An exploration of the factors associated with paediatric burn injuries in rural and peri-urban Malