instant to visually identify missing or incomplete data the 30 data fields populated within the created dataset relate to the information that was available on request or via Freedom of Information (FOI) applications at the time. The dataset construction within excel provides a method of running a filtered search of each column (data) which provides the number of individual fire fatalities who had criteria within their fire incident or death that relate to the search filter that was applied.

Before the dataset was created, the publicly available information via the annual publications only provided statistical outcomes by field e.g. The number of fire fatalities, the number of fatalities who died from smoke inhalation, or who succumbed to a fire caused by smoking materials. There was no previous way of interrogating the published statistical data to identify individuals or individual causes.

6.1 Source of Ignition Validation

Statistical analysis has generated the most fatal source of ignition in house fires is smoking materials, in that collectively the number of fire fatalities where the source of ignition was recorded as smoking materials was the highest individual cause.

Database – 59 fatal fire incidents record smoking materials as the ignition source, cooking appliances 27, these two sources account for 62% of all fatal fires within the research group. (4 fatal fire cause not recorded and 16 fires unspecified – 14% no source of ignition identified)

The results reflect unanimously that the single most identified cause of ignition for fatal fires would be the misuse of smoking materials, this outcome mirrors world research outcomes and the specific outcomes for Scottish fire fatalities as previously discussed within Chapter 3.

Unlike the insufficient data relating to the age of fatalities within accidental dwelling fires, the national publications did record the source of ignition for accidental dwelling fires which led to a fatal outcome. This data record has not been discontinued in favour of the source of ignition for accidental dwelling house fires, with no specific data for injuries or fatalities.

Figure 24 presents the recorded instances of ignition sources of fatal fires from 2006, 2007 and 2008, with 35, 40 and 55 fire deaths respectively recorded with a comparative analysis with the database fire deaths of 39, 43 and 57 for the same period.

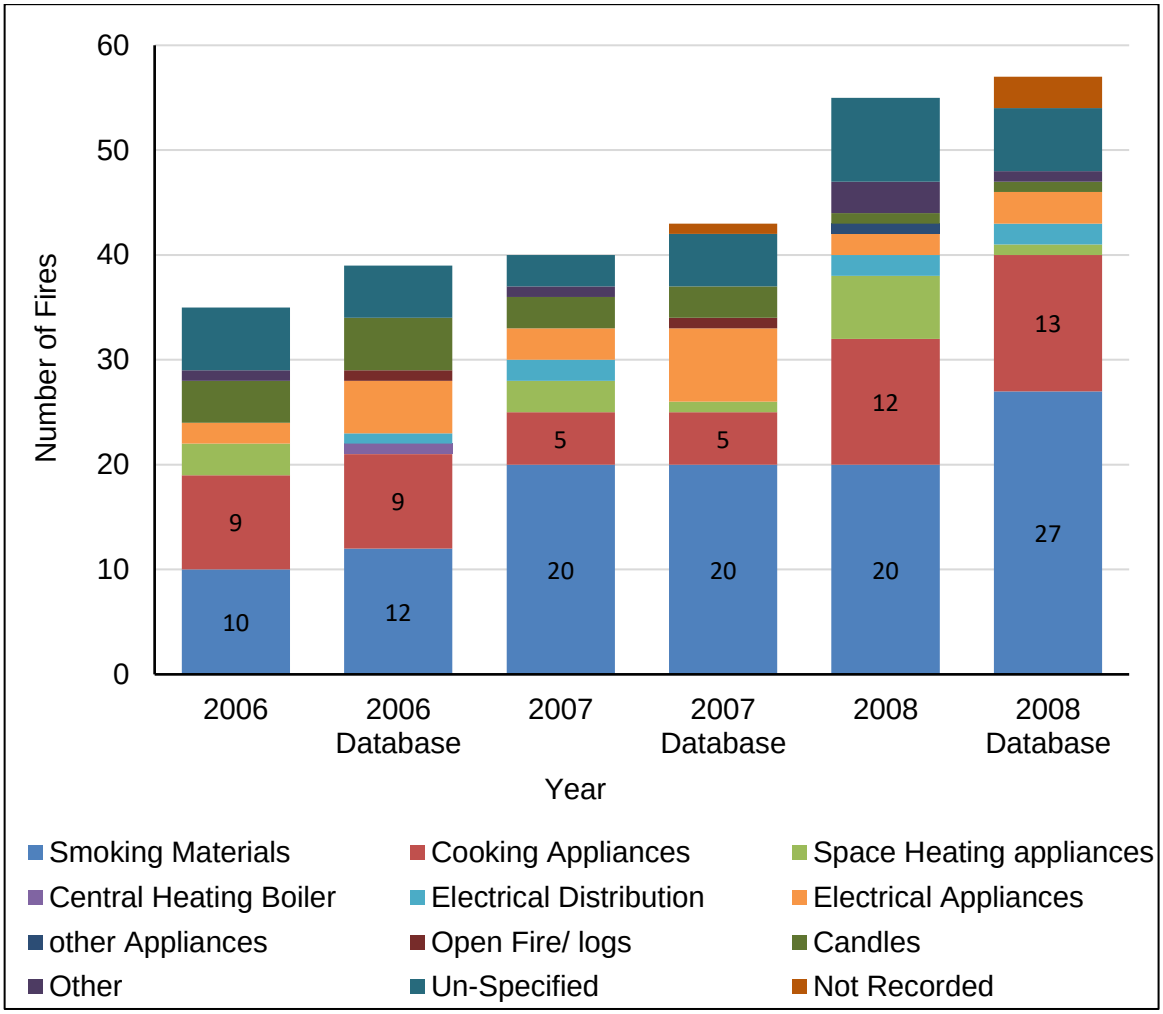

Figure 24: Fatal accidental dwelling fires - the source of ignition comparison of national statistics versus database.

Similar to the argument of accumulated statistics, age groups of fatalities, the data shows that the majority of fire deaths could be attributed to fires caused by ignition sources that were not smoking material related.

2006 – Statistics – 28.6% of fatal fires started with smoking materials
2006 – Database – 31% of fatal fires started with smoking materials

2007 – Statistics – 50% of fatal fires started with smoking materials
2007 – Database – 46.5% of fatal fires started with smoking materials

2008 – Statistics – 36.4% of fatal fires started with smoking materials
2008 – Database – 47.4% of fatal fires started with smoking materials

A worthwhile outcome for consideration is the number of instances of fatal fires where the source of ignition of the fire was either published as 16 fires “unspecified” or 4 fires “not recorded” on the finalised investigation reports or the collated organisation’s data for production. There were 22 fatal fires within the official publications and 20 fatal fires from the database which fell into these categories, so 17% of fire deaths recorded in National publications had no specific cause of the fire reported and this compares to 14% of fatal fires

included in the database. This meant that 20 fatal fires could not be analysed for ignition sources, the inclusion of these additional data fields may not have directly altered the outcome as the main source of the ignition was smoking materials but it could have an impact regarding the second most common cause, cooking, electrical faults etc.

A pattern emerges when the 4 fatal fires which have "not recorded" against ignition sources, were all fatalities from the Highland and Islands who do did not record ignition sources on their fire investigation reports which were submitted to Government for publication and were provided for this research. It must be offered that this is a deficiency in their recording protocols and not down to a deficient fire investigation technique of not knowing what causes a fire.

No pattern could be identified as to why the cause of the fire was "unspecified" as the 16 fire deaths occurred in 3 different fire service areas, Highlands & Islands, but also Strathclyde and Tayside would normally record the identified source of ignition within their reports. There is always the possibility when the source of ignition can never be determined, such as when the fire damage is so extensive the initial starting point may not be identified, it is recognised that this is a possibility, and it is better to record unspecified and treat as incomplete data for analysis rather than the cause being guessed or recorded as something else. This would put all other recorded data facts under scrutiny for accuracy and quality analysis.

It is not yet possible to identify the root cause of all the discrepancies with the data, generally due to the trust put in fire investigators to identify and record the appropriate fire incident and victim details. Fire incident investigation is a "window of opportunity" the investigation must collect evidence or samples quickly before the scene is disturbed or the incident is closed and handed back to the owners. There is the potential of no second chance to find the answers to the record.

The fire investigation report, e.g., source of ignition cannot be verified by a 3rd party once the scene or incident is finished, and any 3rd party verification of data for publication must accept what is in the fire report. The professionalism, trust and integrity of the fire investigator are the baselines for future fire fatality research. The purer the data that is put into the datasets the more robust outcomes from the analysis. It remains evident that there is a weakness in the chain of data quality from source to publication.

6.2 Fire Fatality Data validation

The graphs and figures below are presented as a comparative analysis between the national publication data, publicly accessible annual reports from the fire service published via the Scottish Government, and the accumulated data analysis of the created fire fatality database.

From the publications and figures presented in Chapter 4, it was identified that 130 fire fatalities occurred in accidental dwelling fires throughout Scotland over the three years 2006 – 2008, by comparison, the research database highlights 139 fire fatalities within accidental dwelling fires for the same three-year period. Due to the statistical method of recording and publication, it was not possible to identify what additional fire fatality victim information the National publications did not account for.

For clarification, the data used to populate the database came directly from the fire service, the police investigation officers, and the pathologists' post-mortem examination reports – this data is readily available for verification as indexed in Appendix A.

Figure 25 presents data taken from national publications fire statistics Scotland for 2006 and 2007, Table 1 and Table 2, within the annual publications, 2008 figures were taken from the private communication provided by the Scottish Government for this research, due to the reports being published in the fiscal year rather than previous calendar year format.

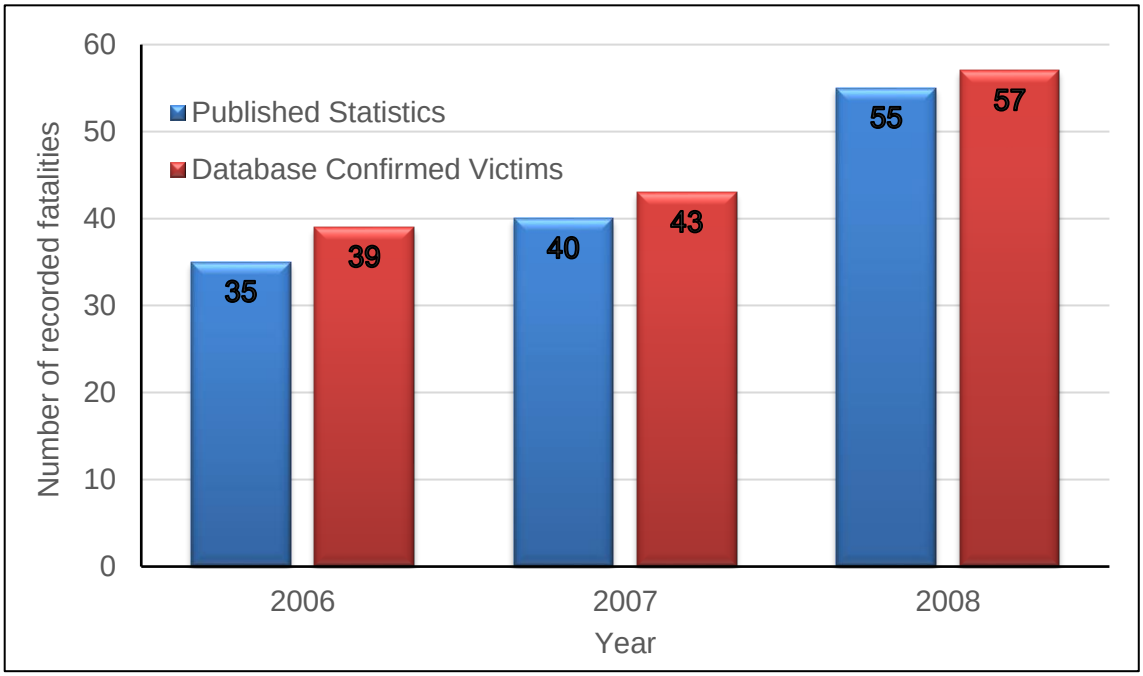

Figure 25: Fire Fatalities Comparison for Accidental Dwelling Fires 2006-2008 (Fatality Statistical Reports versus Research Fatality Database)

The figure highlights additional discrepancies between the accumulated published data and the individual source data collected and collated from each authority with the result being the misrepresentation of nine people who lost their lives to fire. This should raise concerns about the accumulation of fire fatality data being collected, collated, and verified before publication. The discrepancy was identified by cross-referencing fire fatality data provided by the different sources, fire, police, and pathologists, when an additional fire fatality was identified, not in published annual statistics.

Manual analysis was undertaken by the researcher, physically viewing data provided, and establishing what specific data was being provided by each fire service, contributing to the combined Scottish publication regarding fire fatalities.

Table 8, (information from Table 4 in a numeric format), presents the information provided by each fire service concerning the standardised Fire Investigation (FI) template in use throughout the Country. The template has the potential for the investigating officer to submit 20 pieces of direct data attributed to the individual or fire incident.

Fire Fatality Investigation Data Provided – Validation 20 Recording variables presented from the Fire Investigation Template (Appendix B)						
	Number out of 20 Data Fields			Percentage (%) Data Fields		
FIRE SERVICE	Yes	Partial	No	Yes	Partial	No
Central	14	1	5	70%	5%	25%
Dumfries & Galloway	14	1	5	70%	5%	25%
Fife	11	2	7	55%	10%	35%
Grampian	9	0	11	45%	0%	55%
Highlands & Islands	5	1	14	25%	5%	70%
Lothian & Borders	9	4	7	45%	20%	35%
Strathclyde	9	4	7	45%	20%	35%
Tayside	8	5	7	40%	25%	35%
Scotland (Average)	9.87	2.25	7.87	49%	11%	39%

Table 8: Scottish Fire Fatality Data Validation, collated from Fire Investigation reports.

The table above is reflective of the validation of data being collected by the fire service at fire incidents and this is the information that is regenerated into national statistics and published. The results provided from this manual data analysis give the following results.

Concerning the complete population of the data information fields within the Fire Investigation reports the highest performing fire services were Central and Dumfries & Galloway who provided collated data that was 70% efficient towards the report template suggestions, by contrast, the least compliant service regarding data provision was Highlands and Islands who provided 25% of the information requested on the template. The remaining five services providing fire fatality reports provided the efficiency of data provision between 40% and 55%,

The collective outcome for Scotland as a whole is represented by 49% completion for full data being recorded and provided for analysis and 60% efficiency if the part information is included. There was no other data source available at the time which could augment this information to permit the Scottish Government's annual publications to edit the statistics before being published. This missing data is also reflected within the created dataset for this research, as again, no other data source exists to provide fire incident data or information.

As a dataset providing information on people who have lost their lives in a fire; it would appear that the need for improved data collection and provision, in Chapters 3 and 4, is justified when the available data set is approximately 50% complete.

As previously mentioned, validation of the information being recorded and published is not possible at this time, uncertainty remains whether the deficient data fields are a result of incident investigators not recording the information from the scene or whether their data is not being copied or transferred over onto the accumulated Scotland wide data analysis system. In addition to the manual analysis of fire service contribution, an additional analysis was undertaken concerning what specific information, from the FI, reports, and 20 requests, are not being recorded, are their similarities with missing data or trends and observations being drawn from unsupported information.

Table 9 presents the data being collected from each service and provided for national accumulated statistical reports. The table presents the 20 criteria, as presented in Table 4 in Chapter 5, that could be recorded against and record how many times each service records against a data field as it corresponds with their fire investigation reports. As every investigation data field has been recorded against it would suggest that it is not a complete subject that is not recognised.

Fire Fatality Investigation Data Provided – Validation Incident variables presented from Fire Investigation Template (Appendix B)						
8 Fire Services	Number out of 8			Percentage (%)		
INCIDENT DATA	Yes	Partial	No	Yes	Partial	No
Date of incident	8			100%		
Time of fire call	2		6	25%		75%
Address / Postcode	6	2		75%	25%	
SIMD - Deprivation			8			100%
Property Type	5	2	1	62.5%	25%	12.5%
Owner / Occupier	2		6	25%		75%
Fatality Gender	7		1	87.5%		12.5%
Age	8			100%		
Ethnicity	1		7	12.5%		87.5%
Cause of Death	1	2	5	12.5%	25%	62.5%
Contributing Factors		5	3		62.5%	37.5%
Location of Fatality	5	1	2	62.5%	12.5%	25%
Alcohol Confirmed	4		4	50%		50%
Alcohol Level			8			100%
Cause of Fire	8			100%		
Origin of Fire	5	2	1	62.5%	25%	12.5%
Smoke Detector Present	7	1		87.5%	12.5%	
Smoke Detector Working	5	3		62.5%	37.5%	
Smoke Detector Siting	1		7	12.5%		87.5%
No. of Occupants	4		4	50%		50%
Scotland (Average)	3.95	0.9	3.15	49.4%	11.2%	39.4%

Table 9: Fire fatality incident data recorded by Scottish Fire Services; incident criteria applicable to Fire Investigation reports submitted.

The analysis concludes that all fire and rescue services respond by the date of the incident, the age of the victim, and the cause of the fire (caution – an entry may include unknown, other, or unspecified) with 100%, all 8 fire and rescue services recording against these incident details, by contrast only 1 fire and rescue service records data against the ethnicity of the victim or their cause of death and where a smoke detector was installed within the home. The results per subject ranged between 100% provision for information such as date of the incident, age of the victim, and cause of the fire to 0% for fatality alcohol consumption and social deprivation scale where the fire occurred. The majority of fire services record only the fire victim's location, they do not record the gender.

As has been mentioned previously, the window of opportunity to collect information or samples from a fire scene may be limited. Once the investigation is deemed complete and the house is passed back to the owners for cleaning or renovation the potential opportunity to collect more information has gone. Similar to the information concerning the victim, once the funeral has taken place the opportunity to take samples for example has passed.

An identified pattern is that Highland and Island fire investigation reports do not ever include fatality gender, the room of origin of the fire, or the property type in which the fire started. There are no other distinct patterns where a subject or information line is omitted by all investigation reports, but rather it is random what each service is recording and what not recording. Verification and quantity/quality of fire fatality data is needing to be addressed for the accuracy of published reports and research analysis being undertaken to identify remedial measures for the instances of increased dwelling fire deaths and injuries that are occurring throughout Scotland.

Following the previous data analysis undertaken by physical and manual application, a computer-assisted analysis was undertaken on some of the data sets, namely fire deaths per year, victim's age, and the social deprivation scale relating to the address of the fire incident. As the dataset was presented within an excel workbook, the built-in function for data analysis was run, and the results are given below.

The data for deaths per year was run to produce frequency and cumulative percentage results in Table. The results depict the same outcome as the manual analysis undertaken in that the number of fire fatality deaths has increased year on year for the three-year dataset analysed within this project.

Table 10 presents these results as frequency and cumulative.

Year	Frequency	Cumulative %
2006	39	28.06%
2007	43	58.99%
2008	57	100%
More	0	100%

Table 10: Fire deaths per year, frequency and cumulative percentage, Excel program data analysis.

The program was run against the 139 fire deaths that populated the created dataset and the fatality and incident data combined as validated and verified data as was possible at the time.

Figure 26 presents the frequency and cumulative outcomes as representing the total number of fatalities recorded against the year in which they died in the fire.

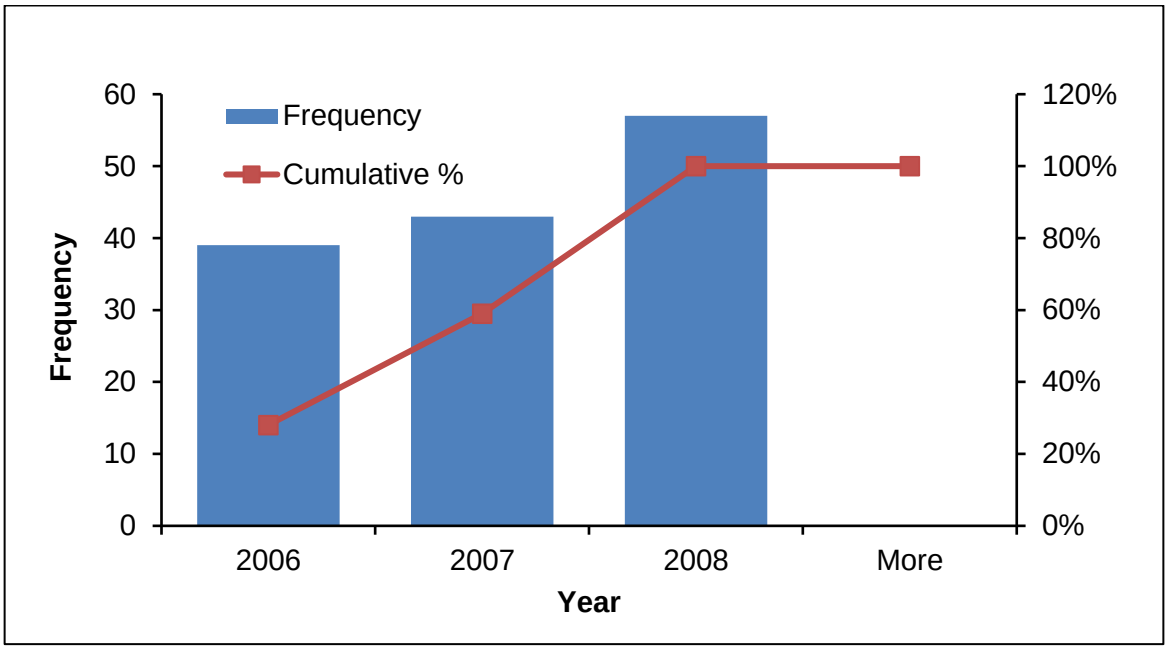

Figure 26: Scottish Fire fatality by Totals, Frequency & Cumulative %, generated from Database via Excel data analysis.

The second category to undergo this analysis is related to the age of fire fatalities and the outcomes generated from the results are represented in Table 11.

Age/Year	Frequency	Cumulative %
10	2	1.44%
20	5	5.04%
30	8	10.79%
40	10	17.99%
50	22	33.81%
60	30	55.40%
70	24	72.66%
80	24	89.93%
90	12	98.56%
100	1	99.28%
More	1	100%

Table 11: Age of fire death victim, frequency and cumulative percentage, Excel program data analysis.

It can again be seen that the aggregated age groups above 60 would represent the majority of fire fatality deaths however as previously highlighted within this research if a ten-year age banding was applied; the population age group most at risk from a fire would be the adults who were within the 50 – 59 years of age group.

Figure 27 presents the results in a graphic format of frequency and cumulative.

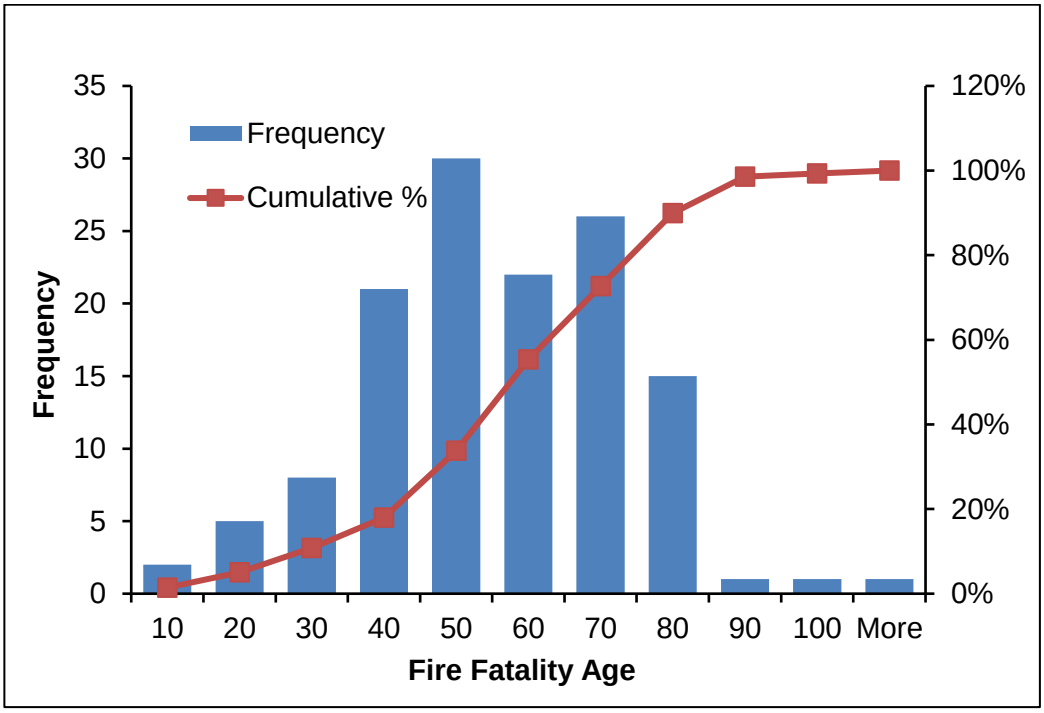

Figure 27: Scottish Fire Fatality by Age, frequency, and Cumulative %, produced via the database excel data analysis

The last category to undergo this analysis was social deprivation, of fire victims by using the address and location of the fire incident, as previously explained this data was not available from fire service reports or publications and the results had to be generated by the researcher specifically for this project. As has been previously discussed throughout this thesis there is a negative relationship between socially deprived communities and fire incidents which result in fire deaths.

Table 12 presents the Scottish Index of Multiple Deprivation (SIMD) results. Vigintiles split Scotland's 6976 data zones into 20 groups, each containing 5% of Scotland's data zones.

SIMD (Vigintile)	Frequency	Cumulative %
5	64	46.04%
10	43	76.98%
15	21	92.09%
20	11	100.00%
More	0	100%

Table 12: Deprivation index of fire death victims, frequency, and cumulative percentage.

Figure 28 presents the results of the 139 fire deaths within a graphic format for where the victim's social outcome or the government's scale of deprivation throughout the country has perceived them to be represented.

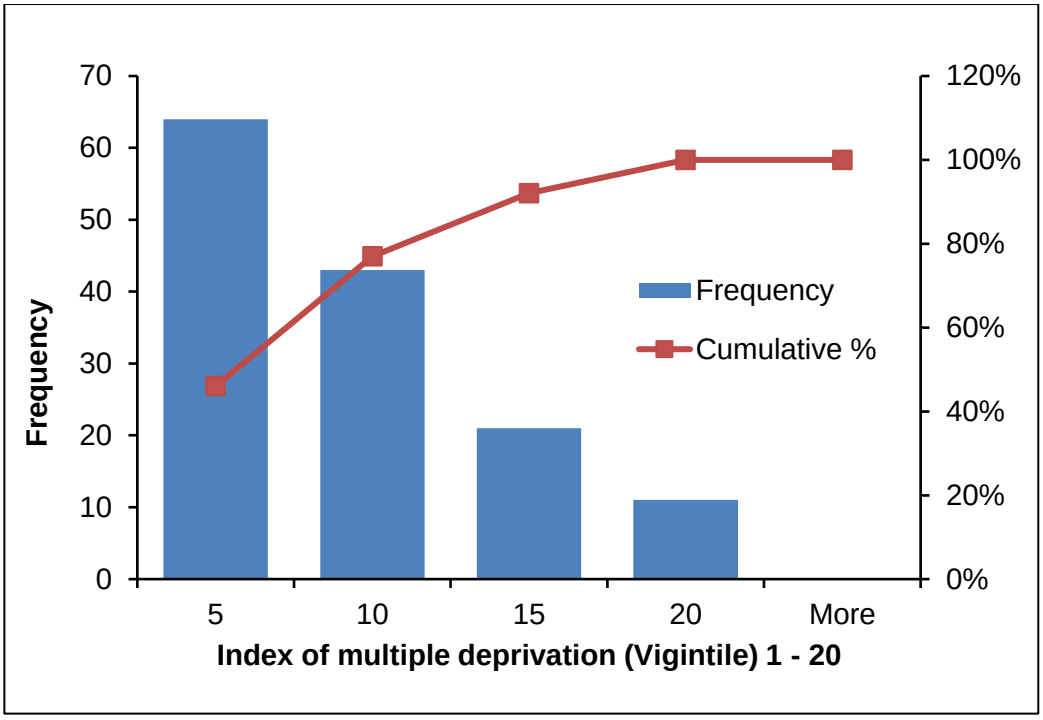

Figure 28: Scottish Fire Fatality by deprivation, frequency, and Cumulative %, produced via database excel data analysis

It is evident that the majority of fire deaths occur within the lowest level quartile of deprivation, lower than 5, on the index scale and the vast majority 77% of fire deaths are within the lower half of the deprivation scale index with an outcome of less than 10. The Scottish Index of Multiple Deprivation (SMID) is a relative index measure of how one postcode area is more or less deprived than another, it does not provide a value of how much more or less a postcode area is deprived compared to another.

6.3 Fire Fatality Age Validation

The age of a fire fatality is a common research-reported outcome, as previously discussed from research (Chapter 3) undertaken around the world, the conclusions report that the people most at risk from dying in a fire in their home are the elderly, and in most cases will be recorded as older than 60 years of age. As has been represented in this research in Figure 30 the predominant age for fire fatalities if analysed by decade age groups would be 50-59 years of age and generally males.

The intention is to broaden the scope of age justification of fire fatality victims in that the database filters are set to identify the young and old fire victims. It was decided to compare fire deaths for those above 60 and young persons below 17 years of age (commonly reported outcomes of the young and elderly most at risk) and compare the results against the age group of 18 - 59 the outcomes reflect by comparison that the fire deaths of the young and old do represent almost half of all fire fatality victims.

- Publication 2006 – 19 of 52 fire deaths compared to 33 deaths
  (36.5% of fire fatalities would be classed as elderly or young)
- **Database 2006** – 18 of 39 fire deaths compared to 21 deaths
  (46.1% of fire fatalities would be classed as elderly or young)

- Publication 2007 – 28 of 58 fire deaths compared to 30 fire deaths
  (48.3% of fire fatalities would be classed as elderly or young)
- **Database 2007** – 21 of 43 fire deaths compared to 22 fire deaths
  (48.8% of fire fatalities would be classed as elderly or young)

- Publication 2008 – 32 of 70 fire deaths compared to 38 fire deaths
  (45.7% of fire fatalities would be classed as elderly or young)
- **Database 2008 -** 28 of 57 fire deaths compared to 29 deaths
  (49.1% of fire fatalities would be classed as elderly or young)

Figure 29 presents the data comparison of age groups between the published statistical reports and the created database.

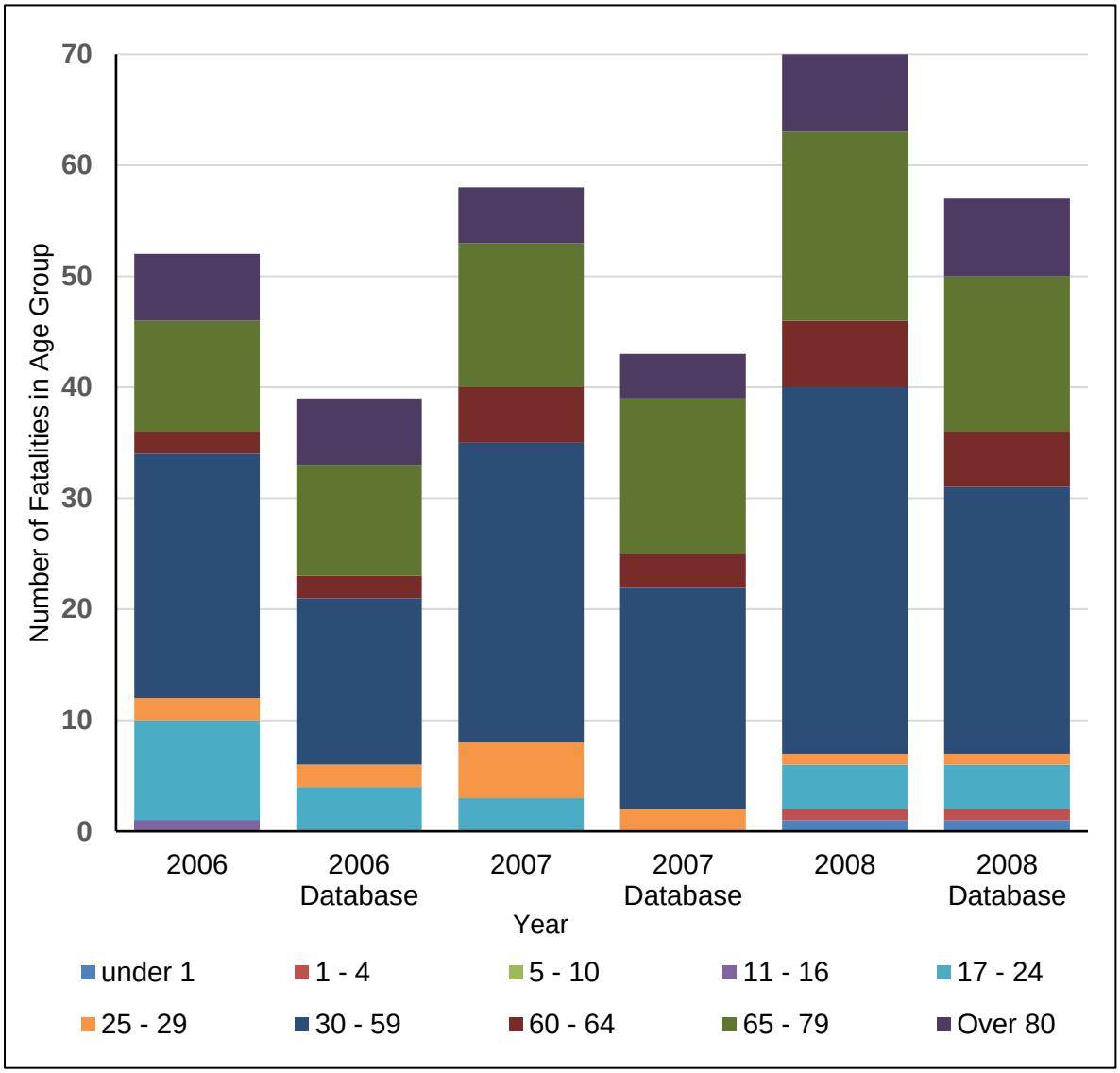

Figure 29: Fire Fatalities by Age Group (Fatality Statistical Reports versus Research Fatality Database)

The basic analysis of fire death data by age even though the subject fields were different due to data available from national publications, did not provide accidental dwelling fire deaths in age categories, it remains true that statistically the account of the elderly or young being most vulnerable in fire has to be further analysed, in all basic calculated outcomes over 50% of fire fatalities are in the middle age group of 18 to 59 years, although it could be contested if % age group concerning population was added into the equation. Generally, a 42-year age span (18 – 59) accounts for more deaths than a 57+ year age span (0 – 17 + 60 – 100+). It would be offered from this research that fire safety intervention programmes and initiatives

should consider equally the intervention advice to the population within the middle age group identified.

An additional fire fatality age analysis was undertaken on the 139 fire deaths included within the created database, the additional analysis changed the age group recording presented in national publications, into age groups in 10-year segments.

Figure 30 presents the results produced from this analysis:

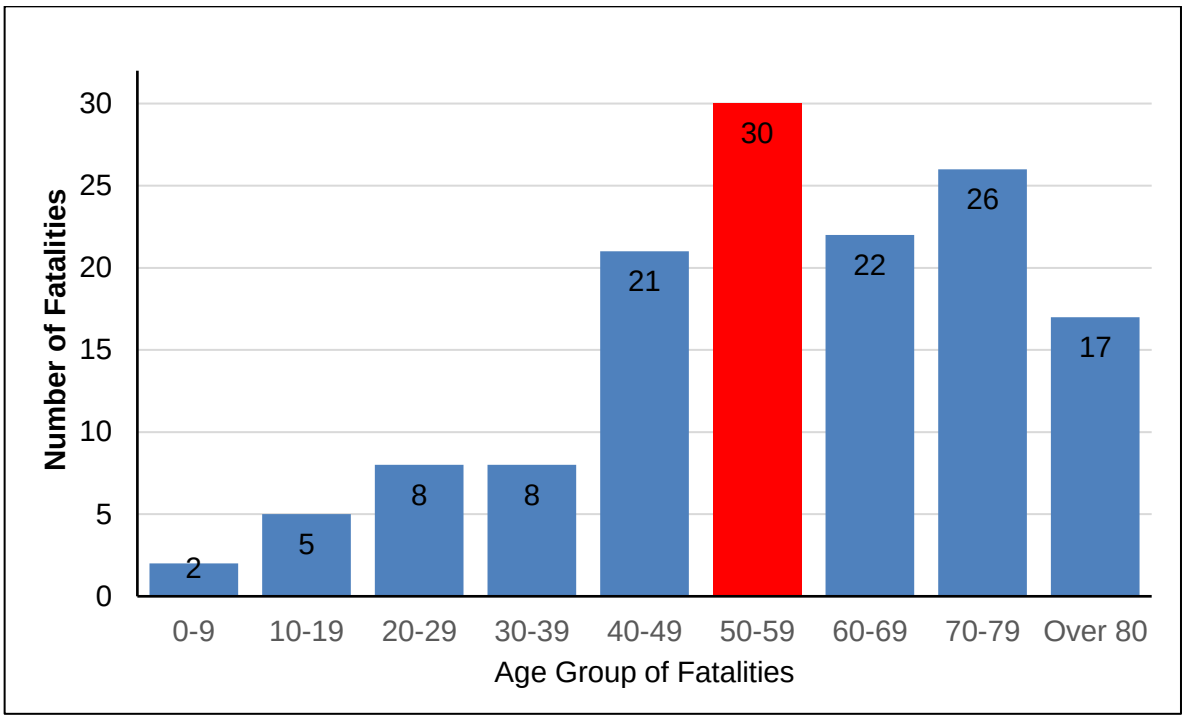

Figure 30: Scottish fire fatalities (2006-2008) represented in decade age groups, from the research database.

There were 65 fire fatalities over 60 years of age and seven deaths of young people less than 20 years of age, giving a total of 72 deaths (51.8%) of the 139 fatalities recorded were either elderly or young. An outcome that reflects the use of statistical single-source data can produce different outcomes, using this grouping has put the elderly and young risk outcomes over 50%.

Another key outcome of this analysis would be to define by decade age group the most vulnerable to become a fire fatality, and on this occasion, it would be the 50 to 59-year-old occupants of dwellings.

It is important to consider the age group as proportionate to the population of the Country. How many fire fatalities occurred within each age group but how does the number of fire

deaths relate to their population within the same age group? The tables and figures below present fire fatality data by age, but in the context of the Scottish population within the years 2006, 2007 and 2008.

Table 13 presents the Scottish population totals for the nine different age groups used for determining the age groups of residents who are most at risk of becoming a fire death statistic.

Scotland Population by Age Group 2006 - 2008			
Age Group	**2006**	**2007**	**2008**
0 - 9	551,063	551,339	554,294
10 - 19	635,442	636,178	632,915
20 - 29	650,580	668,113	683,165
30 - 39	708,243	691,363	676,401
40 - 49	786,388	796,177	802,987
50 - 59	682,961	678,060	680,406
60 - 69	524,877	548,335	564,374
70 - 79	381,391	385,475	390,445
Over 80	212,055	214,960	217,913
Totals	5,133,000	5,170,000	5,202,900
https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/population-estimates-time-series-data			

Table 13: Scottish population totals for 2006 – 2008

The population has not changed dramatically with an increase of 70,000 over the three years, with fewer 10-19 years, 30-39 years and 50-59 year old people recorded as the years progressed. The aim was to produce a measurable scale where the number of fatalities within a particular age group would be calculated against the age group population for that year and achieve a percentage (%), this would result in the % of people within that age group who were dying in house fires.

Table 14 presents the Calculated outcome results for each of the nine age groups, the fire deaths per age group were taken from the research database and a percentage was calculated against the appropriate Scottish population figure from Table 13. The fire fatality numbers

were small in comparison to the population. To get a number that could be compared and displayed for analysis the resultant % was multiplied by 1000 which removed the decimal point from all outcomes.

Fire Deaths by Age Group by Individual Years and Population Groups					
AGE	**2006 Population**	**Fire Deaths**	**%**	**X 10000 to display**	**Risk Age Group Ranking**
0 - 9	551,063	0	0	**0**	1- Lowest Risk
10 - 19	635,442	2	0.0003	**3**	3
20 - 29	650,580	4	0.0006	**6**	6
30 - 39	708,243	4	0.0006	**6**	6
40 - 49	786,388	2	0.0003	**3**	3
50 - 59	682,961	9	0.0013	**13**	7
60 - 69	524,877	3	0.0006	**6**	6
70 - 79	381,391	9	0.0023	**23**	8
Over 80	212,055	6	0.0028	**28**	9 – Highest risk
Totals	5,133,000	**39**			
AGE	**2007 Population**	**Fire Deaths**	**%**	**X 10000 to display**	**Risk Age Group Ranking**
0 - 9	551,339	0	0	**0**	1 – Lowest Risk
10 - 19	636,178	0	0	**0**	1 – Lowest Risk
20 - 29	668,113	2	0.0003	**3**	3
30 - 39	691,363	3	0.0004	**4**	4
40 - 49	796,177	11	0.0014	**14**	6
50 - 59	678,060	6	0.0009	**9**	5
60 - 69	548,335	10	0.0018	**18**	8
70 - 79	385,475	7	0.0018	**18**	8
Over 80	214,960	4	0.0019	**19**	9 – Highest Risk
Totals	5,170,000	43			
AGE	**2008 Population**	**Fire Deaths**	**%**	**X 10000 to display**	**Risk Age Group Ranking**
0 - 9	554,294	2	0.0004	**4**	4
10 - 19	632,915	3	0.0005	**5**	5
20 - 29	683,165	2	0.0003	**3**	3
30 - 39	676,401	1	0.0001	**1**	1 – Lowest Risk
40 - 49	802,987	8	0.0001	**1**	1 – Lowest Risk
50 - 59	680,406	15	0.0022	**22**	7
60 - 69	564,374	9	0.0015	**15**	6
70 - 79	390,445	10	0.0026	**26**	8
Over 80	217,913	7	0.0032	**32**	9 – Highest Risk
Total	**5,202,900**	**57**			

Table 14: Calculated fire deaths % for age group within the population and the resultant risk ranking

The table shows the results expressed in numbers between 0 and 32. The ranking was then applied in the last column which represents the age group most at risk of dying in a house fire as 9 and the least at-risk age group represented by 1.

Figure 31 presents the results of the calculated 5 outcomes of fire deaths per population age comparison. The outcome for 0-9 years in 2006 and 2007 had no fire deaths recorded as was the case for 10-19 years olds in 2007.

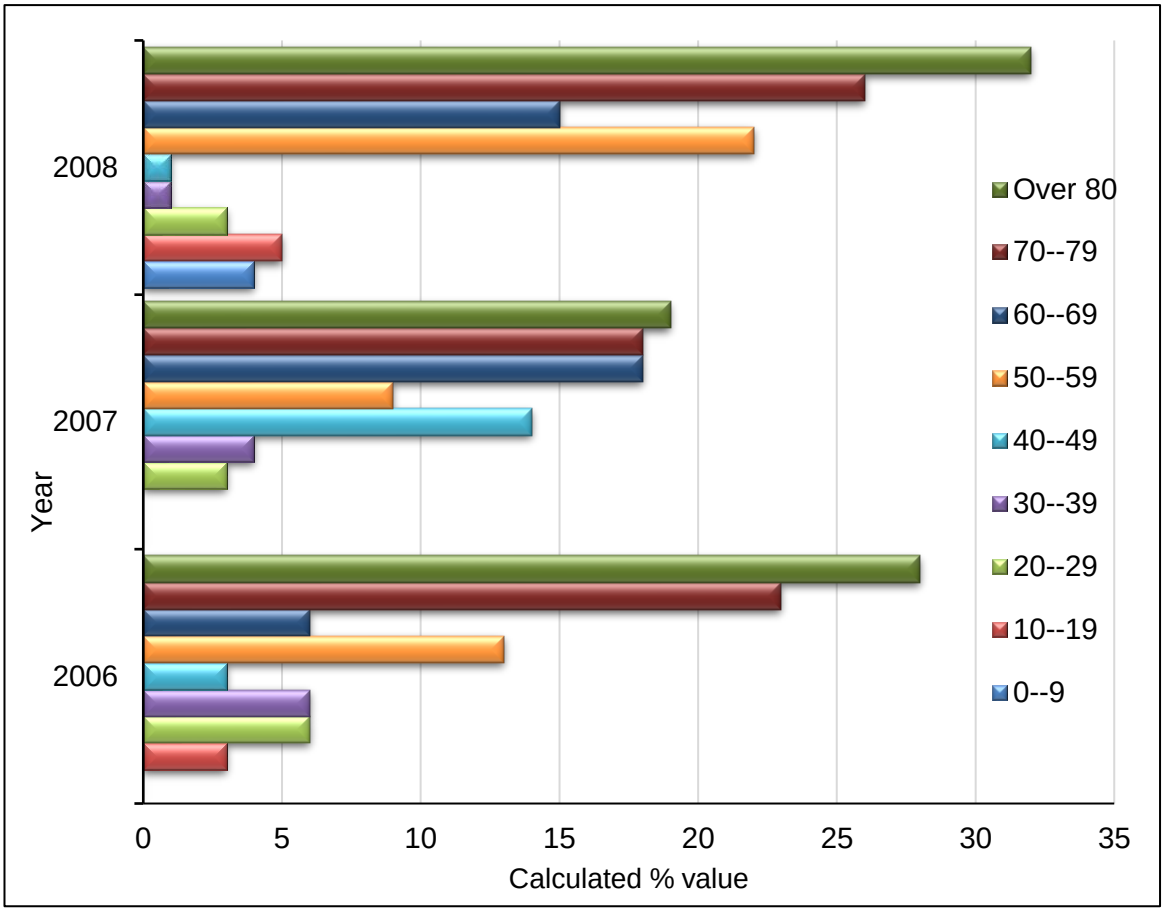

Figure 31: The calculated fire fatality age group per percentage of the population age equivalent

The result has dramatically altered the at-risk age groups for potential fire fatalities, whereas direct statistical analysis highlighted the 50-59 years of age the realistic approach of population comparison has highlighted every year the over 80 age group is at the highest risk, then the over 70s. Some fluctuation exists in the next age groups of 50-59 and 60-69 trading places for the 3rd highest risk over the three years.

To draw an additional comparison the combined fire deaths for each age group were calculated against the combined three-year population to provide a percentage of fire deaths over the three years coinciding with the three-year equivalent population for the Country. The calculations were conducted in a similar way to the previous, as presented in Table 14.

Table 15 presents the calculated outcomes of the collective fire deaths per age group against the age group appropriate for the three years.

Scotland Population by Age Group 2006 - 2008						
AGE	**2006**	**2007**	**2008**	**2006- 2008**	**Fire Deaths**	**%**
0 - 9	551,063	551,339	554,294	1,656,696	2	0.00012%
10 - 19	635,442	636,178	632,915	1,904,535	5	0.00026%
20 - 29	650,580	668,113	683,165	2,001,858	8	0.00039%
30 - 39	708,243	691,363	676,401	2,076,007	8	0.00038%
40 - 49	786,388	796,177	802,987	2,385,552	21	0.00088%
50 - 59	682,961	678,060	680,406	2,041,427	30	0.00147%
60 - 69	524,877	548,335	564,374	1,637,586	22	0.00134%
70 - 79	381,391	385,475	390,445	1,157,311	26	0.00224%
Over 80	212,055	214,960	217,913	644,928	17	0.00263%
Total	**5,133,000**	**5,170,000**	**5,202,900**	**15,505,900**	**139**	

Table 15: Calculated fire deaths % for age group and combined three years within the population and the resultant risk ranking

Table 16 presents the outcomes of the collective fore deaths of the three years, 2006 – 2007 – 2008 combined.

Fire Deaths by Age Group and Population – Collective Three years					
2006 – 2008 combined fire deaths by combined population 139 deaths – 15,500,900 population					
AGE		**Fire Deaths**	**%**	**X 10000 to display**	**Risk Age Group Ranking**
0 - 9	1,656,696	2	0.00012%	1	1 – Lowest Risk
10 - 19	1,904,535	5	0.00026%	3	2
20 - 29	2,001,858	8	0.00039%	4	4
30 - 39	2,076,007	8	0.00038%	4	4
40 - 49	2,385,552	21	0.00088%	9	5
50 - 59	2,041,427	30	0.00147%	15	7
60 - 69	1,637,586	22	0.00134%	13	6
70 - 79	1,157,311	26	0.00224%	22	8
Over 80	644,928	17	0.00263%	26	9 – Highest Risk
Totals	15,505,900	139			

Table 16: Calculated fire deaths % for age group within the population three years combined and the resultant risk ranking

The combined outcome from the calculations presented in Tables 15 and 16 have been used to show the results collectively within a graph in Figure 32.

Figure 32 presents the age group which is rated the highest risk category to succumb to a dwelling house fire.

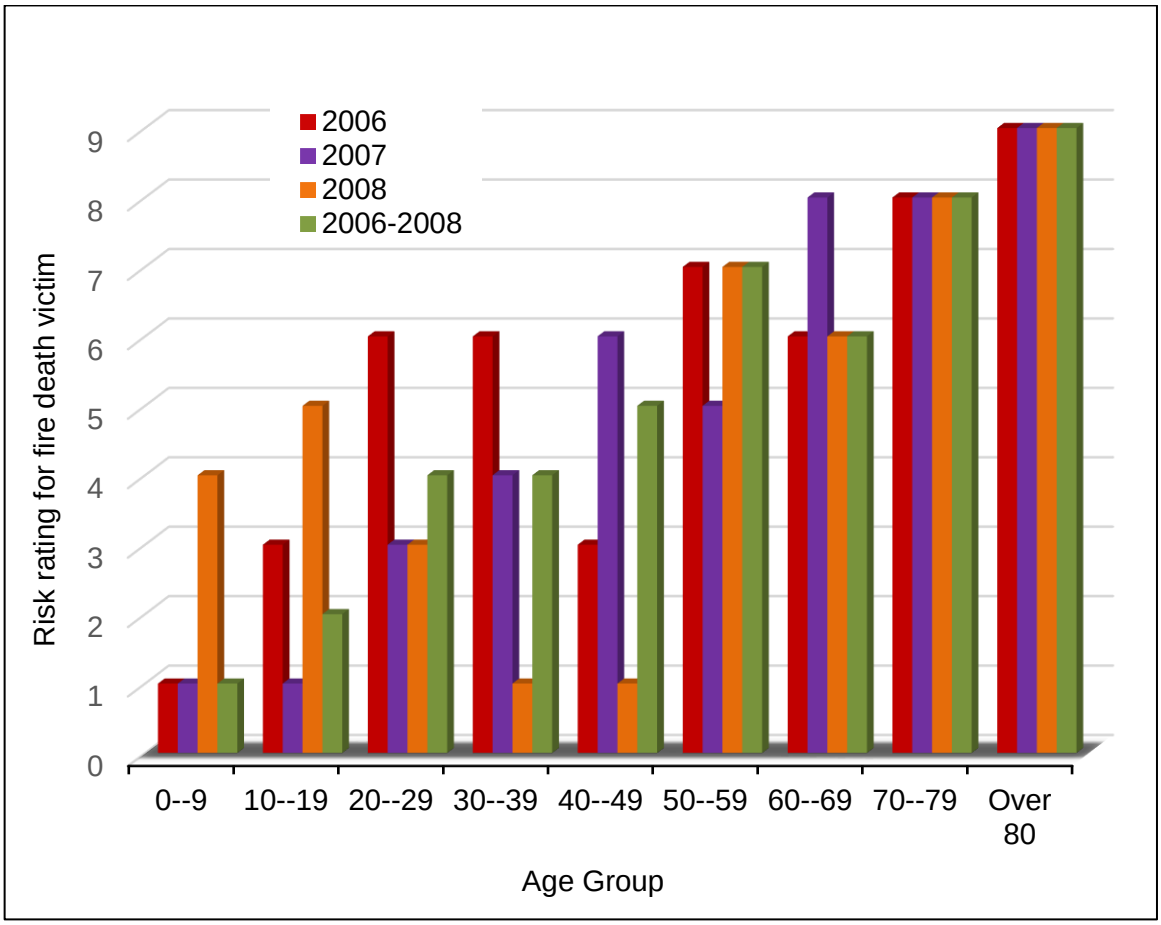

Figure 32: Combined high-risk fire fatality by age/ by population individual years and the 3-year collective.

The results are consistent, which could be expected as the calculated % against the population numbers for each age group. The over-70 and all over-80 age group are the highest at-risk people in the Country who may succumb to a fire in their home. The statistical age group of 50-59 is the constant 3rd at-risk group over the years.

6.4 Fire Fatality Alcohol Consumption and Deprivation Validation

The same dataset results provided by the 8 different fire services, Table 4, was again used in this analysis example with the addition specifically for alcohol confirmed and the Scottish Index of Multiple Deprivation (SIMD). The inclusion of external source data for these responses was considered appropriate, as Alcohol is a contributing factor in fire deaths and the highest proportion of fire deaths occur in dwellings within socially deprived

communities, two statements that reflect the outcome of fire fatality research and publications not just in Scotland or the UK but are common themes throughout different countries including America, Australia, and European countries, as discussed in Chapter 3 and 4.

The recording of alcohol consumption being suspected was only provided by 4 fire services 50% of the available data source, and no fire service recorded the outcome of toxicology results which confirmed or otherwise if alcohol or the level of alcohol within the victims' blood could be considered as a contribution to their death in a fire. The social deprivation linked to increased house fires and the instances of fire deaths and injuries can be considered, the national publications for fire deaths and injuries for 2006 – 2008 had no records or information on social deprivation provided within the statistical reporting by any fire service in Scotland.

The relationship between alcohol and social deprivation and resultant fire deaths both appear in research reports and news headlines,

"The likelihood of fatalities and serious injuries increases when there is suspicion of impairment due to drugs or alcohol", BRE Briefing Paper (2019)

Press coverage of a report being published by Strathclyde in 2005, the year before the 3-year database fatalities, made the statement; -

"Strathclyde Fire and Rescue said in a new report it was determined to slash the number of fire deaths and sever the link between house fires and alcohol".
BBC NEWS | Scotland | Alcohol-related fire deaths drive

Press coverage of a report published by Strathclyde in 2011, three years after the three-year database fatalities, made the statement; -

Chief Fire Officer "He said smoking, cooking and heating were factors but "alcohol" was the main reason why people lost their lives".
Alcohol blamed for Strathclyde fire tragedies - BBC News

By cross-referencing data provided from post-mortem reports and fire incident data, it was possible to record some outcomes of alcohol blood analysis results but even then, only 50% availability for data provision was achievable. In the absence of a specific alcohol level, an assumption is taken that the drinking and driving limits in Scotland [48] are: 50 milligrams of alcohol per 100 millilitres of blood or 67 milligrams of alcohol per 100 millilitres of urine, blood and urine analysis included in post-mortem results when taken.

It was interesting to compare the concern with alcohol-related fire deaths in the years before and after the research period and how this was reflected when the database of fire fatalities was analysed for the contribution of alcohol to their outcome. Alcohol-suspected and alcohol-confirmed data were taken from the additional fire fatality reports provided by the fire services and the pathology post-mortem reports and toxicology results. (Over 18 years old)

Database – 137 fire fatalities, alcohol suspected 43, alcohol confirmed 21 (15.3%)

2006 – (18-85) 39 fire fatalities, alcohol suspected 14, alcohol confirmed 5 (12.8%)

2007 – (27-89) 43 fire fatalities, alcohol suspected 12, alcohol confirmed 7 (16.3%)

2008 – (18-101) 55 fire fatalities, alcohol suspected 17, alcohol confirmed 9 (16.4%)

2007 – reduced by 1 case to 6 (14) as the blood and urine levels were below 50 and 67mg

2008 – reduced by 1 case to 8 (14.5%) as blood and urine levels were below 50 and 67mg

This research is not discounting the relationship between alcohol consumption and fatal fire victims, rather it would contest that the issue of alcohol is under-reported, as only 50% of the fire investigations recorded a consideration of alcohol as a contributing factor in the fatality. Although it is a pathologist's role to take blood for toxicology testing at the post-mortem not all adhere to this code of practice and again the outcome of results available to analyse for research is reduced, of the 139 fire death reports requested only 34 reports provided the toxicology results as 21 confirmed and 13 tested negative for alcohol.

The direct relationship between fire deaths and alcohol consumption has not been proven at this time. The need for more comprehensive data relating to the confirmed toxicology for alcohol within a fire victim is required before the statements being made in fire service reports and press conferences can be justified.

Social deprivation is mentioned along with alcohol as a contributing factor for fire fatality victims in that, the *"Scotland Together"* report highlights.

"Of all the accidental dwelling fire deaths, 31% occurred in the Scottish Index of Multiple Deprivation 15% most deprived areas. This demonstrates that people in the poorest areas of Scotland are more likely to die in a house fire than those living in more affluent areas".

As no records or reference to the scale of deprivation apportioned to a dwelling fire was made available from the National statistical publication the reliance was on the researcher to self-populate the database by assigning a Scottish Index of Multiple Deprivation (SIMD) scale to each fire fatality.

By manually inserting each postcode, one by one and the interactive tool generates scale results, between 1 and 20, with one being the most deprived communities and 20 the least deprived, the database was able to assign a deprivation scale to most fire fatalities or rather their address. The six deaths reported from Highlands and Islands provided insufficient information to obtain a postcode, no address or any other information which could assist.

Database – 133 fire fatalities,

1 – 5 = 58 (44%), 6 – 10 = 43 (32%), 11 – 15 = 21 (16%), 16 – 20 = 11 (8%)

2006 – 39 fire fatalities,

1 – 5 = 16 (41%), 6 – 10 = 11 (28%), 11 – 15 = 7 (18%), 16 – 20 = 5 (13%)

2007 – 41 fire fatalities,

1 – 5 = 18 (44%), 6 – 10 = 13 (32%), 11 – 15 = 8 (19%), 16 – 20 = 2 (5%)

2008 – 53 fire fatalities,

1 – 5 = 24 (45%), 6 – 10 = 19 (36%), 11 – 15 = 6 (11%), 16 – 20 = 4 (8%)

The results reflect the previous outcomes and the recognition that social deprivation is a contributing factor regarding dwelling fire incidents and the fatal outcome for the occupants. The outcome of 44% of all fire fatalities, 58 deaths, within the study who were living in houses/ communities which represented the lowest quartile of social deprivation throughout Scotland, and 76% which represents 101 fire deaths occurred within the lower half of Scotland's deprived communities. The upper half of the deprivation scale from SIMD 11-20 accounted for 32 deaths, 24% of the total 133 fire fatalities that could be analysed with the database.

Whereas the link with alcohol was inconclusive without additional data to review the social deprivation contribution to fire deaths in Scotland is unquestionable and an area of intervention to focus on for future fire safety initiatives.

6.5 Fire Fatality Perception

Common assumptions and public awareness information campaigns are being promoted to provide information about fire safety in the home and subsequently to be proactive in the quest to reduce dwelling fires, fire deaths and injuries. The most common examples include fire deaths mainly in the elderly population, alcohol being a major contributing factor, or most fire deaths occurring in socially deprived areas.

6.6 Additions to Dataset Identified

This research offers a proposed extended dataset database for future recording of Scottish fire deaths. The proposed additions have the intention that with continued discussion and research around fires and fire deaths and the current considerations that there is a need for more in-depth analysis of fire deaths and injuries and into the actual fire science of the incidents the availability and access to this data could provide additional progress towards reduction strategies or improvements for the health and well-being of occupants in a fire.

The initial action to address, as discussed previously, would be to ensure present data fields are accurate, completed and verified, this would permit a robust analysis to be undertaken. By identifying what other information could be included within the database, it is important to initially identify, findings from research undertaken, the relevance of including the additional data and what would it contribute to the analysis or future outcomes, and secondly where would this additional data be sourced.

Concerning fire fatalities, the identified additional data would be sourced from the Post-mortem reports, as mentioned in Chapter 5, full post-mortem examinations and toxicology screening should be undertaken for all Scottish fire fatalities as required by the Procurator Fiscal. The basic blood test analysis report would provide levels of alcohol present in the blood, and any prescribed or illegal substances consumed by the occupant before death; additionally, blood toxicity screening could be extended to include testing for levels of carboxyhaemoglobin, carbon monoxide in blood and concentrations of hydrogen cyanide present.

These additional dataset results are either currently available as they are required by the Procurator Fiscal or in the case of hydrogen cyanide, the test is common and would just

require direction to the lab to perform the test on the blood sample provided. If such additional data was made available for analysis, an investigation could be made on the extent that alcohol or other substance may have had on the occupant's ability to respond to the fire or reaction concerning trying to escape. The blood screening results which could confirm the presence or concentrations of hydrogen cyanide or other substances including known carcinogens would augment our understanding of exposure, to the smoke, within a dwelling fire, either contributing to death or injury for the occupants.

A proactive approach to further understanding would incorporate the additional data relating to samples being taken at the fire scene, our understanding and knowledge of fire deaths and injuries could be enhanced with information regarding the fire and specifically, the smoke being produced, swab and laboratory analysis of soot, ash and debris together with environmental monitoring analysis, could provide factual results, to augment experimental results from test fires, on the various products of combustion produced within certain dwelling fires.

Figure 33 presents the additional data columns added to the existing database, these additional results could be filtered concerning additional criteria to be compared with, e.g., how many fire fatalities aged over 50 had excessive alcohol consumption in their system and had inhaled excessive levels of carbon monoxide or hydrogen cyanide during the fire?

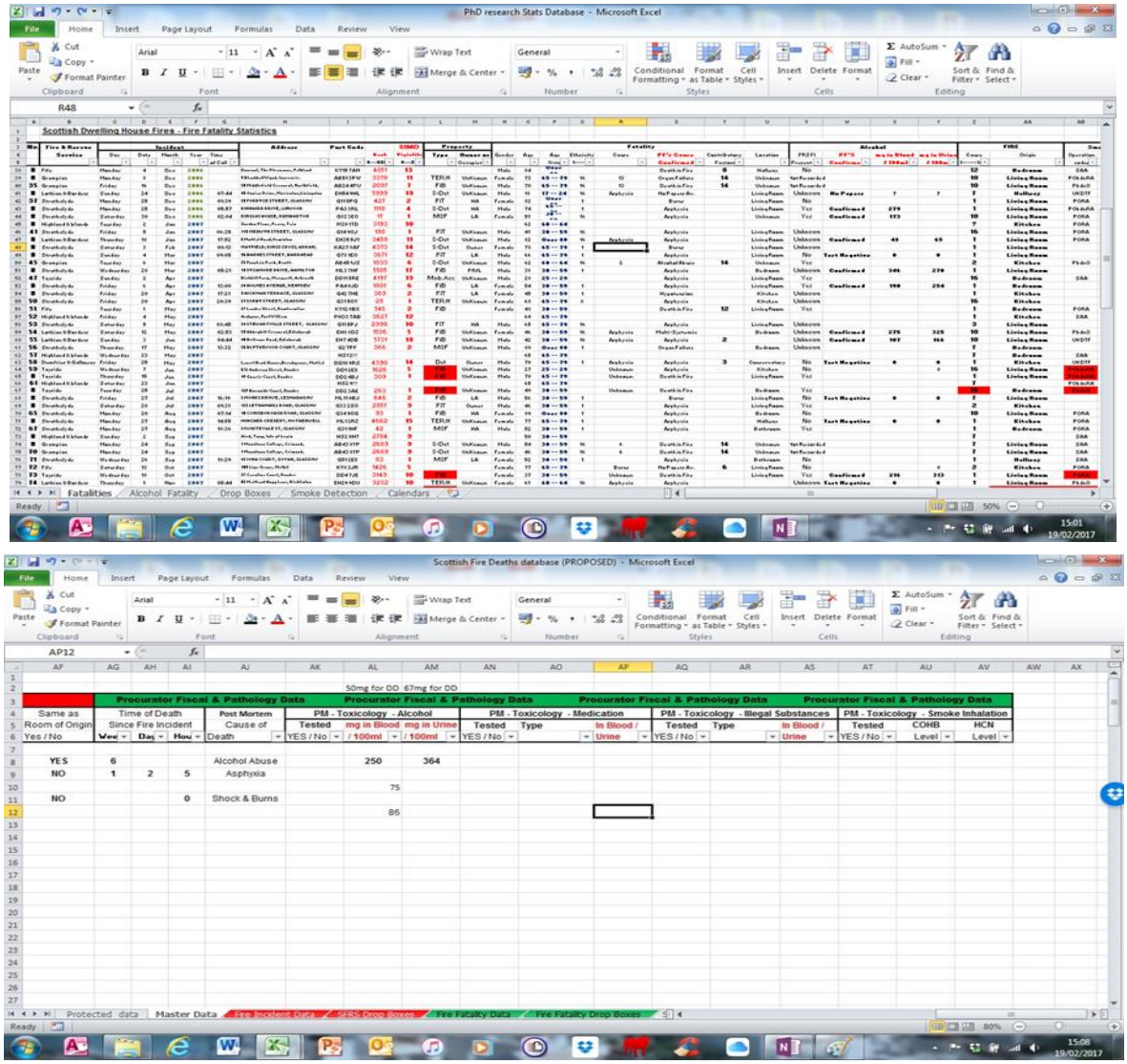

Figure 33: Scottish Fire Fatality (injury) database additional dataset columns proposed

The acceptance of dataset additions relating to fire scenes and the toxicology of victims could very simply be extended to incorporate the same samples being drawn from incidents or individuals when it was a casualty rather than just a fatality. Fire casualties routinely get blood analysis for carboxyhaemoglobin levels, as confirmed by the A&E Consultant interviewed for this research, Chapter 7, 7.5.3, and possible testing for HCN, depending on the patient's medical condition.

These results are recorded on the NHS database of patient records, and potentially available for research analysis, if an agreement was reached to routinely run blood screening on fire casualties, a database could be enhanced to incorporate 900 fire incident details per annum rather than just under 50, fatal fires annually in Scotland.

No information is available or collected at present throughout Scotland on the toxicity of smoke either at the fire incident or from the fire victims themselves, limited blood screening of fire fatalities takes place concerning alcohol/drugs or for additional medications. These test results generally do not get published or incorporated in the annual statistical and analysis reports, the intention would be to influence change in a positive information-sharing protocol to improve health and well-being.

Table 17 presents the results produced from the database which either agree or conflict with the public perception of fire fatalities as reported by the fire service or it provides a comparison with the fire service recorded data and the pathologists' reported data relevant to the fire fatality. The database results should provide an insight into what analysis could be drawn if data and information were quality controlled for completion and accuracy and if the different datasets available could be combined into a single usable analysis tool.

Fire Service FI Reports and Datasheets – 139 Fire Deaths in Dwellings				
Fire Fatality	Over 65	Adult 18 - 64	Child Under 16	Not Recorded
Age	55 deaths	82 deaths	2 deaths	
Gender	M–24 F–25 6?	M–51 F-20 11?	M -? F -?	19 14%
Cause of Death	Burns = 4 Burns/Smoke = 2 Smoke = 10	Burns = 3 Burns/Smoke = 3 Smoke = 17	Burns =? Burns/Smoke =? Smoke =?	39 + 59 + 2 = 100 72%
Location Room Found	Living room = 15 Bedroom = 10 Kitchen = 9 Other = 10	Living room = 26 Bedroom = 9 Kitchen = 10 Other = 8	Living room =? Bedroom =? Kitchen =? Other =?	11 + 29 + 2 = 42 30%
Time of Fire 08:00- 23:00 23:00- 0800	Day = 24 Night = 13	Day = 22 Night = 29	Day =? Night =?	18 + 31 + 2 =51 37%
Alcohol/ drugs	Yes = 11 No = 19	Yes = 32 No = 13		25 + 37 = 62 44%
Cause of fire Ignition	Smoking – 26 Cooking – 8 Electrical – 9 Other - 8	Smoking – 32 Cooking – 19 Electrical – 9 Other - 7	Smoking - 1	4 + 15 +1 = 20 14%
Deprivation Poor 1 >20 SIMD Vigintile	1 > 5 = 23 6 > 10 = 17 11 > 15 = 9 16 > 20 = 3	1 > 5 = 35 6 > 10 = 25 11 > 15 = 11 16 > 20 = 8	1 > 5 = 0 6 > 10 = 1 11 >15 = 1 16 > 20 = 0	3 + 3 = 6 4%
Pathologist Post Mortem Reports				
Cause of Death	Burns = 4 Burns/Smoke = 1 Smoke = 27 Other = 15	Burns = 4 Burns/Smoke = 0 Smoke = 38 Other = 26	Burns =? Burns/Smoke =? Smoke =?	8 + 14 + 2 = 24 17%
Alcohol/ drugs	Positive = 6 Negative = 7	Positive = 15 Negative = 6		42 + 61 = 103 74%

Table 17: Scottish fire fatality (accidental dwelling fires) database analysis and comparison of complete and incomplete data fields.

In contrast to public information, most fire fatalities are elderly; most fatal fires are caused by smoking materials, most fatal fires result during the night in bed and alcohol is the main contributing factor which is suspected for fire fatalities.

The contradiction to these perceptions is evident if the database search/filter is applied. For example, smoking materials cause the most fatal fires – 139 fatalities, 66 died from smoke inhalation/asphyxia = 47.5% which is the highest single cause.

Although some of the criteria such as deprivation, smoking materials and smoke inhalation remain relevant to the research into fire deaths, the generalisation of the highest statistical

data, or collective common results, provides a limited enhancement to the knowledge or understanding of Scottish fire fatalities. The database does however augment statements and justifications mentioned previously in that smoke inhalation was by far the biggest cause of death for fire fatalities during this period and the fatal fires were ignited from smoking materials and it is clear there is a relationship between social deprivation and fatal dwelling fires with 72% of fire fatalities coming from neighbourhoods below the mid-point on the Scottish Index of Multiple Deprivation (SIMD) vigintile scale, SMID is a relative index in that it can represent a scale of deprivation and say how an area is more deprived than another but not by how much.

Caution should also be observed when referring to other accumulated data such as the contribution of alcohol with only 21 cases 15% of fire deaths being confirmed as having positive results for the consumption of alcohol.

6.7 Database Strengths and Shortcomings

The source data used to create the database was obtained from different sources and agencies. As the publicly available publications were only statistical, an approach had to be made to the different agencies involved in fire fatality investigations or post-mortems. As the data is sensitive, different protocols exist to get the information released. Agreements to confidentiality, freedom of information requests and agreement from the Crown Office of Scotland to release certain post-mortem examinations.

This administration process took over a year of sending communications and attending meetings to discuss the research proposal and the need for data, the justification to responders of the data required, what will be used and what will be retained confidential.

It was not possible to validate or verify the individual data provided by each fire service, their data represents the information recorded by individual officers, either operational reports or specific fire investigation reports, the accuracy and authentication of the information provided relies on trust and recognition of the competence and professionalism of the individual providing the source data.

The data and information provided were given in different formats, word documents, excel workbooks, and handwritten notes on previously printed data tables. All the individual

pieces of data were inputted manually into the research database, the process took over two years to complete. Populating the database, and amending data as new information was provided. A time-consuming project to provide a worthwhile useable research analysis information tool.

It has been identified throughout this research that data availability and sharing are the foundations of future research where the analysis can influence change or in this case improvements to health and well-being. Barriers to sharing data exist as previously discussed throughout this research.

- Incompatible data systems to transfer information, internal authorities.
- Data collection in different countries is not compatible with each other.
- Data gathering procedural changes, making comparison difficult.
- Personal confidential information, patient records.
- The availability of the dataset to share, does the authority have it recorded.
- The legislation applicable to personal data sharing, such as GDPR.
- The commitment of the agencies to want to share or contribute.

This legislation has an impact on what data and information are permitted to be stored and shared regarding an individual or their personal information. The request for additional data for research or agencies to want to work collaboratively and share data, compliance with these Acts of parliament is required, but from a researcher's perspective not unsurmountable or unachievable to obtain to assist progress.

There are contributions to this subject from several sources like the MORI poll previously mentioned when public opinion was positive towards their personal data/information being used to progress, efficiency, research and generally to assist improvements. An NHS public information leaflet [49] is also available which informs patients how their data is collected, stored and used for research.

Public access to and use of data is governed by legislation and ethical reasons for requesting the information. Any use of personal data must be ethically justified and produced or shared in compliance with current legislation [50] such as the General Data Protection Regulations (GDPR). Data sharing or linkage with medical records has not been widely researched at present but the potential is recognised for future research projects, a report published [51] gives the distinctions of requesting the information for financial reasons or health and well-being opportunities. The latter being agreed with the procurator fiscal in the peer interviews Chapter 6, where access could be available if the reasons were for the “greater good”. There

are examples of good practice which may also be able to be adapted to suit the data sharing being requested for fire fatalities and fire casualties, with the newly adopted principles that the duty to share information can be as important as the duty to protect confidentiality.

The research was undertaken into burns victim data [52], inaccuracy with the recorded data was identified, and inaccuracies with both the victims' details, such as injury type and the fire incident. These findings replicate the outcomes of this research also. Their research did however identify potential additional data sources within the NHS recording systems and recommends a joint data-sharing protocol that would improve knowledge and understanding of casualties from fire.

An advisory consideration [53] when requesting data from different sources to create a single database would be to try and control the data quality being submitted, and how a reference could be assigned to an individual that would be anonymised sufficiently to protect the confidentiality of the casualty or victim but still be recognisable to the different agencies to assign their data to the single case.

6.7.1 Database strengths

The single data source for fire incident and fire fatality information

- Provides a single platform containing all combined information (on fire fatalities and fire incidents, building type, geographic location, etc.).

Has the potential to add additional information for fire casualty

- The creation of an electronic database enables additional information to be easily added, for example, data on **smoke inhalation** (presence of hydrogen cyanide or other fire gases) **treatment provided at the scene** (oxygen or antidotes) **diagnosis and treatment at the hospital.**

Single permission for data set access for confidentiality

- As described earlier in this Chapter the collection of data for the population of the data set involved numerous communications with both fire services and other public authorities who have responsibilities for fire fatality victims in Scotland (Appendix A).

- The creation of a single database source of combined information can significantly reduce research time.
- The confidentiality of personal information can be controlled for the single data source, either by restricting access to the most personal identifiers and permitting access to the remaining data and information or permitting full access to ALL data if confidentiality can be assured concerning the requirement for the information.

The database is electronic and can be sent or accessed from any computer

- The formulation of an electronic database or even an App computer application provides instant access to the information, which can be accessed via any computer or tablet (see Chapter 7), notwithstanding the required permissions to log into the file.
- The information data can be sent instantly, attachments via e-mail, etc.

Permits instant combinations or permutations of data to be generated and provided

- A "live" dataset can be accessed, and made available to individuals, who could update the data as required, would be useful when some data (post-mortem blood analysis) may be delayed and can be inserted when available and the entire database remains updated and relevant.

6.7.2 Database shortcomings

Time-consuming to manually source individual data and manually input it into the database.

- As previously described the present situation throughout the Country involves fire fatality data being collected and retained by different authorities and as such to compile a robust dataset relating to the fire, the fire fatality, or fire injury victim, different authorities have to be contacted and requested to release the information.
- Currently, each authority, as previously described, retains the information within different formats, and the release of the information is controlled under different access to confidential information agreements.
- There is currently no nationally agreed standard of information collection or sharing in place between the different authorities involved in fire deaths or injuries.

Data available for research relies on the quality of data from different individual sources.

- With no agreed standard currently in place, the validation of data and confidence in the data provided is difficult and has an impact on the results or conclusions drawn from any data analysis.

Limited potential to verify the data provided.

- With the limited possibility for retrieving missing or unreported data (fire investigation, scene, has a “window of opportunity” to collect information, once the fatality has been released for funeral arrangements) the reliance on provided data from the different authorities is paramount to the validity of research data and reported outcomes and results.

Chapter 7: Sharing Protocols Through Subject Matter Interviews

This chapter provides a project proposal following the analysis results of the previous Chapters which concluded that there is a deficiency in the accuracy of data being collected and a lack of data sharing makes for difficulties in obtaining research information about fire deaths.

Section 7.1 outlines the requested interviewees and their chosen profession and Section 7.2 justified the chosen participants and their relevance to the research on the subject of fire deaths and injuries. The participants included the procurator fiscal for all Scottish fire deaths, an accident and emergency consultant who treats fire and smoke inhalation victims, the police crime scene manager responsible for the fire incident if a fatality occurred and three members of the fire service; a senior officer, a fire investigation officer, and an operational officer all of whom have a role in the fire incident and victim information recording.

The researcher undertook a series of peer review interviews as it was felt the professional opinion of people who work in the different authorities who have an active role in fire fatality or fire injury victims' investigation, or other legal or medical involvement would be a positive influence towards the future course of actions. Section 7.3 sets out the administration tasks and requests to carry out the interviews with the practical tasks to get the project implemented. Section 7.4 provides the detailed interview method adopted for verification of the project. Section 7.5 provides an account of each interview with the scribed responses from each participant to the questions posed during the interview. A personal narrative contribution was provided by Professor James Grieve, Section 7.5.7, a pathologist who has performed post-mortems on fire fatalities and provided evidence in court as an expert witness on both fire deaths and other causes of death including murder. Section 7.5.8 provides the summarised interview responses from each participant.

Section 7.6 sets out the intended peer review proposals for the project by introducing an electronic data collection system. The system via a tablet can be populated by each authority involved in the fire fatality investigation. The tablet app would contain all the identified information relating to the individual fatality, from the fire incident details to the post-mortem report and the blood screening and toxicology results. The population of the

individual fatality details would be concluded in real-time with confirmed results being available in days. The individual cases can then be amalgamated to form a comprehensive database of fire fatality data.

7.1 Requested Contributions from Peer Interviews

Several interviews were conducted with practitioners who were experts in different aspects of the fire investigation process, or related processes. Their opinions on the recommendations developed in previous chapters were sought, together with their professional opinion regarding the collection and sharing of data, within their area of specialism with the fire or fire casualty intervention process. The interviewees were representative of legal (Procurator Fiscal) – legislation applicable to fire deaths and injuries; Medical (A&E Consultant) – emergency and hospital treatment of smoke inhalation casualties; Police (Scene of crime Manager) – duties and roles they undertake at fire fatality incidents; Fire Service – Manager, Operational Officer and Fire Investigation Officer – their involvement and interpretation of the current and proposed Fire Investigation practices and awareness.

7.2 Identify the Participant's Profession

A list of prospective professions and job roles was compiled at this stage. The list of professions and roles were procurator fiscal, crime scene manager, fire investigation officer, senior fire service officer and accident and emergency professional who would provide medical care for fire victims attending A&E following a fire. The relevance of the selected individual professionals to this research project was:

Procurator Fiscal – All accidental fire deaths in Scotland, are subject to a report to the procurator fiscal with jurisdiction for the area in which the death occurred. Additionally, all fires which were the result of a criminal act are also reported. The Scottish Fatality Investigation Unit, (SFIU), are a department within the Crown Office that collates all the fire deaths and deliberate fire information from the different Fiscal areas throughout Scotland and retains a central recording system relevant to Scotland as a whole.

The Procurator Fiscals also have responsibilities and jurisdiction regarding post-mortem examinations, to request that an examination is undertaken, request additional tests and

receive the results. Procurator Fiscals also oversee the practices undertaken during a post-mortem by pathologists and are responsible for ensuring that the final reports provided by the pathologist are appropriate and in line with current practices and protocols required by the Crown Office, (not all available post-mortem reports align with the standards).

The procurator fiscal is also responsible for the prosecution in a court of criminal acts regarding fire and is responsible for the evidence presented, reports and articles. They are also responsible for the witnesses they cite to appear for the prosecution which includes police officers and fire officers. They require expert investigation outcome reports and expert testimony from the witness, which means they understand the competence of individual witnesses and the evidence they provide.

Within the Scottish Fatalities Investigation Unit, (SFIU), the procurator fiscal is also duty-bound to appear at major incidents, such as the Stockline factory explosion and the Clutha bar helicopter accident, and oversee or participate in the investigation process, so they possess practical experience and knowledge of incidents and the outcome of investigations. Given the diverse role undertaken by Scottish Procurator Fiscals, they are a source of knowledge, experience, and opinions relative to a range of subjects within this research project.

Accident & Emergency Practitioner – within Scotland, the accepted practice is for an Ambulance to attend a fire incident. For fire casualties, including smoke inhalation victims the ambulance crews will administer first-aid on the scene. Following clinical assessment, professional judgement, and patient agreement, the casualty will be transported to an NHS hospital and admitted in the first instance to the Accident & Emergency department.

Accident and Emergency staff, nurses and doctors will oversee the patient treatment and care. A&E consultants provide advice and guidance. Following treatment, patients will then be released or assigned to a medical ward for continued treatment and care before discharge. Both Ambulance crews and A&E staff will provide the treatment for smoke inhalation victims, particularly the provision of oxygen therapy. The administration of drugs will generally be within the hospital. Information about potential antidotes for toxins inhaled by victims in a fire is available to hospital staff within the Toxbase information system and includes advice and guidance on application.

TOXBASE is an online information system, a primary clinical toxicology database, controlled by the National Poisons Information Service, (NPIS). The site [54] provides updated and relevant information for medical personnel on the diagnosis, treatment and management of patients presenting at A&E with a suspected poisoning injury, including information for the use of Cyanokit antidote (hydroxocobalamin) for administration to hydrogen cyanide inhalation patients.

Hence the relevance of this research, the individuals who administer the treatment or the immediate aftercare for people who have experienced smoke inhalation in fires, have a valued opinion on the current practices, improved practices, or the barriers to overcome.

Police Crime Scene manager – Police Scotland has the legal duty and responsibility for the management of the fire incident scene when the fire has been extinguished. In relation to a fatal fire or a suspicious fire, a crime scene manager will be assigned to oversee all activities at the incident, the crime scene manager will monitor scene preservation and control any access to the incident without lawful purpose. The officer will oversee the investigations and the collection and recording of evidence or other investigation protocols such as witness statements and scientific test results.

The crime scene manager will determine when the investigation is complete and will close the incident and return responsibility to the owners. These individual officers have experience working with their scenes of crime officers (scientists), fire service operational crews and fire investigation officers, with such experience these individuals have knowledge and experience of expectations applicable to the research subject being undertaken.

Fire Service – the fire service has different levels of management and involvement in fire investigations and as such, it was anticipated that the contribution to this research may be augmented by the experience and opinion of personnel from the different levels within the structure of involvement.

> **Senior Officer –** these individuals may or may not have direct responsibility for the management of fire investigation, depending on their roles within the service; they will however be involved in the results of investigations within their geographical area of supervision. Senior officers also use accumulated fire incident reports and analyses from across Scotland to contribute to senior management meetings in relation to fire safety & community fire safety reduction strategies and initiatives to

be deployed locally or Service-wide. As they have access to the fire fatality database it was worth getting their opinion if they felt the data and information provided were sufficient to introduce remedial campaigns or to provide sufficient information to them and colleagues on the issues and common contributions leading to dwelling fires, fire deaths and injuries.

Fire Investigation Officer – hold a middle manager role within the service. Fire Investigation (FI) Officers all come from within the service, either appointed on promotion or a side move for career development purposes to obtain additional skills. No formal qualifications or experience is required before taking up the post and doing the role. A two-week induction course is provided. The course is delivered by experienced and expert people from the fields of fire investigation or fire science.

Fire Investigation officers are mobilised to fire incidents where a fatality has occurred. A deliberate criminal act of wilful fire-raising also warrants additional investigation due to the nature of the damage or inconvenience caused. FI officers may also attend major events that warrant a higher level of recording. As these officers have the responsibility to investigate fatal fires, provide and submit reports to the procurator fiscal and potentially be the expert witness in the prosecution's case, it is reasonable to assume that these individuals would have experience, knowledge and opinion on the subjects being raised in this research. Their contribution would be worthy of consideration.

Operational Officer – The officer in charge (OIC) of the fire appliances attending incidents has additional responsibility for fire investigation. The OIC will complete an electronic fire incident report on return to the station if casualties were present, or other pertinent information. These electronic reports form the content of National Fire Data which is reproduced for the Annual publications issued by the Fire Service in conjunction with the Scottish Government. The circumstances of the fire are reported, the nature of the injury to any occupant and the fire service action on arrival and during the incident.

There is no formal training provided to the OIC for them to undertake the fire investigation element of the emergency response to an incident. The determination of cause and situation becomes a professional judgment from experience and prior

knowledge of incidents. However, their findings form the basis of data used for research and other purposes. If the OIC determine the fire was started by smoking materials or an electrical fault or some other intervention, then that becomes the fire cause on record. The involvement and opinion of operational officers have a genuine contribution to this research, as they are the individuals who record the most information that inevitably becomes the source of data that every researcher has available, and so quality, accuracy and integrity must be provided.

7.3 Interview Practical Applications

Prepare Administration

It was necessary to compile a list of questions that the participant would be asked at the interview. As each profession has its area of responsibility regarding fire fatalities it was necessary to formulate the questions which related to the conclusions or recommendations that were specific to each profession so that the participant could provide an informed response. The interviews were semi-structured in that they raised a specific issue but also permitted the ability to expand on the topic if the participant cared to do so at the time.

Questions were specific to the participant's occupation or involvement with fire investigations, and fire victims (Appendix F) and were taken from the following list of subjects –

- Competence of the fire service and officers to retain responsibility for fire investigation, should the Fire Service retain the role and duty of investigating fire incidents?
- Provision of training and certification of fire officers involved in investigations, should criteria be set for the qualifications or experience of fire investigation Officers?
- Quality and authentication of fire investigation data and recording, should the statistical data in reports and publications, from the Fire Service be verified under an accreditation scheme?
- Samples taken from the fire scene for laboratory testing concerning fire toxicity, should we take additional samples/swabs which could assist fire smoke toxicity analysis?

- Quality and availability of fire fatality post-mortem and toxicology data, should we share more fire fatality data to assist in the understanding of the cause of death or smoke toxicity, blood screening and tissue analysis?
- Increased access to post-mortem data for future research analysis relating to fire deaths and injuries, should we share more fire fatality data to assist in the understanding of the cause of death or smoke toxicity? Victim confidentiality is assured.
- On-scene and hospital medical treatment for fire casualties, with particular emphasis on smoke inhalation patients, what are the current practices for smoke inhalation victims at the fire incident? Should we consider the use of antidotes for smoke inhalation as adopted by other countries?
- Potential access to smoke inhalation victim data for future research analysis relating to fire deaths and injuries. Should we share fire injury victims' data, and blood screening on arrival at the hospital, to further enhance knowledge on the effects of smoke toxicity?

A participant information sheet was prepared, this would provide the participant with the background to the research project and provide them information regarding what would be done with the information provided should they wish to participate. This information sheet carried the contact details of the researcher, and the university should they at any time want to make contact or verify the authentication of the researcher via the university.

A participant consent form was prepared based on a university template, which provided the participant with the opportunity to agree to take part in this project. The consent form detailed the rights of the participant to withdraw at any time and provided them with information that notes would be taken throughout the interview and that a completed "write-up" of their notes would be sent to them for their approval or amendments before further analysis. Each participant would then be asked to sign the consent form, if in agreement, and this form would be retained by the researcher in hard copy.

University Ethics Approval - An ethics approval application was required and completed for this project; the Approval was granted by Glasgow University for the ethics application submitted for number **300160143**.

Contact potential participants – To try and keep the selection of potential interview participants as open and transparent as possible, (not previously known to the researcher), the approach taken was to request relevant organisations to identify potential participants. This was achieved by identifying the contact telephone numbers for each agency/authority that the research would like to involve. The Scottish Fatalities Investigation Unit (responsibility for fire fatalities), Police Scotland (provision of crime scene managers), NHS Ayrshire (responsibility for the treatment and care of smoke inhalation and five casualties), Scottish Fire & Rescue Service, (responsibility for the attendance at fires, subsequent fire investigations and for the recording and reporting of fire and fire casualty information and data for publications) were all contacted.

The initial discussion introduced the thesis research and the intended interview project and asked if they would have an individual (specific role to agency) who would be willing to participate. The researcher stated that it could be from anywhere in Scotland and that the date, time, and venue would be at the request of the participant. The initial response from each communication was supportive and enthusiastic regarding the overall research project being undertaken and that they are interested in the eventual outcomes of the research work.

Initial contact was the main administration contacts for each profession, except for NHS Ayrshires, when contact was made with Crosshouse Hospital, with the intended reason that from recent fire incidents in the area, it was positive that the A&E department had had fire victims admitted recently, so would thereby be able to give an opinion on recent practices of treatment and care given to fire victims.

Additionally, the Scene of Crime Officers, forensic scientists for Scotland and the Scottish ambulance service were both contacted in the same way as the other agencies; however, a negative response was received for their participation in the project interviews at this time. These two agencies have relevant involvement, with fire investigations and with the treatment of medical care to fire casualties and would therefore have had a valued opinion to contribute. The declined involvement is recorded as a limitation on research for the project outcomes and summary.

Interview locations – As offered in the initial conversations with the different agencies, the date, time, and locations would be as requested by the willing participant. The interviews spanned over eight weeks due to the acceptance or availability of individual participants. All

interviews were undertaken in the participant's office, except for the A&E consultant, when it started in the participant's office but moved to the hospital A&E department for computer access, to view TOXBASE.

The interviews ranged in time of day, all, however, took place during the participants' normal working hours, or shift pattern, the geographic locations were Edinburgh, Glasgow, Kilmarnock and Ardrossan, and all costs for travel and subsistence were borne solely by the researcher during this project.

Pre-interview clarification and consent – After formal introductions, the project aim was introduced, verbally and a pre-printed copy was provided to each participant, (Appendix G) the consent form was discussed detailing what would happen during the interview and how the information would be recorded, due to security and confidentiality the decision to tape-record the interviews was replaced by the method of taking written notes during the discussion. The participant was then informed where they could obtain further information or withdraw their consent for inclusion at any time. Each participant acknowledged the consent information and signed the form in agreement. No participant requested recognition or inclusion within the acknowledgements of the Thesis document.

During the interview process – Each interview started by reading the first question, as the information was provided by the participant. The interview then proceeded as a discussion on the subject. The list of questions was used as an aid memoir for the researcher to ensure the questions were being addressed, but not particularly in the pre-set order. This also permitted additional information or opinion on the subjects to be discussed**.** For example, the procurator raised his involvement in major accidents, including exposure to carcinogens; and the A&E Consultant transferred the interview down to her department to show the researcher the poisons Toxbase site.

The researcher took notes and wrote down additional information raised. The notes were not formulated in shorthand, or transcribed word for word, the notes were rewritten immediately after the interview to include the responses and comments to be as accurate and complete as possible.

Post Interview – the rough notes taken during the interview were written up at the earliest opportunity to ensure accuracy and transparency of what was discussed. Each comment,

observation or opinion was grouped into the relevant heading or pre-set question to include all the contributions the participant provided. The time scale between each appointment date made it possible to devote the time to finalise comprehensive notes for each interview undertaken.

Confirmation and agreement from participants – on "completion" of the interview participants' contribution, within the consolidation interview responses (Section 7.5.8 below) each participant was contacted and a "final" draft of their contribution, professional and opinion was presented to them, either in hard copy or via e-mail communication, to allow them to amend the content or reject its use within the final thesis submission.

No participant requested to remove their contribution; no notifiable amendments were requested. The offer was verbally given again for their contribution to be acknowledged; all declined the necessity for the researcher to name the participants.

Authentication and storage of interview administration – Due to consideration of retaining personal information it was decided that communication via email, or the storage of information, particularly if it contained personal information with which an individual could be recognised was restricted as far as reasonably practicable. The administration, consent forms and interview notes are all on hard copy, under the sole authority of the researcher. These can be provided for authentication purposes, and the names, positions and employer contact numbers can also be provided for just, lawful and authentication reasons as so required concerning this thesis submission.

7.4 Interview Method

The intention was to follow a structured method to conduct interviews with certain professionals and peer groups. The interviews would be conducted as semi-structured personal interviews [55] as a qualitative research project the interview style (semi-structured) would allow the researcher to raise the particular topic, but permit freedom of response and diversity from the interviewee. The personal interview was considered preferable to the group as limitations to access individuals with the particular specialist skills relevant to the fire death subject were achievable. The peer review interview process was 'purposive' sampling in that the candidates were specific to the areas of specialism for fire deaths, so non-random sampling frame, the agencies or departments where the individual

worked was selected but the individual was randomly chosen by the agency due to their willingness to participate in the project. The occupation was non-random, but the participant was random for the researcher.

The objective of undertaking the interviews was to get professional clarification or opinion on the outcomes and recommendations of this research study or for the individual to contribute their knowledge and expertise regarding a relevant matter or subject that the researcher failed to identify during the research. Table 18 presents the interview implementation sequence which was adopted: -

Consolidation and Validation Interview sequence of tasks	
Potential participants	Identify the potential individual participants, “who” within each organisation or agency would be most appropriate to have knowledge or opinion on the aspects of this research.
Interview administration	Compile the research interview statement, what it is about and the intended aims and objectives. Compile the interview process and interviewee agreement form Compile a Questionnaire to be referred to during the interview, everyone had some different questions which were specific to their role and direct involvement. Complete ethics approval administration, with interview intentions.
University Ethics approval	Make an application to the ethics committee, providing a completed application, interview administration and confirmation that confidentiality will be maintained and that children or young persons are not subject to this project.
Contact participant agencies	Phone calls were made to the administration offices of each authority/agency, explaining that I would like to interview (speak with) a colleague who was involved in the field of fire fatality or fire injury victims. Scottish Fatalities Investigation Unit (SFIU) - Glasgow, Crosshouse Hospital - Ayrshire, Police Scotland - Glasgow, and Fire Service Headquarters - Hamilton were all contacted, and individuals replied with their interest to participate.
Interview locations	The interviews were all conducted at the interviewee's place of work, this was intentional, to limit the disruption, and save time and money for the willing participant.
Pre-interview clarification & consent	At the meetings - Following the introduction, the information and consent forms were presented for the agreement of the interviewee's participation.
Post Interview	The scribed notes taken by the researcher during the interviews were used to draft the conclusions within the thesis report, no electronic security requirements are necessary for this research outcome.
Confirmation & Agreement	The final transcript on the outcome of the interviewee’s participation was shown to the participant, either in hard copy or sent by e-mail for their agreement or amendment and final consent that the transcript within the thesis is a true reflection of the interview questions and discussion that took place. All amendments and additional comments requested by the participant were included within the final transcript as it now appears in the thesis report.
Authentication and Storage	The notes scribed during the interviews remain in the sole ownership of the researcher to format the transcript as used within the research publication only. The consent forms agreed upon by the participant, remain in sole ownership of the researcher
Access to the information provided	The information provided is anonymised and appears both in electronic format and hard copy within the completed research thesis as produced by the University on submission. No other electronic record exists for any information provided during the interview process. Hard copies of the research intention consent to participate, and ethics approval documentation exists for the sole purpose of academic clarification and authentication if so requested.

Table 18: Consolidation and Validation Interviews - sequence of tasks undertaken.

7.5 Interview Responses

The transcribed responses from the individual interview participants are detailed below. The participants augmented the research findings by either agreeing with what the research identified or suggested or by disagreeing with the research outcomes due to professional or their own opinion on the issue.

7.5.1 Procurator Fiscal
(Personal Communication, 13th April 2017)

The statements below represent both the professional and personal opinions that were given at the time of the joint interview/discussion that took place. The participant has extensive experience, knowledge, and involvement with the subject of fire fatalities, fire investigation and associated legal proceedings and made the following observations -

- The participant was supportive that the fire service should retain the role of being the authorised fire investigation department for Scotland.

- Accreditation from a recognised 3rd Party would enhance the reputation of fire investigation report outcomes, but it is for the court to ultimately decide on the competence of investigations and expert witnesses. An "expert" witness may give an opinion on matters; a witness must stick to facts.

- Supportive of the concept of knowledge, experience, qualifications, and accreditation can collectively be used to prove competence.

- All suspicious fires and fire deaths are subject to investigation and a report to the procurator fiscal, reports from around the country are merged within the jurisdiction of the Scottish Fatality Investigation Unit (SFIU) both in Glasgow & Edinburgh.

- All Fires are considered deliberate until they are proven to be accidental, which is the ethos of investigation. Investigate the scene to prove that no malicious intervention existed.

- The final report to the procurator fiscal will consist of contributions from police, fire and pathology reports and contributions relevant to the case.

- Crown Office guidance and codes of practice for pathology post-mortems indicate information to be recorded and toxicology results are stipulated for ALL fire death post-mortems.

- Post-mortems will always be requested by the procurator fiscal for a fire fatality victim, the PF will not accept a "view and grant" certificate, an acceptable procedure for other deaths being recorded.

- Acknowledgement that not all post-mortem reports are completed to the appropriate standard and that discrepancies exist in different geographical areas of the country, but this was a matter that the Crown Office was looking to address and rectify deficiencies.

- The level of investigation undertaken will be determined by the incident, and the level of scrutiny for content and accuracy will also be in line with the level of the incident.

- Supported the intention of future research being undertaken with access to fire casualty victim medical data and information, confidentiality and anonymity can be assured, and the data does exist in formats applicable to the NHS. The participant does not foresee any legal barrier to appropriate research requests if ethical and moral guidelines are complied with.

- Supportive of subject-related research on fire, fire deaths and injuries, given that the main aim of the Scottish Fatalities Investigation Unit (SFIU) department is prevention.

7.5.2 Crime Scene Manager
(Personal Communication, 9th May 2017)

The statements below represent both the professional and private opinions that were given at the time of the joint interview/discussion that took place. The participant has experience as a police officer with additional knowledge and involvement with the subject of fire fatalities, and fire investigation due to their role as scene manager and made the following observations:

- The participant works with all other agencies involved in the investigation process and is responsible for the management of the contributions from the other agencies and the joint submission to the procurator fiscal.

- The participant is supportive of the fire service and maintaining their role in fire investigations and offered that the current joint protocol between the police, scene of crime officers (SOCO), and the fire service work is effective for investigation conclusions.

- The fire service personnel can bring expert experience and practical knowledge relating to fire science and firefighting to the investigation which is a positive influence regarding what happened.

- The participant receives information on the fire investigation report from the fire service but intimated that it is an information-sharing partnership and that the police will share information with the fire service to assist in their investigation.

- Expressed 100% support regarding competence and that to prove this standard the combination of experience, knowledge, qualifications, and accreditation of investigation practices should be a requirement.

- Although supportive regarding taking additional samples from the fire scene, to get information on toxins and carcinogens with the soot or ash deposits, limitations exist, in practically taking the samples, and the time and financial implication of analysing additional samples. Generally, the main samples removed for analysis will be if an accelerant was used in the actions of setting the fire.

- The public access to fire fatality documentation was not wholly supported; acknowledgement of the benefits of getting information to the public for prevention awareness was outweighed by the consideration for the family and that the legitimacy of the content would have to be verified and justified before publication.

7.5.3 Accident and Emergency Consultant,
(Personal Communication, 20th April 2017)

The statements below represent both the professional and private opinions that were given at the time of the joint interview/discussion that took place. The participant has experience as a medical practitioner with additional knowledge and experience of dealing with casualties attending hospital following a fire, with both burns and smoke inhalation injuries due to their role as a consultant within the A&E department and made the following observations:

- The main priority of staff when a patient attends A&E would be a rapid diagnosis of symptoms and the preservation of life; airway breathing and circulation. To stabilise the patient's vital symptoms and transfer to medical ward treatment care facilities.

- Although previous experience with smoke inhalation victims was not used to administering antidotes for hydrogen cyanide poisoning, the participant was familiar with their existence, but they are not routinely used within their hospital, health board or Scotland in general, and certainly not used by paramedics on-scene at fire incidents.

- Recognition of different countries' approaches to emergency medicine has to be considered in the "use/ do not use" antidote debate. France, for example, conducts emergency medicine on the scene and not within the hospital environment. Indicating a more proactive or robust practice is taken at incidents in other countries.

- There is a medical reluctance to routinely use antidotes for smoke inhalation victims particularly for HCN poisoning mainly due to the recorded side effects, and potential harm that could be caused if administered. This is particularly so if HCN level is not a contributing factor to a patient's condition. The lack of testing for HCN in blood within the field or A&E environment is also a limit. Current tests can take hours to analyse and confirm exposure. The participant did not see a dramatic or routine change to current practices regarding HCN antidotes until the testing and diagnosis issue can be resolved.

- Routine blood tests for patients presenting with smoke inhalation will be the confirmation of carboxyhaemoglobin levels with blood, and possibly x-rays if lung damage is suspected, with patient treatment determined by these results.

- The participant was supportive of any additional research that aids health & well-being improvements, they perceived no reason why legitimate researchers could not access patient data, blood counts, etc. if confidentiality and anonymity were assured, and the research was appropriate regarding the greater good of well-being. All smoke inhalation victim's carboxyhaemoglobin levels data currently exist.

- The participant accessed Toxbase, the A&E department's online tool, for poison, diagnosis, and treatment advice looked up both smoke inhalation & HCN poisoning, printed off the information available to A&E staff for consideration, and acknowledged the use of antidotes can be considered but is presently not common practice or an immediate consideration inpatient treatment.

7.5.4 Senior Fire Service Officer
(Personal Communication, 28th April 2017)

The statements below represent both the professional and private opinions that were given at the time of the joint interview/discussion that took place. The participant has experience as a Senior Officer within the Fire Service with managerial and supervisory responsibility for a geographical area within the service, previous experience in fire investigation and additional responsibility for the implementation of fire reduction strategies and initiatives throughout their location of responsibility and made the following observations:

- Fire fatality and fire injury trends although they have reduced historically, recent years have not shown any decline and in the main increased numbers are being recorded.

- As a fire officer, the participant believed that the service should retain the role of fire investigation and that the service is the most appropriate authority to undertake the task, however they acknowledge the questions being raised on competence and it is up to the Fire Service to respond to this and prove the level of investigation is professional and competent and can prove so if challenged.

- The availability and access to fire fatality data and information available but restricted to statistical summaries and are not individual incidents or casualty specific. This can be restrictive on the level of information that can be obtained on the subject and is

particularly restrictive if any form of comparative analysis was to be undertaken, between incidents from other geographical areas throughout the service.

- There is an inherent reluctance to undertake full disclosure of information between departments, from fire investigation to data services to operational areas. This reluctance even extends to fires or fire fatalities which occur within the participant's geographical area of responsibility. This extends to both electronic data and fire investigation reports.

- The participant believed that the reluctance, to get access can be frustrating but data protection, confidentiality and the existence of criminal cases mean that some limitations must be respected; however, they believed that within the same organisation, access to additional information should be improved.

- The participant was cautious about releasing fire fatality information for public access, stating that confidentiality and respect for the existing family must be considered even if the justification to allow access would benefit the reduction of fires or fatalities.

- Support for the improved competence of fire investigation was supported; any additional accreditation or verification of investigation practices, protocols or individual investigators would only enhance the credibility and acknowledgement of the fire service contribution to fire investigation at incidents.

- Historically the fire service has promoted from within the ranks, and the ethos was to learn on the job, rather than be qualified for the job before taking up the role The participant believed that this is true of Fire investigation officers, given that given a culture exists for blame or liability and challenges made on competence either from insurance companies, defence in legal prosecutions or generally to prove professionalism of fire investigation outcomes, the requirement for additional or compulsory qualifications and competence should be considered.

- The participant stated that the training given to operational incident commanders on fire investigation was limited, with provision limited to an online training module with links to external documents for self-teaching. They were also aware of the importance of recording appropriate information on fire reports as these results populate national

statistical and fire incident outcomes for publication. The participant would support an improved structure for fire investigation training for operational officers.

- Officer was aware of the current accreditation scheme of the IOS 17020 and was aware it had been discussed at the senior management level but was sure the service has yet not made an application to progress the accreditation pathway.

- Although not familiar with the specific use of antidotes for smoke inhalation victims, (following discussion and explanation of its use) the participant could see the potential benefit from one side and reluctance from the other. The participant felt that more work was required to establish a practical protocol for first aid on fire casualties, potentially more aligned to ambulance and paramedic colleagues who attend, as the firefighter role has yet not advanced sufficiently to undertake this level of casualty treatment.

7.5.5 Fire Investigation Officer,
(Personal Communication, 11th May 2017)

The statements below represent both the professional and private opinions that were given at the time of the joint interview/discussion that took place. The participant has experience as a Fire Investigation Officer within the Fire Service with previous experience as an operational officer; incident commander attending fires and he made the following observations:

- FI officers have policies and procedures for their role; they differ from operational procedures (role-specific) but are generally adhered to and used as a format for working and undertaking investigations. Some operational procedures still apply to the FI role such as the use of PPE in incidents.

- No entry qualifications or prior experience were required before taking up the role within the FI department, although no formal qualifications were available, some workshop events were provided with expert guest presenters, with legal, fire science and investigation experience, who provided guidance and assistance regarding the investigator role and the expectations of completed reports.

- Samples taken at the scene are usually restricted to the possible use of accelerants; scene of crime officers (SOCO) may take most samples for analysis. The procedure followed

at incidents does not normally permit the taking of samples for additional research analysis purposes. The participant would not object to the taking of soot and ash samples if so requested and if this leads to a better understanding of fire toxicity, that would be a positive.

- The participant was not sure of the exact reason, but in practice, the department does not provide a copy of the fire investigation report to the firefighters who were at the incident. As an operational officer in Charge, they could see the benefits of themselves or their crew, getting to know the circumstances which led to the fire or fire death, from an incident they had attended. Confidentiality does not exist, because they were there, and unless a legal case is pending, the participant did not see why the report cannot be shared. The information would increase knowledge, experience and understanding.

- The participant was reluctant to share information within the public domain, however, if confidentiality was assured and the publication would assist in a reduction in deaths, injuries or fires, the participant did not see a big concern with it. The participant stated that "You can see most of the information in the press or online, perhaps the service has to "have a think" on their information-sharing protocols."

- As a firefighter and fire investigation officer he would not like to see the service lose the specialist role or department of fire investigation, if questioned on experience or competence thought the Service should be able to defend such a challenge. This may require investment in the department and the officers, to gain accreditation for their investigation procedures or qualifications for their officers from attending accredited courses specific to investigation practices.

- If such an accreditation scheme exists to which the Fire Service could apply and achieve the level of competence or expectation then they should apply, as FI officers your work, assumptions, outcomes and opinions are routinely recorded, Your report may be questioned by insurance investigators, who may want to disagree with your findings or a defence lawyer in court may want to challenge your findings, professional experience and additional competencies, such as accreditation and qualifications would augment your argument and justification for the investigation findings.

- As an operational officer, was glad they had had the experience gained within the FI role, there are some occasions when you are required to make a judgement on the cause or spread of the fire, was glad to have the additional experience to fall back on. Did not believe colleagues operationally get sufficient training and believed given the specific role and specialism of fire investigation that a greater emphasis should be given to training and development on the subject for colleagues.

- The participant had never actually read into the use of antidotes as a first-aid treatment for smoke inhalation casualties, but their experience tells that most casualties and fire deaths result from the inhalation of smoke, so therefore if there is a treatment that can assist recovery then it would be worthy of consideration.

7.5.6 Fire Service Operational Officer
(Personal Communication, 15th May 2017)

The statements below represent both the professional and private opinions that were given at the time of the joint interview/discussion that took place. The participant has experience as an Operational Officer within the Fire Service experience of a firefighting role and progression to the officer in charge of emergency incidents, with the responsibility to ensure the incident is resolved and additionally to undertake fire investigation as appropriate after the fire and he made the following observations:

- The Participant has responsibility for the safety of his crew and ultimately the conclusion to the incident such as the fire being extinguished, with an additional role as an officer in charge to undertake a fire investigation at the scene, in order to complete the fire incident report on return to the station. He undertakes fire investigation on fire incidents that do not involve fire fatalities or are suspicious in nature of ignition source which would lead to insurance losses or criminal convictions, if so, the investigation of these fires is passed onto the dedicated Fire Investigation Officers.

- The training given regarding fire investigation is limited to a single module within the online personal development programme for all station personnel; He believed this training was insufficient given the responsibility placed on the officer in charge and the completion of fire reports, which become national data and statistics. The role of investigating fires appears important but the commitment from the service to provide training and information does not attract the same commitment.

- The data services department will review the submitted fire report and will contact the officer who completed the report, to change or address a certain section of the report. On most occasions, the review may be justified and was an accidental error, but on occasions, it was felt that the report had to be amended to satisfy the report rather than the facts of the incident.

- Although not directly involved with the FI department, an agreement was offered that the fire service should retain fire investigation but that the service and the officers should be confirmed as competent, the service as a competent investigation authority and the officers as individual competent investigators, and if that meant applying for an accreditation scheme of assisting officers to gain relevant qualifications then the service should make this commitment.

- As an officer within the fire station environment, they have no access to fire statistical data, or information, any more than the public can access national publications. Data service access is restricted to senior officers, and the fire investigation department does not release their investigation reports to the station, even when the officer in charge and his crew attended the incident. It was felt that this practice was detrimental to the operational crews, data access would assist their task of developing reduction initiatives, and allow for realistic evaluation of outcomes, and getting the fire investigation report from their fire incident would allow the crew who attended to understand the sequence of events or conclusions drawn regarding what happened either with the fire or leading to the fire death. He believed the service should rethink its protocol for information sharing.

- Not aware of the impact or use of antidotes for the treatment of smoke inhalation victims at the fire scene but was proactive in his thinking that if it assisted with the care and wellbeing of fire victims it was at least worthy of further research and discussion, and if the procedure is adopted by firefighters in other countries, then there may be some advantages to its implementation in Scotland.

7.5.7 Forensic Pathologist‘s Contribution

A response to a request for a contribution to the peer group data validation was provided by Professor James Grieve, a Professor in Forensic Medicine at Aberdeen University and a

leading Pathologist within the Country with experience including Post-mortem examinations on Fire Death Victims.

The contribution was provided in a Narrative communication (Appendix H) and his personal opinions are summarised below:

- "Pathologists should be encouraged to attend at the locus of fatal fires, particularly when the deceased is still in situ".

- "There should never be any situation in which full toxicological analysis for alcohol, drugs and special substances and poisons related to the fire (CO, HCN, any hazardous substances specific to that particular event) is not conducted on body fluids or tissues as available and appropriate".

- "Encourage that all post-mortem examinations in fire deaths conform to thorough basic standards and include a minimum or optimum data set" – "include the requirement for full toxicology, etc".

- "Death in Fire" is a noncommittal, non-judgemental holding position that is entirely adequate for the public record and covers all eventualities including natural death and all manner of deaths including homicide, etc. The final report to the procurator fiscal is where there should be exploration and interpretation of the actual cause and mechanism of death".

- "The critical issue is to encourage more communication amongst various parties and experts".

- "I would always endorse anything that stimulates education, research and development in all fields, particularly, where that will prevent further loss of life".

- "Anything which contributes to the health and safety of individuals for the future must be wholeheartedly encouraged. Therefore, I would support research into hazards of smoke inhalation, and into ways of preventing these or mitigating the adverse effects".

7.5.8 Summarised Interview Responses

Generally, the interview responses supported the research outcomes being validated by peers, the contention was concerned with the access sharing of personal data relating to fire death or injury victims.

Although each participant had their own opinion of their professional involvement, procedures they support or otherwise, ALL were positive towards a reduction of fire deaths and injuries, all were supportive and enthusiastic regarding this research and likeminded research being undertaken if it leads to reduced fatalities, injuries and fires and improves health and wellbeing within Scottish communities.

It was considered appropriate that the fire service should remain the authority for the investigation of fires throughout Scotland, years of professionalism and professional credibility hold the service on the steady ground regarding competence to do the role, it was intimated that the certification and acknowledgement of a 3rd party accreditation scheme would enhance the reputation of the service and investigating officers and align the service to other investigating authorities throughout the U.K. and Europe.

The qualifications and personal competencies of fire service fire investigation (FI) officers are not as robust as other investigators within both the public and private sectors; such qualifications as MSc Fire Scene Investigation are offered by The University of Central Lancashire. The requirement for formal qualifications is not a pre-requisite to commencing an FI position within the service. Training can be restricted to a few weeks of formal lectures and advice from subject experts and is augmented by the individuals' previous professional experience of attending fires and supplemented by a mentoring system when existing FI officers provide advice and guidance, both theoretical and practical, on-scene, assistance to the new entrant to the department. Both university degree-level qualifications and specific "skills for justice" fire investigation competence levels exist as a formal accreditation [56] to ISO 17020, to partly justify competence, available but not compulsory for all FI officers undertaking the role.

It was suggested by the participants that compliance with formal qualifications and accreditation would support the fire service officers, whenever formally questioned about

summations or conclusions or if their investigation outcome is being challenged legally, and the credentials of the individual may be exposed.

The access to or availability of fire and fire fatality data and reports was very restrictive even within the service let alone made available to the public. Fire service personnel are unsure of why the information is so restricted Only senior officers not operational crews are given information about an incident they attended. The participants in the fire service unanimously thought a service review was required, as access to this information would enhance their knowledge and assist in the development, justification and evaluation of safety initiatives, and performance indicators for reduction strategies.

Although the consensus was that information could be made public, collectively the acknowledgement was to consider confidentiality, and respect for family members. Although it was acknowledged that the name and age of a fire fatality victim routinely appear in the press and online news articles, personal information is already made public. Additional public information on the cause of fire or cause of death or injury may augment current information and raise awareness of the dangers and impact of house fires.

The implementation or justification for the use of antidotes as a first-aid treatment at the scene received mixed opinions, although the subject was not familiar to most, after a discussion on the subject, the fire service personnel favoured further investigation on the use of antidotes, and that if it saved or improved lives and colleagues in other countries adopt the practice it is worthy of consideration. The opinion of the A & E participants was that it has a potential use and that the Toxbase system provides information for medical treatment. However, caution was offered in that currently no suitable or time-critical diagnostic test is available which would confirm a diagnosis of hydrogen cyanide poisoning.

The acceptance of additional research being undertaken on issues relating to fires, fire deaths and injuries was a positive pro-active approach, taking more samples at fires to aid fire toxicity information, taking more blood samples to understand inhalation exposure levels, having access to other department's data sets of information, all possible actions. The caution was the time spent to take these additional samples and the financial implication to the department for analysis costs.

The acknowledgement that future research was positive, each authority retains relevant data and information and sharing protocols could be implemented or improved, confidentiality and anonymity of the casualty confirmed. Sharing data is possible to improve the health and well-being of occupants in house fires, it may well be those proactive discussions between each authority, and how they can assist each other may be the starting point. Medical, legal, police and fire officers believed that future combined data research analysis would be for the greater good.

7.6 Peer Review Interviews Proposal

The use of online technology and mobile apps are a frequent occurrence for both society and organisations, although not everyone may be confident in the security of personal data, the following examples are frequently used:

- Online banking, personal bank details.
- Booking flights and holidays, personal passport details, credit card details.
- Applying for or changing passports & driving licences, personal details of name, address, national insurance number, bank details, and credit card details.

Within organisations, technology has been accepted and progressed, most organisational administration has got a computer application, and the use of tablet technology, for remote communication, has been adopted by the Police, Fire Service and the NHS particularly to assist paramedics and ambulance crews on the scene including the Scottish Ambulance Service and the East Midlands Ambulance Service) see Figure 34 below, which suggests that organisations are satisfied with security and confidentiality protocols when recording specific personal data, either relating to criminal activity, past or present, vehicle ownership or insurance and Ministry of Transport (MOT) information or the specific personal information relating to a patients treatment and care information.

Figure 34 presents the process and flow of information available on the tablet communication system adopted by ambulance crews, confidential access to patient medical history, the crews would then triage the patient, look up guidance if required or access specialist units within the hospital, paramedics on-scene then complete the patient information with the on-scene treatment given, if a hospital admission is required, medical teams at Accident and Emergency have instant updated access to the patient file and the treatment given on-scene and the patient diagnosis of why they are being taken to hospital.

On completion of the hospital treatment, the patient confidential records are immediately updated.

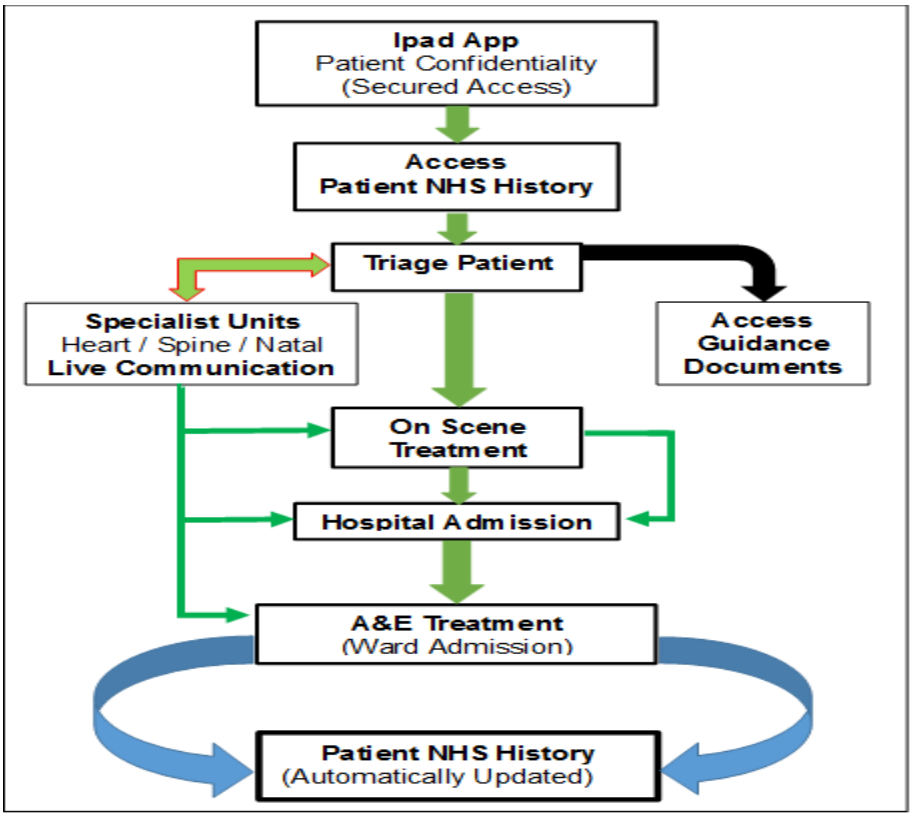

Figure 34: Ambulance/Paramedic, IT mobile Tablet improving patient care, (the figure has been reproduced for this research publication from the East Midlands Ambulance service model).

There is also a tablet app currently available for specifically Fire Investigation "Fire Investigation in the iPad era" [57] so with this type of technology amended to include other organisations' data a complete outcome of the fire fatality circumstances can be produced. The process currently involves each authority completing their reports, some information sharing exists between the police, fire, and pathologist, and ultimately these individual reports are collected in a file and presented to the Procurator Fiscal, a legal determination follows on the instance of death and then the information is provided to the Scottish Fatalities Investigation Unit (SFIU) who maintain a register of all deaths from fire, (and other causes) throughout Scotland.

In the current situation, organisations are comfortable with the use of tablets and electronic data collection and storing methods, they all use technology to record or transmit information to other sources. Each report is ultimately combined, and there is a final compiled register at the Scottish Fatalities Investigation Unit (SFIU) offices.

This project concept is named

TAFIST – Tablet Assisted Fire Investigation System Technology

The idea is to encourage all organisations involved in fire fatality investigations to use the same program to record their information. Justification for the implementation of such a system would require agreement and cooperation from all the different organisations to embrace the concept of improving fire fatality information and investigation outcomes and embrace the concept of sharing information pertinent to the fire incident or fire fatality.

The diagram below, Figure 35, was created by the researcher to list the variable considerations and applications for TAFIST as associated with the different organisations currently involved in Scottish Fire Fatality investigations, (Appendix E provides a full-screen version).

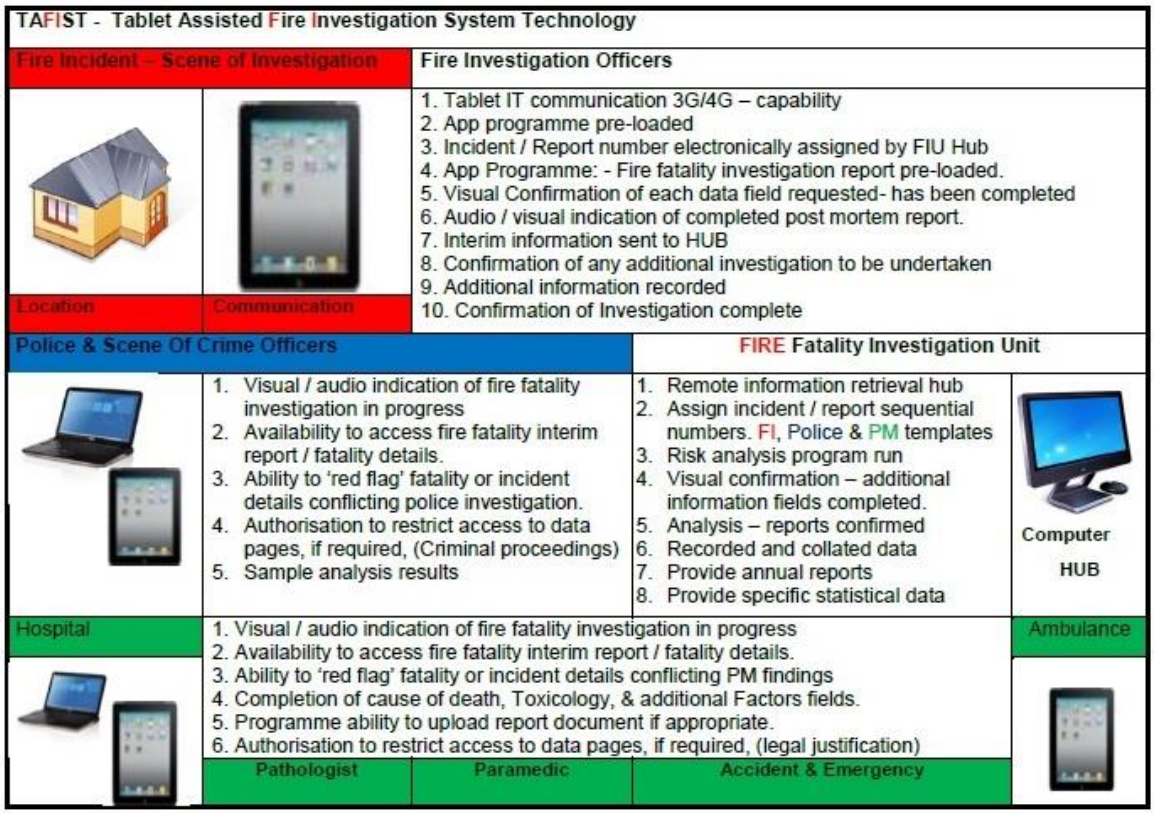

Figure 35: Fire Investigation future technology proposed - Authority data collection variables and contributions

The main hub computer, potentially located within the Scottish Fatalities Investigation Unit (SFIU) would be the primary source of computer intelligence and the collection hub for the collected data. The main hub computer would be populated by the different agencies when the fire fatality or injury investigations or interventions are being completed. The fire incident and victim data would be recorded either on-site via a tablet app or computer on

return to an office-based computer terminal. The tablet app would be created to be a native app [58] which could be developed for different operating systems, such as IOS or android. The app would remain on the tablet and have the capability of "store and forward". This would enable the app to be populated with information on-site, without an internet connection and the device would sync and format the information once an internet connection was available.

The program/app when open would provide a series of tabs or pages, each tab relevant to an organisation, Police incident information – Fire investigation report – Post-mortem results. The intention would be that with the cooperation of each authority, each tab/page would have all the specific information data fields applicable to their organisation's involvement in the investigation. No duplication of work, using this platform, as their section can be saved/printed and is an acceptable report. And the produced reports would be of a standard acceptable to their organisation's requirements. Suggestion-

Tab 1 – General incident information; case number, date, time, address,
Tab 2 – Police Scotland - Police incident report data, including accidental deliberate etc.
Tab 3 – Police – Forensic Science additional data analysis
Tab 4 – Fire Service, Fire Investigation Report data, cause of the fire, fire fatality data
Tab 5 – NHS – Pathologists, Post-Mortem Results, cause of death, toxicology etc.
Tab 6 – (NHS A&E etc. additional data set when acceptance to include fire injury victims)
Tab 7 – Procurator Fiscal, (for the area of a fatality), agree on outcomes, accidental or deliberate, any further criminal case action, suspend sharing or agree to share with collective database.
Tab 8 – Final verification by SFIU, agree with all data accuracy and complete, progress information to a collective database of fire fatalities, close this case.

Perceived advantages of the implementation of this concept:

- Data sharing between organisations is complete.
- The time scale of available data on fire deaths could be available within days or weeks rather than years, (unless criminal proceedings apply).
- Missing and incomplete data fields are dramatically reduced due to the checks involved.
- Data quality and verification are improved due to the sharing protocols and the data cell checks incorporated into the system.

- The system removes a level of data validity concern, this system compiles data from the source e.g., the investigator at the scene.

Disadvantages

- Verification of quality and accuracy of source data relies on the trust of the investigators' professionalism.
- The entire system relies on cooperation and agreement from all organisations, or the final outcome would still have a source of information missing.
- There would be financial implications for the program development, maintenance, and update.

Figure 36 presents a graphical image of the information pathways between the organisations involved in fire fatality investigations, there is a larger graphic to view within Appendix E.

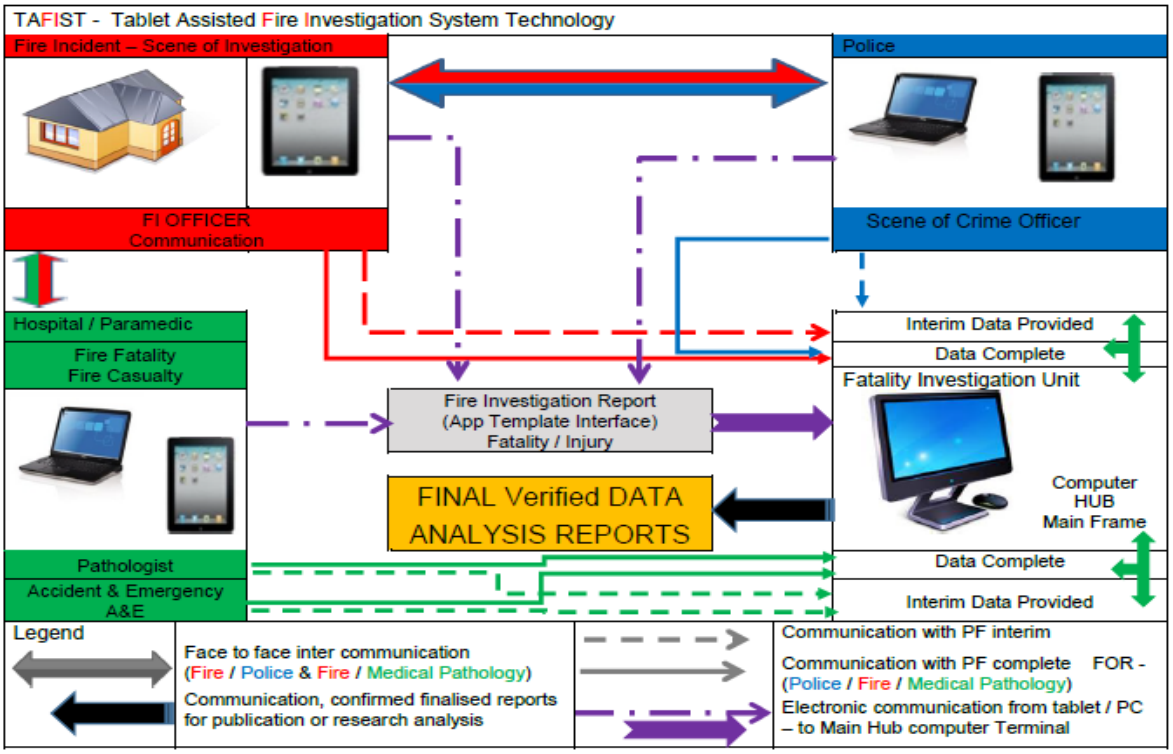

Figure 36: Fire Investigation future technology proposed - Electronic data sharing pathways

It is recognised that implementing such a system, would require a computer program developed for the main communication hub to allow different authorities to communicate with the main hub and mobile app development to allow access whilst on the scene using a tablet mobile device. Computer developers could design the systems applicable to this project at a cost for production and maintenance, or it may be possible to encourage computer studies students to embark on a project of development that would be accepted by the authorities investigating fire and fire deaths.

Chapter 8: Conclusions and Recommendations

The research described in this thesis has demonstrated that providing increased quality, quantity and content of data recorded and shared concerning fire fatality and fire incident injury victims enables a comprehensive analysis to be undertaken to provide remedial initiatives to improve the health of the victims in fires and the firefighters responding.

The created database demonstrated that the collective analysis of data provided a stronger validated response of justification of the criteria applicable to fire incidents, fire deaths and fire injuries. If such a combined and accessible platform existed for fire fatalities and fire injury victims, it could be assumed that the resultant initiatives or remedial interventions could be validated and confirmed as a true reflection of the risks being addressed.

Figure 37 presents the different agencies or information sources available applicable to a fire fatality victim which could be used for research analysis to provide recommendations towards improvements to the data collection or sharing protocols or to the initiatives that are implemented to influence reduction strategies.

Figure 37: Conclusion summary of multi-information collection & sharing

The figure represents the agencies involved, the fire service, police service, the health service for pathology or treatment and care, and the production of reports or results from each agency that contains information relevant to the fire fatality or the fatal fire.

This work provides a contribution and impact on the fire science community. First, the contributions to knowledge are reviewed in terms of the additional understanding of fire fatality data and the potential for enhancement. Second, the contribution and value of the research database itself which was developed as part of the research are described. Finally, consideration is given to the impact of the work outside of academic research on professionals and practitioners working in fire safety and fire incident investigation.

8.1 Contribution to Fire Investigation

This research identifies current fire investigation data and collection practices adopted throughout Scotland and draws comparisons with other practices concerning what data is currently collected and what data could be collected to increase the quality of analysis outcomes that can be drawn following fire incidents**.**

- Fire Investigation reports can provide more accurate data.
- Fire Investigation data can be provided in less time.
- Fire investigation data can be shared efficiently.
- Fire Service can provide "good practice" initiatives to improve health with an improved understanding of fire incidents, fatalities and injuries.

The research combines the involvement of the different agencies involved in the fire investigation process including Fire, Police, and Pathology.

8.2 Contribution to Fire Data Analysis

The research undertaken identifies the fire incident and fire casualty data currently being collected, collated and shared with other agencies or researchers to increase our understanding surrounding the fire, the fire death or fire casualty, additionally the research identifies the data that is missing and the inaccuracies that are identified through the data being analysed.

The creation of a fire fatality database is offered as a contribution to assist the different agencies. The database combines publicly available data and freedom of information requested data from the fire service, police force, and health service concerning post-mortem report results.

- Improved data quality for analysis.
- Verified outcomes from data analysis can be useful to different agencies including the fire service and the health service.
- Gives a complete picture of the circumstances surrounding the fire or cause of death or injury to augment future working practices or initiatives.

The research identifies additional datasets that could be added to the database to accommodate the research conclusions for additional data to assist future research.

8.3 Contribution to Fire Science

The thesis is offered as a limited contribution to fire science. The research was not specifically a scientific approach to the concern of smoke inhalation victims it does however assist fire scientists to have a perspective of where the scientific results of fire toxicity cross over into the practical effect that “smoke” from fires has on the health of occupants.

The research outcomes incorporate the fire toxicity research findings and provide additional information from a fire scene or fire victim which would assist and augment future scientific experiments on the subject of smoke inhalation or contamination from dwelling fires.

- The improved quality of data will assist research projects.
- The data would be up to date rather than two years old.
- The data on smoke toxicity from within the fire incident would assist fire science research as “real-time” results compared to simulated incidents.
- The blood toxicology results would assist fire scientists by providing an accurate level of absorption of toxins by the human body during a fire.
- Analysis of fire debris particularly “soot” will provide fire scientists with additional data regarding the toxins or carcinogens which are present in certain fire incidents.

The research presents conclusions that progress in understanding fire deaths and fatalities would benefit from a combined theoretical science and practical fire incident approach.

8.4 Contribution to the Health of Occupants

With the main aim of this research is how to improve the health of occupants of dwelling house fires; this thesis is offered as a contribution to assist multiple agencies in achieving this.

Health professionals involved in the care of smoke inhalation victims will get an understanding of what their patient has inhaled which can lead to appropriate medical intervention for the acute and chronic effects of smoke being presented. Whilst on scene at incidents, medical intervention for smoke inhalation will improve the health and future well-being of the occupants and the patients will be less distressed or ill when arriving at the Accident and Emergency department.

Having this additional awareness and knowledge of blood toxicity data from fire victims will assist medical staff to provide a quicker diagnosis and implementing an appropriate treatment plan. If the intention to reduce fire deaths or injuries is successful, the result will also lessen the workload for medical staff with fewer admissions to the hospital or reduced stays in the hospital because on-scene intervention started the healing process at the earliest opportunity.

8.5 Limitations

Any potential threats to the validity of the research have endeavoured to have been identified and addressed throughout the thesis in particular within Chapter 5. The source material of data provided for this research has been accepted on trust and professional accreditation from the national publications or the additional information provided for this research under private communication due to additional personal and confidential details regarding the fire fatality victim.

The data requested from each fire service was provided by an individual, the freedom of information officer, the limitation would be the extent of the data the individual collected or collated to provide for this research, each service provided different quantities of data, was that an individual choice or commitment. The missing data fields could be confirmed that the service just did not have that information, unable to confirm. Every fire service did

participate and did contribute to the research. It is not validated that each service provided all the fire fatality data they had for the period being researched.

Data requested from pathology and the post-mortem results were specific in detail and a positive contribution to the research and the creation of the database, there were limited responses from the area procurator fiscals for the release of the post-mortem reports, the explanation offered by the Crown Office was that reports were archived or "not available" there was no course of action available to make a second request for participation. Some post-mortem examinations did not offer the cause of death, this is contrary to pathology guidance but recorded "Death in Fire" did not contribute to the required sections within the database, akin to fire investigation reports there is no recourse available to revisit and validate the report.

Due to personal time constraints and limited personal financial contributions, there was a limited number of participants for the validation study, with six participants with an extra individual contribution from a pathologist. The mitigation to this is that the participants were all subject experts within their field of involvement in fire fatality cases. The diverse stakeholders were able to give an opinion regarding their relevant expertise.

As an initial fire fatality research project, the fundamental design had limitations in that the data for research was generated from what was available at this time, the future proposal for additional research will have fewer limitations as the data being identified for research will be influenced by the researcher. If future research identifies such criteria as blood analysis and if the agreement is reached that every fire fatality has a full toxicology screening of blood, and a code of practice requirement for pathologists carrying out post-mortems, the results would be available for research. Fire incident smoke toxicity is also a future research consideration, with an agreement to collect soot samples or gas analysis at the fire incident and then laboratory test to provide toxic concentrations, again the data results would be available.

There is limited scope to contest the data quantities or criteria provided, the "window of opportunity" to re-visit the fire scene or obtain verification of personal identifiers regarding the fatality is gone. Incomplete data fields provided must be accepted, an analysis may provide justifications for missing or incomplete data or ultimately depending on the quality of incomplete data fields, assumptions would have to be made.

The realistic scope of research, time and thesis production and publication, has had to be justified to provide a statement that the outcome of this research project warrants a statement of a valid contribution to the subject. As described in Chapters 5 and 6, the decision was taken to provide an introduction and awareness to the research potential for smoke inhalation medical intervention and regarding the understanding of increased risks to firefighters from smoke contamination.

It is offered that both these subjects are valid within the research arena of dwelling fires fatalities and injuries. The identified shortcoming of missing and available data was prioritised over these subjects. The research progressed on the research validation of missing data and the potential for future development of data on the subject. The research project proposals, conclusions and recommendations will augment the recommended future research which is required about smoke inhalation and smoke contamination to improve health and well-being.

Personal limitations also exist for the content and publication of this research project. As a solo researcher, the consciousness to avoid personal interpretations and avoid personal bias was a challenge that was addressed with the assistance and support of the project supervisor who ensured the justification of content was worthy and referenced as a contribution and not an opinion.

Chapter 9: Future Work

The principles of the database creation and the proposed electronic recording and data sharing system have the potential to be implemented for current and future work concerning fires, fire deaths and injuries. The research has identified areas of deficient data collection or recording and has justifiably proven the advantage of sourced data being accumulated within a single source for validation and analysis. The progressive next step is to introduce data collection and sharing between agencies, to advance our understanding of fire deaths and injuries.

With a willingness to participate and the commitment from each agency to improve the scope, quality and quantity of fire fatality and injury data, a research source database could be available. The tablet-assisted collection and sharing system proposal could be implemented within each country or region of the UK, which would provide a national database of relevant fire death and injury data about Scotland, England, Ireland and Wales. The database would be available for research analysis from the field of fire science, fire investigation and medical intervention concerning smoke inhalation and contamination.

Final Thoughts

This research is offered as a firefighter who believes this is the “bit more I could do” to try and reduce the pain, suffering and loss experienced in house fires for the members of our communities that we serve, having witnessed death, injury, and family devastation from dwelling house fires. And personally, it felt like it was happening far too often and more should be done.

The research has now confirmed that fire deaths, injuries and ill health to firefighters are caused by smoke inhalation and contamination at dwelling house fires and other fire incidents. The researcher owed it to his colleagues who put their lives on the line to save others, to highlight the risks they face in doing their job, and what can be done to improve their health and well-being.

This project identified the different skills and professional commitment of different peers who were involved with fires, fire deaths and fire injuries. The research began with a review

of the peer-reviewed literature, research publications into fires and fire toxicity and the national publications referenced and within the public domain. However, it was quickly identified that more was required. The researcher, therefore, collected information from fire services and pathologists and ultimately the expert and professional opinion of people who work and are involved in fire deaths and injuries every day as part of their jobs. In addition, the researcher benefited from attendance at presentations given by like-minded individuals who presented their work, and their opinions at conferences, open to questions from the audience. This enabled the researcher to participate in a community that also wanted to influence policy and change practices concerning fire safety.

An example of this research approach was the opportunity afforded to the project by a leading pathologist in Scotland, who provided a day of his time to discuss and advise on the progression of research into fire deaths, this meeting happened within the first month of the research and years later and at the submission phase.

A personal contribution was provided by Professor James Grieve, a pathologist with many years of experience in fire fatalities both doing post-mortems and attending fire incidents to witness the fatality on the scene. Professor Grieve intimated that more accurate and comprehensive blood screening could be undertaken for each fire fatality and that future fire casualty information could be a positive addition to future research projects on fire or fire victims. His professional opinion is that every pathologist should be visiting the fire incident to obtain more information relating to the fire death as we have a lot we can learn from the incident.

The progress towards the improvement of the number of fire deaths or the number of people who are being injured in house fires rests on the combined effort and commitment of the different agencies involved in the process involved. This thesis identifies the different agencies involved. It is hoped the different agencies may read this report and recognise their agencies' current involvement and contribution concerning fire fatalities or injuries. If each agency considered the recommendations applicable to them that their agency could implement, this would add to the accumulated fire data source that can be used to influence change and influence commitment to improvement.

This research deals with some of the aspects involved when a person dies or is injured in a fire in their home, it does not address, social or economic conditions, or deliberate acts which

led to the fire incident. This research is offered as a contribution to assist in the improvements of health and well-being for occupants of dwelling houses and firefighters who would be required to attend a fire incident. More fire data is required to be collected from the fire incident and the victim; this information must be collated in a single source of data for research. Agencies must commit to working together, providing and sharing their information to reduce the life-changing impact on families from a fire within their homes.

The hope is that things must change for the better soon, from the National Fire Protection Association (NFPA) report from around 1930 till today we are saying the same thing, not enough data, not sharing data, and smoke inhalation is killing people in fires, when do we address this? Hopefully now!

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Appendices

Appendix A

Fire Fatalities in Accidental Dwelling Fires

Information & Data pertaining to the Development of

Research Database

Iain Gavin BSc (Hons) M.I.Fire.E. M.I.F.P.O. M.I.F.S.M. I.A.F.S.S.

"Some information contained within this folder is of a sensitive nature and as such reader discretion and confidentiality is requested and expected"

University of Glasgow

PhD Research – Fire Fatality Database 2006 – 2008 – Source Material

Sequential by Date Number – From – T0 – (subject)

	Information	Fire Incident Data	Post-Mortem Data
Reference	**Description**		
001-ISG-SFB-Letter	Letter to Chief Fire Officer. Research Introduction and request for assistance from Strathclyde Fire Brigade		**01.01.10**
002-ISG-MSP-Letter	Letter to Scottish Government MSP re Research Introduction		**21.03.10**
003-SGD-ISG-Letter	Letter – Reply from MSP re-Fire Fatality Research Project		**04.05.10**
004-ISG-AllCFO's-Letter	Letters to All Chief Fire Officers, Request for research assistance and fire fatality data		**14.01.11**
005-CentralFRS-ISG-	E-mail offering support from Central Scotland Fire & Rescue Service		**17.01.11**
006-H&IFRS-ISG-	E-mail Offer of support and assistance from Highlands & Islands Fire & Rescue Service		**17.01.11**
007-D&GFRS-ISG-Letter	Letter – Reply from CFO, Dumfries & Galloway Fire & Rescue Service		**18.01.11**
008-ISG-SFB-	E-mail Requesting Freedom of Information data from Strathclyde Fire Brigade		**18.01.11**
009-ISG-D&GFRS-	E-mail Establish Contact with Dumfries & Galloway Fire & Rescue Service, Request Fire Fatality Data		**21.01.11**
010-D&GFRS-ISG-	E-mail Clarification on the data request		**24.01.11**
011-ISG-FifeFRS-	E-mail Confirmation of contact for obtaining Data relating to Fife FRS		**01.02.11**
012-ISG-Update-All-	E-mail Generic update to ALL, information on data collated to date		**03.02.11**
013-SFB-ISG-	E-Mail- Update on data request progress		**08.02.11**
014-ISG-Info-ALL-	E-mail circulation of research Fire Fatality Information Data request form		**11.02.11**
015-ISG-Form-	The research generated Fire Fatality Information – Data Request Form, sent to all Fire Services throughout Scotland		**11.02.11**
016-L&BFRS-ISG-	E-mail Clarification on the submission of data for the research project.		**14.02.11**
017-ISG-L&BFRS-	E-mail Additional information to Lothian & Borders Fire & Rescue Service, Research Plan		**14.02.11**
018-FifeFRS-ISG-FID-	E-mail Completed forms for Fire Incident/ Fatality victims in Fife		**15.02.11**
019-FifeFRS-Fatalit Data-	Fire Fatality Incident data for 10 Fire Victims from Fife Fire & Rescue Service		**15.02.11**
020-L&BFB-Info-	E-mail Lothian & Borders FRS contact details in order to assist with research		**15.02.11**
021-ISG-FifeFRS-	E-mail Acknowledging Fire Fatality Incident Data from Fife FRS		**15.02.15**
022-ISG-L&BFRS-	E-mail confirming data request with Lothian & Borders FRS identified service contact		**16.02.11**

023-GU Pathologist-ISG-	E-mail with Pathologist / acknowledging assistance and meeting confirmation	16.02.11
024-ISG-H&IFRS-	E-mail research data request from Highlands & Islands Fire & Rescue Service	18.02.11
025-SFB-ISG-	Information on Confidentiality contract agreement meeting between Researcher & Strathclyde Fire Brigade	18.02.11

	Information	Fire Incident Data	Post-Mortem Data
Reference	Description		
026-TaysideFRS-ISG-	E-mail confirming data request support from Tayside Fire & Rescue Service		21.02.11
027-CentralFRS-ISG-FID-	Fire incident data provided by Central Scotland Fire & Rescue Service		22.02.11
028-CentralFRS-Data-	Excel datasheet of Fire Fatality Incident Data from Central Scotland Fire & Rescue Service		22.02.11
029-GUPathologist-ISG-	E-mail with Pathologist arranging/confirmation of meeting		24.02.11
030-ISG-SFIU-Letter-	Letter to SFIU, Introduction & Request for Research Assistance		02.03.11
031-SFB-ISG-	E-mail containing information regarding FOI Contract with Strathclyde Fire Brigade		03.03.11
032-SFB-Info-	E-mail containing information regarding FOI Contract with Strathclyde Fire Brigade		04.03.11
033-ISG-GrampianFRS-	E-mail to Grampian FRS with a Copy of the letter to the Chief Fire Officer		07.03.11
034-ISG-Tayside FRS-	E-mail Acknowledge Fire Fatality Incident Data from Tayside Fire & Rescue Service		07.03.11
035-TaysideFRS-Data-	Spreadsheet for Fire Fatality Incident Data from Tayside Fire & Rescue Service		07.03.11
036-H&IFRS-Data-	Excel Spreadsheet of Fire Fatality Data from Highlands & Islands FRS – Incident details 17 victims		10.03.11
036-ISG-H&IFRS-	E-mail acknowledges assistance & Data from Highland & Islands Fire & Rescue Service		10.03.11
037-SFIU-ISG-	E-mail Response from Scottish Fatalities Investigation Unit, offer of research assistance.		24.03.11
038-GrampianFRS-ISG-	E-mail Chief Officer Requires a letter of endorsement before assisting with the research project		29.03.11
039-SFIU-ISG-	E-mail from SFIU obtained Crown Office Agreement & Approval for Research project & Post- Mortem Reports		29.03.11
040-ISG-SFIU-	E-mail acknowledge Crown Agreement for Post-Mortem / Toxicology reports		29.03.11
041-SFIU-ISG	E-mail identification of police case numbers may be required for sourcing Post Mortem and Toxicology Data		30.03.11
042-SFB-ISG-	E-mail Legal verification of FOI contract wording required by Strathclyde Fire Brigade		30.03.11
043-GrampianFRS-ISG-	E-mail Grampian Chief Officer does not want to contribute to this research project at this time – Staff Workload		30.03.11

044-ISG-SFIU-	E-mail Provide SFIU with example data obtained at present and how to proceed to obtain PM & Toxicology Reports	**30.03.11**
045-H&IFRS-ISG-	E-mail communication re-meeting arrangements in order to discuss fatality data not included in reports	**30.03.11**
046-SFIU-ISG-	E-mail SFIU intimating that Police case numbers may be required to obtain PM & toxicology reports from pathologists	**30.03.11**
047-ISG-SFIU-	E-mail to SFIU re-police case numbers following discussion with Strathclyde Police	**31.03.11**
048-ISG-H&IFRS-FID-	E-mail showing collated data for Highlands & Islands Fire & Rescue Service and meeting request	**31.03.11**
049-ISG-H&IFRS-FID	Research Collated fire incident & fire fatality data at the present time	**31.03.11**
050-ISG-CentralFRS-FID-	E-mail showing collated data for Central Fire & Rescue Service and meeting request	**31.03.11**

	Information	**Fire Incident Data**	**Post-Mortem Data**
Reference	**Description**		
051-ISG-CentralFRS-FID	Research Collated fire incident & fire fatality data at the present time		**31.03.11**
052-SFIU-ISG-	E-mail SFIU acknowledges Grampian Fire & Rescue Service is not willing to participate in or assist with research at this time		**04.04.11**
053-ISG-D&GPolice-	E-mail Request for assistance from Dumfries & Galloway Police Force for fire fatality case numbers		**05.04.11**
054-ISG-FifePolice-	E-mail Request for assistance from Fife Police Force for fire fatality case numbers		**05.04.11**
055-FifePolice-ISG-	E-mail Fife Police Unable to provide case numbers from FRS's information or data, Telephone conversation		**05.04.11**
056-ISG-SFIU-	E-mail to SFIU to discuss identifying and accessing Post-mortem case numbers/reports		**05.04.11**
057-Central-ISG-FID-	CONFIDENTIAL Central FRS provided Fatal Fire Interim Reports for six fire fatalities – Fire Incident Data		**05.04.11**
058-D&GPolice - ISG	E-mail Offer of assistance from Dumfries & Galloway Police to investigate case number for fire fatality victims		**06.04.11**
059-D&GPolice - ISG	E-mail Provision of Police Case Numbers and procurator fiscal References for two Fire Fatalities from D&G Police		**06.04.11**
060-ISG-FifeFRS-	E-mail Fife Fire & Rescue contact requested what specific fire fatality case numbers were required.		**06.04.11**
061-SFIU-ISG-	E-mail Providing Police case numbers, Request SFIU write a letter to Strathclyde Police confirming Crown Office support		**07.04.11**
062-GrampianFRS-ISG	E-mail Apology from Grampian FRS for not supporting Research but intimated another approach my produce results		**07.04.11**

063-ISG-CentralFRS-	E-mail Providing research summary data in addition to requesting assistance for police case numbers	**11.04.11**
064-ISG-H&HFRS-	E-mail Providing research summary data in addition to requesting assistance for police case numbers	**11.04.11**
065-CentralFRS-ISG-	E-mail Central Scotland Fire & Rescue Service provide Police Case numbers in order to progress research	**12.04.11**
066-CentralFRS-FID-	Excel Spreadsheet Confidential Information – Police case numbers & fire fatality personal information	**12.04.11**
067-ISG-L&DPolice-	E-mail Confirmation of Crown Office support email from SFIU sent to Lothian & Borders Police	**14.04.11**
068-ISG-L&BFRS-	E-mail Confirmation of meeting arrangements, fire fatality research data summary provided.	**14.04.11**
069-ISG-L&BFRS-FID	Excel Spreadsheet Research Collated fire incident & fire fatality data at the present time	**14.04.11**
070-CentralFRS-ISG-	E-mail Confirmation of meeting arrangements to discuss and consolidate fire fatality data used in this research project	**18.04.11**
071-L&BPolice-ISG-	E-mail Confirmation of assistance being provided, and clarification on Police case numbers required.	**18.04.11**
072-ISG-StrathclydeFB-	E-mail to FOI officer Strathclyde Fire Brigade, presenting data received and collated so far within the research project	**19.04.11**
073-StrathclydeFB-FID	Excel spreadsheet provided by Strathclyde Fire Brigade, fire fatality incident data 2006-08	**19.04.11**
074-ISG-SFB-FID	Excel Spreadsheet Research Collated fire incident & fire fatality data at the present time	**19.04.11**
075-SFIU-ISG-	E-mail Confirmation Crown Office approval letter sent to Strathclyde Police, acknowledging assistance from L&B Police	**20.04.11**

	Information	**Fire Incident Data**	**Post-Mortem Data**
Reference	**Description**		
076-CentralFRS-ISG-	E-mail Confirmation of Site meeting to discuss fire fatality research data collected so far from Central Scotland FRS		**26.04.11**
077-ISG-TaysideFRS-	E-mail requesting fire fatality names as this information is required by the police to provide case numbers		**27.04.11**
078-ISG-TaysideFRS-FID	Excel Spreadsheet Research Collated fire incident & fire fatality data at the present time		**27.04.11**
079-ISG-FifePolice-FID	E-mail information provided regarding fire fatality victim's names as requested by Fife Police		**27.04.11**
080-FifeFRS-FID	Confidential information Excel spreadsheet of Fife fire victims' names requested to provide police case numbers		**27.04.11**
081-Central Police-ISG-	E-mail Acknowledgement for Central Scotland Police, FOI request and assistance for the research project		**27.04.11**

082-ISG-TaysidePolice-	E-mail, request to Tayside Police for the research assistance of case numbers following data provided by Tayside FRS	**27.04.11**
083-ISG-SFIU-	E-mail Acknowledge Crown Office letter sent, update on progress for obtaining Police Case Numbers	**27.04.11**
084-CentralPolice-ISG_	E-mail Clarification requested by Central Scotland Police regarding Freedom of Information Request.	**28.04.11**
085-ISG-CentralPolice-	E-mail Information provided to Central Scotland Police regarding information request for the research project.	**28.04.11**
086-SFIU-ISG-	E-mail SFIU suggesting their e-mail is passed to Tayside Police to create an information-sharing protocol	**28.04.11**
087-CentralPolice-ISG	E-mail Central Scotland Police offering assistance in providing information from different sources	**28.04.11**
088-Grampianpolice-ISG	E-mail Grampian Police aware of current research and offering their assistance should Grampian FRS provide Data	**28.04.11**
089-Stra/Police-ISG	E-mail Strathclyde Police, acknowledge Crown Office approval, will send data to SFIU in the first instance	**28.04.11**
090-StrathclydeFB-FID	Confidential information Excel spreadsheet of Strathclyde fire victims requested to provide police case numbers	**28.04.11**
091-ISG-Stra/Police-	E-mail Acknowledge assistance from Strathclyde Police, Provide Fire Fatality Data existing to identify case number.	**28.04.11**
092-FifePolice-FID	E-mail CONFIDENTIAL Police case numbers and Personal Information regarding Fife Fire Fatality victims	**03.05.11**
093-ISG-FifeFRS-	E-mail to Fife Fire & Rescue Service regarding receipt of police case numbers and clarification re fire fatality data	**04.05.11**
094-FifePolice-ISG-	E-mail confirmation from Fife Police, fatality data missing due to death sometime after fire incident	**06.05.11**
095-GUPathologist-ISG-	E-mail From Glasgow University Pathologist, acknowledging research data received and offering assistance	**13.05.11**
096-SFIU-ISG-	E-mail Update from SFIU, cause of death data received for most FRS's Toxicology Reports Requested from PF's	**18.05.11**
097-SFIU-ISG-	E-mail Using the suggested spreadsheet could be problematic, a meeting to be arranged to appraise data obtained by SFIU	**10.06.11**
098-GrampianFRS-FID	Excel Spreadsheet Grampian Fire & Rescue Service, Fire Fatality Incident data for 2006 – 2008.	**06.07.11**
099-ISG-GrampianFRS-	E-mail Acknowledge fire fatality incident Data from Grampian FRS, and provided project summary report	**07.07.11**
100- L&BFRS-FID-	Excel Spreadsheet Lothian & Borders FRS, Fire Fatality Incident Data for 2006 – 2008.	**07.07.11**

	Information	Fire Incident Data	Post-Mortem Data
Reference	**Description**		
101-D&GFRS-FID	Fire Fatality Incident Data for two Fire Victims from Dumfries & Galloway Fire & Rescue Service		**07.07.11**
102-D&G-SFIU-ISG	Excel Spreadsheet – **Confidential** – Post-Mortem & Toxicology Results for Dumfries & Galloway Fire Victims		**Via SFIU**
103-Central-SFIU-ISG	Excel Spreadsheet – **Confidential** – Post-Mortem & Toxicology Results for Central Scotland Fire Victims		**Via SFIU**
104-Fife-SFIU-ISG	Excel Spreadsheet – **Confidential** – Post-Mortem & Toxicology Results for Fife Fire Victims		**Via SFIU**
105-L&B-SFIU-ISG	Excel Spreadsheet – **Confidential** – Post-Mortem & Toxicology Results for Lothian & Borders Fire Victims		**Via SFIU**
106-Strathclyde-SFIU-	Excel Spreadsheet – **Confidential** – Post-Mortem & Results for Strathclyde Fire Victims		**Via SFIU**
107-SFIU-ISG	E-mail from SFIU, **Confidential**- additional Toxicology Results for 9 Strathclyde Fire Victims		**21.07.11**
108-SFIU-ISG-	E-mail Response from SFIU to the research question of awareness of fire fatality Database or future potential		**07.09.11**
109-Strathclyde-SFIU	**Confidential** Full Post-Mortem and Toxicology Reports for 8 Strathclyde Fire Fatalities (Wishaw General Hospital)		**12.09.11**
110-SGD-ISG-	E-mail response from the Scottish Government regarding research future aim of a specific fire fatality database		**12.09.11**
111-Tayside-SFIU-ISG	Excel Spreadsheet – **Confidential** – Post-Mortem & Toxicology Results for Tayside Fire Victims		**Via SFIU**
112-ISG-StrathclydeFB-	E-mail request advice and guidance on the sources of information within the Service, FI/ FSEC/ IRS etc.		**20.09.11**
113-SGD-ISG-	E-mail response from the Scottish Government regarding my research database creation and future development		**14.10.11**

Appendix B

D.O. Fire Inv.	Fire Safety	Media Liaison	Control	H.M.I.

Date sent to above……

Fire Safety/Fire Investigation/HMI
Fatal Fire Interim Report

(Complete one form for each fatality)

1. Service	2. Station Area	3. Risk category	4. Local Authority Area		
Fire & Rescue Service					
5. Date of Incident	6. Incident Number	7. Time of Call	8. Time of Mobilising	9. Time of Arrival	10. Time of Stop
11. Location/Address of fire					12. Postcode
12. Name of Fatality				13. Age	14. Sex
15 Home Address (if different from above)					15 (a) Postcode

16. Type of Property (tick to indicate)						
House		**Flat (see below)**		**Caretakers Flat**		
Single Occ.		Single Occ.		**Flat over Shop**		
Unoccupied		Unoccupied		**Caravan/Mobile Home**		
Derelict		Derelict		**Office/Shop**		
Multi Occ.		Multi Occ.		**Outside Area**		
Miscellaneous (please state)						
17. Brief Description on type of property						
18. Does it conform to building regulations current at time of construction						

Insert 'T' for Terrace or 'B' for Block

19. **Location of Fatality:**

20. **Location of Fire(s):** Give location of seat(s) of fire, floor, use of room and position in relation to the location of fatality.

21. **Fire Spread/dynamics**

22. **Source of ignition**

23. **Material Ignited First**

24. **Material responsible for the development of fire**

25. **Supposed cause of fire(s)**

(a) Likely cause –

(b) Other possible causes

26. **Main factors contributing to fatality:** please indicate and explain any factor contributing to the victim being unable to leave the premises. If not known, please enter details in the comment box.

Please mark as **Direct/Indirect/X (**not applicable) **Note:** each box must contain an entry

Alcohol Involvement		**Drug Abuse**		**Prescribed Medication**		**Learning Difficulties**	
Unattended Child		**Mobility Impairment**		**Smoking**		**Some form of Care in the Community**	
Any other Physical Disability		**Unknown**		**Living Alone**		**Other (please specify)**	
Comments							

27. **Was the victim the sole occupant**

28. **Did the incident involve non-fatal casualties (Non Fire Service)**

29. **Did the incident involve rescues?**

30. **If YES to 29, were rescues effected by F.B. personnel**

31. **Was smoke detection/alarm installed?**
(a) Within the affected premises?
(b) Elsewhere in the building

32. **If YES to 31** **(a) Did it function correctly**
(b) Did it alert the occupants

33. **If answer to 32 (a) was NO, please indicate reason.**

No Battery/Battery removed		**Detector dismantled**		**Damaged by fire**	
Incorrectly installed/sited		**Other or unknown (please state below)**			
Comments					

34. **If answer to 32 (b) was NO, what are the supposed reasons for non-alert?**

35. **If smoke detection installed, what was the power source(s)**

36. **Was there heat detection installed within the premises**

37. **Did it function satisfactorily**
(if NO, give reason)

38. **Was there a sprinkler system installed in the premises**

39. **Did it function satisfactorily?**
(if NO give reason)

40. **Was there other firefighting equipment installed within the premises (including domestic extinguishers)**

41. **If no smoke detection/alarm system/sprinkler installed within the premises, please state in your opinion if the fatality COULD have been prevented if a smoke alarm or system of automatic detection had been installed.**

42. **Please give any other information which may be of relevance (e.g. sound of smoke alarm heard by neighbour, occupier known to have removed battery, empty bottles found adjacent to settee, date victim died in hospital, etc.)**

43. **Cause of death/Toxicology report to be forwarded as soon as possible**

Signed……..Fire Investigation Officer

Date……

Appendix C

Fire Fatality Information / Data Recording Sheet **2006 – 2007 - 2008**

Question?	Result			
Fire & Rescue Service				
Incident **Time of Call: -**				
Day + Date / Month / Year				
Address + Post Code **(required to obtain SIMD)**		**SIMD**	**= ???? / ??**	
Property type				
Owner or Occupier (rent)				
Fatality				
Ethnicity				
Gender				
Age				
Location (room)				
Cause of Death				
Any Contributing Factors				
Alcohol confirmed as a contributing factor	Yes / No	PM - Result -Blood Alcohol Concentration figure	**=**	
Fire				
Cause of fire				
Room of Origin				
Any Contributing Factors				
Smoke Detection				
Operation Code				
Reason for non-operation				
Location/ Siting (rooms)				
Number of Occupants at time of the incident?				

Appendix D

60 Turnberry Wynd
Tarryholme
Irvine
North Ayrshire
KA11 4DP

Chief Fire Officer
Central Scotland Fire & Rescue Service
Service Headquarters
Main Street
Maddiston
Falkirk
FK2 0LG

14th January 2011

Dear Chief Fire Officer

PhD Research Study – Fire Fatalities within Scottish Dwellings

In discussion with Glasgow University, I have been offered and accepted the opportunity to undertake a PhD research placement. The project of study would be to further investigate and research the instances of fire fatalities within accidental dwelling fires throughout Scotland.

In line with this research opportunity, I am requesting the endorsement and assistance of your Fire & Rescue Service to enable a Scotland-wide analysis to be undertaken. I have as appropriate obtained support and assistance from the Scottish Government, Community Safety and Resilience Unit together with the permission and acknowledgement of assistance from Chief Officer Sweeney of my fire service.

The research would focus more on the specifics of accidental dwelling fires and research why the generalised contributory risk factors such as deprivation, smoking and alcohol consumption appear to result in fire deaths within Scotland at a higher or more consistent rate than in other areas or countries.

This opportunity came about after discussions with the Community Safety and Resilience Unit and The Scottish Fire and Rescue Advisory Unit at the Scottish Government. My interest and intentions were passed on to Professor Chris Johnson at Glasgow University. Professor Johnson and I have had many discussions on the research subject proposal, and he agrees with me in that we could use this research opportunity to further the previous research works that have been undertaken and could add to the understanding of fire fatalities within our dwellings. Any results or outcomes from this research could be used to augment or enhance the results from recent good practice publications such as “Scotland Together – A study examining fire deaths and injuries in Scotland”.

This proposed research project would look closer at the specifics of fire fatalities and examine the deeper causes and associated factors. The project would have a triangular approach to fire deaths. Initially, I looked at the years 2006 – 2008, 3 years as recommended in the Scotland together document. This target group may be reduced to single years fatality statistics, once the level and quantity of research required are fully appreciated. Briefly, the research approach would address: -

Statistical Analysis – (overseen by Professor Johnson) a study of accidental dwelling house fires, involving statistics from Fire & Rescue Services, National and Local Governments, (building on the good practice of previous research publications)

Fire Science – The common causes of dwelling fires include the affected room but additionally looking at the specifics of the materials ignited first or contributing to the development of the fire. Secondly looking at the smoke production/toxicity in relation to the materials ignited why in some fires do people escape while others succumb to the toxic effects?

Psychology - Are there any psychological differences between the people within our communities compared to other areas? The deprivation impact on the individual and the common risk factors of elderly, smokers & possible alcohol, or other debilitating substances, common throughout the world so why a higher resultant fire fatality rate than in these other countries?

If you are willing to give your endorsement to this research project the researcher would request your permission to access the information specific to the target group fatalities being studied. Access to the fatal fire investigation reports and other statistical and specific data gathered from these incidents.

By the Scottish Government, Statistical data provided the number of relevant files/reports applicable to your Service would appear to be:-
2006 (3 Fatalities) – 2007 (2 Fatalities) – 2008 (3 Fatalities) = 8 Fatalities

Any research findings may be shared with my peers as appropriate however **total confidentiality** of the individual fatalities will be stringently maintained at all times, the research does not require individual names however other personal statistics, gender, age, address etc will be required.

I trust the information given above is sufficient for you to make an assessment of the appropriateness of my project proposal and to determine whether you and your Fire & Rescue Service would be willing to endorse and provide support for this project.

In line with confidentiality, I would be willing to attend your Service Headquarters to obtain the information. Additionally, I have provided my Strathclyde Fire & Rescue Service e-mail address to assist in the process of correspondence between your Service personnel and myself.

Should you require any additional information regarding this request I would be more than happy to oblige. I can assure you my intentions for this project are both honourable and professionally motivated. I want to contribute to the outcomes of All Scottish Fire & Rescue Services by assisting to create safer places for our communities to live by reducing the fear of and the catastrophic effects of a fire that some suffer.

Yours Sincerely

Iain S Gavin **BSc (Hons), M.I.Fire.E. M.I.F.P.O. M.I.F.S.M.**

Watch Commander B, Community Safety Enforcement, Kilmarnock Fire Station,
Campbell Street, Kilmarnock, KA1 4HL, Tel: - 01563 533321
e-mail – Iain.gavin@strathclydefire.org

Additional Contact Details – e-mail – Mobile –

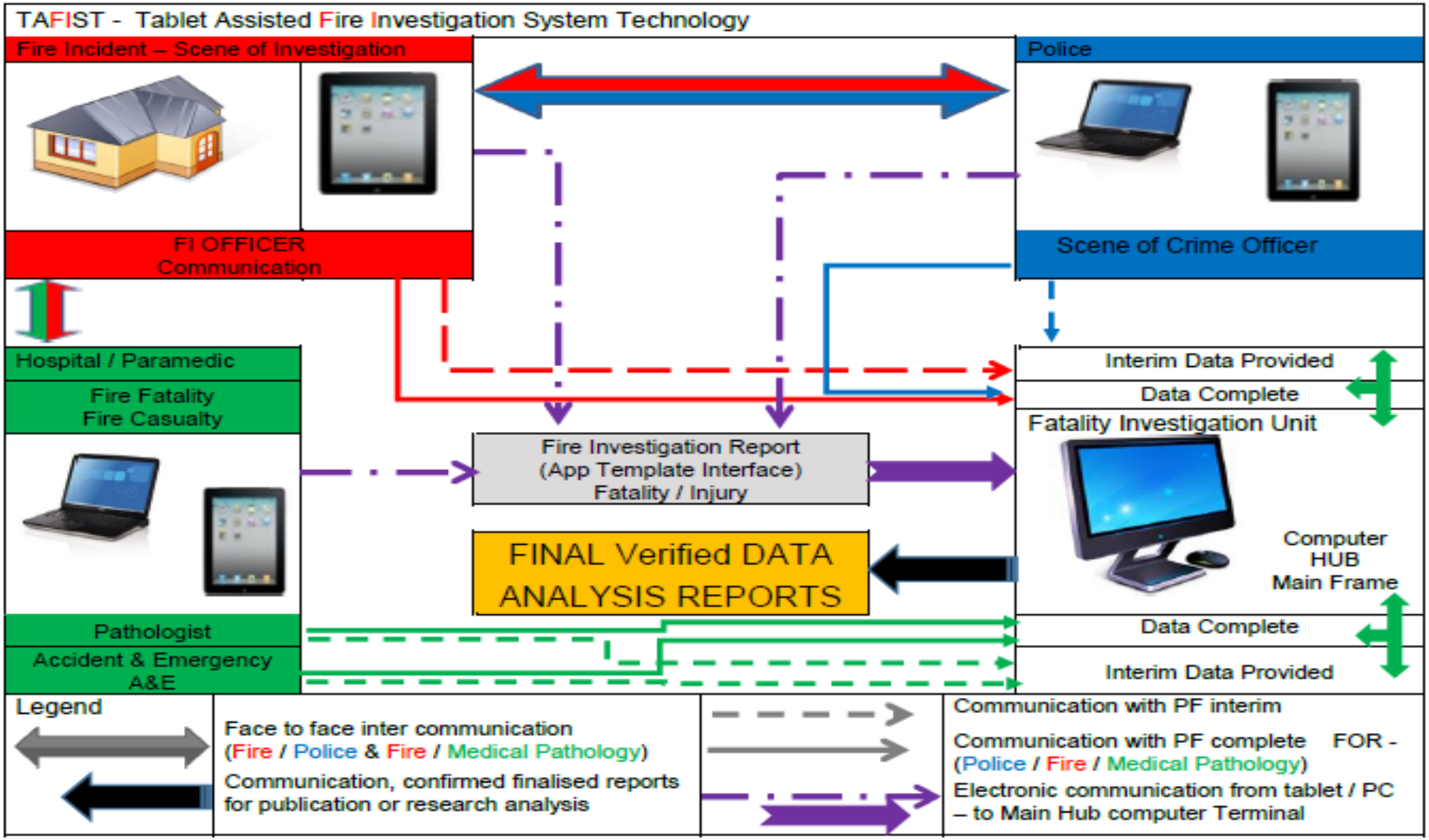
TAFIST - Tablet Assisted Fire Investigation System Technology

Fire Incident – Scene of Investigation		Fire Investigation Officers
 Location	 Communication	1. Tablet IT communication 3G/4G – capability 2. App programme pre-loaded 3. Incident / Report number electronically assigned by FIU Hub 4. App Programme: - Fire fatality investigation report pre-loaded. 5. Visual Confirmation of each data field requested- has been completed 6. Audio / visual indication of completed post mortem report. 7. Interim information sent to HUB 8. Confirmation of any additional investigation to be undertaken 9. Additional information recorded 10. Confirmation of Investigation complete

Police & Scene Of Crime Officers		FIRE Fatality Investigation Unit	
	1. Visual / audio indication of fire fatality investigation in progress 2. Availability to access fire fatality interim report / fatality details. 3. Ability to 'red flag' fatality or incident details conflicting police investigation. 4. Authorisation to restrict access to data pages, if required, (Criminal proceedings) 5. Sample analysis results	1. Remote information retrieval hub 2. Assign incident / report sequential numbers. FI, Police & PM templates 3. Risk analysis program run 4. Visual confirmation – additional information fields completed. 5. Analysis – reports confirmed 6. Recorded and collated data 7. Provide annual reports 8. Provide specific statistical data	 Computer HUB

Hospital			Ambulance
	1. Visual / audio indication of fire fatality investigation in progress 2. Availability to access fire fatality interim report / fatality details. 3. Ability to 'red flag' fatality or incident details conflicting PM findings 4. Completion of cause of death, Toxicology, & additional Factors fields. 5. Programme ability to upload report document if appropriate. 6. Authorisation to restrict access to data pages, if required, (legal justification)		
	Pathologist	Paramedic	Accident & Emergency

Appendix E


TAFIST - Tablet Assisted Fire Investigation System Technology
Fire Incident – Scene of Investigation
Police
FI OFFICER
Communication
Scene of Crime Officer
Hospital / Paramedic
Fire Fatality
Fire Casualty
Interim Data Provided
Data Complete
Fatality Investigation Unit
Fire Investigation Report
(App Template Interface)
Fatality / Injury
FINAL Verified DATA
ANALYSIS REPORTS
Computer
HUB
Main Frame
Pathologist
Accident & Emergency
A&E
Data Complete
Interim Data Provided
Legend
Face to face inter communication
(Fire / Police & Fire / Medical Pathology)
Communication, confirmed finalised reports
for publication or research analysis
Communication with PF interim
Communication with PF complete FOR -
(Police / Fire / Medical Pathology)
Electronic communication from tablet / PC
– to Main Hub computer Terminal

Appendix F

University of Glasgow | School of Computing Science

PhD Research Interview Participants

Title of Project: Dwelling House Fires (Scotland), Investigation, Analysis, Data **Collection** and Sharing. To augment the safety and well-being of Occupants and Firefighters

Name of Researcher: Iain S Gavin

Scope of Interview participants:

The Research will endeavour to obtain a cross-section of professional opinions from throughout Scotland. The geographical profile for the investigation of fire fatality and fire victims throughout Scotland is divided into the responsibilities of three areas, North Scotland, East Scotland, and West Scotland.

The objective would be to obtain a professional opinion on the outcomes derived from the research and to comment on the feasibility of conclusions and recommendations contained within the final thesis report.

Participants:- Some questions are common between professions. When the participant responds by yes or no to a particular question, the discussion will open up to clarify the response. The opening introduction and discussion for ALL participants will determine their organisations and professional involvement in fire fatality investigations or fire fatality and injury casualties' treatment and care.

Procurator Fiscals Service – Legal jurisdiction regarding all Scottish Fatalities. Recipients of the final investigation Reports.

Q Are current published policies and procedures accurate and adhered to in practice?

Q is the current practice of reporting a fire fatality investigation the most professional and best practice for accurate outcomes? (could be the reports from 4 different agencies depending on the fire scene investigation)

Q Would the Procurator Fiscals Service (Scottish Fatalities Investigation Unit) recognise current qualifications and experience? Or would professional qualifications and a recognised membership of an accredited agency be positive towards verification of final reports or any legal case arising?

Q what is the legal position regarding public access to publications of Fire Fatality or Fire Investigation reports?

Q Whilst considering Patient Confidentiality, what are the barriers to obtaining toxicology reports or death records pertaining to fire fatalities and fire victims for the purpose of medical and fire science research?

Police Crime Scene Manager – responsible for the management and control of the incident scene, and the assistance regarding the completed submission to the Procurator Fiscal.

Q Are current published policies and procedures accurate and adhered to in practice?

Q Does the current practice of up to 4 different authorities involved in the investigation make the scene management responsibilities and role more difficult?

NHS A&E Consultants – Emergency Treatment of fire victims, smoke inhalation and burn injuries

Q Are current published policies and procedures accurate and adhered to in practice?

Q What is the current status for the treatment of smoke inhalation victims?

Q What antidotes are provided for victims of hydrogen cyanide inhalation following house fires?

Q What are the practical – Acute and Chronis effects from smoke inhalation for fire victims?

Q What is your opinion on the use of antidotes for smoke inhalation victims at the fire scene?

Q What is the current practice for taking blood samples from smoke inhalation victims? What is being tested for? And what are the practical obstructions to requesting full blood toxicology screening from all smoke inhalation victims?

Scottish Fire & Rescue Service (SFRS)–

SFRS Senior Officer – Responsibility for managerial decisions within the organisation with the role to ensure all policies and procedures are fit for purpose and adhere to best practice principles.

Q Are current published policies and procedures accurate and adhered to in practice?

Q Are there any additional results or information that could be obtained from the fire scene in order to enhance the safety and well-being of fire victims and firefighters?

Q Would it be an advantage or disadvantage to provide Operational Crews with access to Fire Investigation Reports? Could they learn from previous incidents?

Q What is the Service's interpretation of sharing information regarding Fire Fatality or Fire Investigation reports? Other agencies' investigation reports are public access.

Q Should Fire Investigation remain a role within the Fire Service (not a legal requirement)?

Q Would it be an improvement for the Service if Fire Investigation Officers and procedures were accredited in relation to qualification and practices to undertake Investigations?

Q Given the stages of Fire Investigation within the Service, and the importance of the recorded results, do you believe that current training and information for Operational Officers is sufficient and appropriate?

Q Are you aware of any firefighters who have cancer, given the published research, do you believe that additional investigation of toxins at the fire scene would be a positive advance regarding the well-being of firefighters?

SFRS Fire Investigation Officer- the role of investigating the circumstances of the fire and any subsequent fatalities or injuries, Responsibility for producing the final investigation report (same questions but from the professional opinion of officers involved in the practice of Investigations)

Q Are current published policies and procedures accurate and adhered to in practice?

Q Are there any additional results or information that could be obtained from the fire scene in order to enhance the safety and well-being of fire victims and firefighters?

Q Would it be an advantage or disadvantage to provide Operational Crews with access to Fire Investigation Reports? Could they learn from previous incidents?

Q What is the Service's interpretation of sharing information regarding Fire Fatality or Fire Investigation reports? Other agencies' investigation reports are public access.

Q Should Fire Investigation remain a role within the Fire Service (not a legal requirement)?

Q Would it be a positive improvement for the Service if Fire Investigation Officers and procedures were accredited in relation to qualifications and practices to undertake Investigations? ISO accreditation etc.

Q Given the stages of Fire Investigation within the Service, and the importance of the recorded results, do you believe that current training and information for Operational Officers is sufficient and appropriate?

Q Are you aware of any firefighters who have cancer, given the published research, do you believe that additional investigation of toxins at the fire scene would be a positive advance regarding the well-being of firefighters?

SFRS Operational Officer – responsible for attendance at fire incidents, will undertake fire investigation of level 1 incidents, incidents not involving fatalities or excessive damaged caused by deliberate ignition from a criminal act of wilful fire-raising.

Q Are current published policies and procedures accurate and adhered to in practice?

Q Are there any additional results or information that could be obtained from the fire scene in order to enhance the safety and well-being of fire victims and firefighters?

Q Would it be an advantage or disadvantage to provide Operational Crews with access to Fire Investigation Reports? Could they learn from previous incidents?

Q What is the Services' interpretation of sharing information regarding Fire Fatality or Fire Investigation reports? Other agencies' investigation reports are public access.

Q Should Fire Investigation remain a role within the Fire Service (not a legal requirement)?

Q Would it be an improvement for the Service if Fire Investigation Officers and procedures were accredited in relation to qualifications and practices to undertake Investigations? ISO accreditation etc.

Q Given the stages of Fire Investigation within the Service, and the importance of the recorded results, do you believe that current training and information for Operational Officers is sufficient and appropriate?

Q Are you aware of any firefighters who have cancer, given the published research, do you believe that additional investigation of toxins at the fire scene would be a positive advance regarding the well-being of firefighters?

Appendix G

University of Glasgow | School of Computing Science

PhD Research Consolidation Interview
Participant Information

Title of Project: **Dwelling House Fires (Scotland), Investigation, Analysis, Data Collection and Sharing. To augment the safety and well-being of Occupants and Firefighters**

Name of Researcher: **Iain S Gavin**

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part.
Thank you for reading this.

What is the purpose of this study?
The current PhD study has been researching fire fatalities within dwelling houses; the cause of the fires and the resultant cause of death of the occupant. The study has concluded that there are a number of different Authorities involved in the procedure of fire and fire victim investigation from the fire incident scene to the determined cause of death by a post-mortem. It has also become of interest during the research study that smoke inhalation within a dwelling fire is not only the major cause of death but is also the major cause of injury to occupants, additionally, the contamination of smoke from fire incidents is receiving worldwide recognition as a source of increased cancer risk for firefighters.

Current practices adopted by Authorities involve different professionals completing their own department's reports and as such the collation, access and sharing protocols relating to fire fatality victims require contact and request from these different organizations.

The study has produced conclusions and recommendations regarding the acknowledgement of current good practice but also infers potential improvements for consideration, relating to fire scene investigation, routine tests at post-mortems and routine tests which could be conducted on casualties presenting at A&E from smoke inhalation following a fire incident.

This interview project endeavours to get a professional opinion from each Authority in relation to current practices, in consideration of the research findings, and also to obtain a professional opinion on the suggested outcomes and recommendations of the PhD study being undertaken.

The interview would take approximately 30 minutes to complete, depending on the content and cooperation, the process will take place at a time and venue of your choosing

and the researcher will take notes after which a transcript will be formalized for your consent and agreement for inclusion within the completed PhD thesis submission.

Who is being invited to take part?
The invitation to participate is being extended to professionals from the multi agencies involved in the different aspects of fire fatality investigations, Fire Scene investigation and pathology – Post-Mortem examinations. Additionally, the research has highlighted outcomes involving smoke inhalation victims at fire incidents and as such, the invitation to participate is extended to include Accident and Emergency staff at Hospitals who provide the initial treatment and tests on the presentation of a smoke inhalation casualty.
The agencies being invited to participate: -
NHS – Accident & emergency Consultant, Pathology Consultant
Police Scotland – Crime Scene managers, Scene of Crime Officers
Fire Scotland – Senior Officers, Fire Investigation Officers
Procurator Fiscal, Scottish Fatality Investigation Unit

What are the possible benefits of taking part?
Your participation would benefit the credibility of the research outcomes, conclusions, and recommendations; your contribution would potentially lead to the justification or improvements of current practices and as such contribute to the health & well-being of fire victims and the potential reduction initiatives which may be considered.

What happens at the end of the study?
The final research thesis will carry a chapter on the consolidation and verification or otherwise of the research study findings and conclusions. The transcript of the interviews undertaken will be published in print within the PhD Submission. The availability and access to the publication will be in accordance with the University of Glasgow's policy and procedures for completed PhD Thesis submissions. There is no intention to publish the contents or information provided in any journal or additional public access forum.

Confidentiality - who will have access to the information I provide?
The access to your responses will be as mentioned above. Your information within the thesis body will be anonymized to the extent of "following discussion with a professional within the field of……."
The intended script for inclusion will be provided to you prior to final inclusion within the document, as such, you can confirm your agreement with the text, or request amendments until a final agreement is reached between the researcher and the participant.

If you decide and confirm that you would wish to accept the offer of being included within the acknowledgements list of the PhD thesis, your name profession and position would be recorded, again the exact inclusion of the text will be agreed upon between the researcher and participation prior to final inclusion within the document.

It must be re-iterated; at no time will individual patients, victims or legal case information be discussed at any time during the interview discussion process. This is a generic discussion regarding current protocols implemented to get a professional opinion on the research outcomes and conclusions drawn from the Study.

Can I ask questions about the research project?
You may ask more questions about the study at any time - before, during and after the study. The researcher will provide their telephone number and contact details and will additionally provide the contact details of the University Supervisor who is overseeing this project, in order that they are available to answer your questions or concerns about the study at any time.

Can I withdraw from the study?

Your participation in this research project is voluntary, and you may withdraw from the research at any time and for any reason, without explaining why.

Will I receive financial compensation?
Participation is voluntary and as such, there is no financial remuneration or transaction.

Your consideration for participation in this study is greatly appreciated by the researcher and trust the information provided above is satisfactory and comprehensive for your acceptance to participate.

Appendix H

COMMENTS ON FIRE FATALITY RESEARCH

It is difficult for me to specifically comment on the actual questions which are posed. However, I have some general observations.

a) I think that the pathologists should be encouraged to attend at the locus of fatal fires, particularly when the deceased is still *in situ*. I believe that in Scotland, nowadays, that would require an instruction from the Procurator Fiscal, but that should not interfere with the principle; however, I derived enormous benefit from having the opportunity to watch, discuss and learn from fire investigators and others at the scene, and consider that I developed a proper understanding of what I could contribute to the integrated investigation and analysis of the circumstances and mechanism of death which would be important from the perspective of attributing manner of death (natural causes, accident, suicide, homicide, etc.) as well as contributing to a thorough and just delivery of evidence in any criminal proceedings.

b) There should never be any situation in which full toxicological analysis for alcohol, drugs and special substances and poisons related to the fire (CO, HCN, any hazardous substances specific to that particular event) is not conducted on body fluids or tissues as available and appropriate. Not only does such indicate causes of death from fire (e.g. smoke inhalation), but may confirm a toxicological cause of death not directly related to the fire (though perhaps part of the causation of the initial conflagration) or contribution to the cause of death, or indeed indicate that death was nothing to do with the fire. I cannot comment particularly on the value of analysis of material from the physical environment of the body, but my general belief would be that such (possibly with correlation to toxicological findings in the body) might be of value. It would be worth considering collecting and storing such samples for possible future analyses.

c) It would be good to encourage that all post-mortem examinations in fire deaths conform to thorough basic standards and include a minimum or optimum data set. I have always been against the notion of having a universal template or "tick box" arrangement as it militates against professionals thinking in any particular case, and perhaps modifying the examination in particular circumstances in order to optimize the information available. That would, of course, include the requirement for full toxicology, etc.

   Presently the Royal College of Pathologists (RCPath) is constructing various guidelines for different types of examinations for routine pathologists conducting examinations. For example, I, along with others, produced a recent guideline for the examination of a body recovered from water. At present, I am unaware of a guideline relating to Death in Fire, but such may be published in due course or might be recommended.

d) I should like to make specific remarks about "Death in Fire" as a cause of death. I was brought up to use that expression on a Medical Certificate of Cause of Death in most cases of fire fatality, in order to produce a death certificate quickly or timeously for the relatives and permit the procurator fiscal early to release the

body while further investigations are carried out. It is preferable to signing the death up as "unascertained" after the initial post-mortem examination, as it does at least indicate on the Death Certificate that the deceased had been involved in a fire, while the all-important ancillary investigations are carried out (particularly toxicology which may take many days, or, for much of Scotland and remaining U.K., many weeks). The fundamental problem is that of whether the deceased was alive when the fire started or had died of other causes (including natural death and homicide along with other possibilities) before the fire started or was started by a third party. In order to establish that, especially in a badly burned body, we will rely on e.g. carbon monoxide concentrations. "Death in Fire" is a noncommittal, non-judgemental holding position which is entirely adequate for the public record and covers all eventualities including natural death and all manner of deaths including homicide, etc. The final report to the procurator fiscal is where there should be exploration and interpretation of the actual cause and mechanism of death.

e) I think that, overall, the critical issue is to encourage more communication amongst various parties and experts. Nowadays, in clinical medicine, it is commonplace to have a Multidisciplinary Team Meeting (MDT) with all interested parties and specialists who might have a contribution to a patient's care, focussed on the patient. We, in Aberdeen, have a similar process involving forensic pathologists in another area of our activity. We should encourage such meetings in fire investigation (if necessary, chaired by the Procurator Fiscal) as it facilitates understanding of everyone's roles and capabilities and allows for different specialists to question others and gain deeper comprehension of the potential of the investigation; it informs future practice as well as providing valuable feedback.

f) Of course, I would always endorse anything that stimulates education, research and development in all fields, particularly, where that will prevent further loss of life or property (I do not have to mention the recent Grenfell Tower disaster as a critical example of where things have not been fully and properly understood and implemented).

g) Similarly, anything which contributes to health and safety of individuals for the future must be wholeheartedly encouraged. Therefore, I would support research into hazards of smoke inhalation, and into ways of preventing these or mitigating the adverse effects.

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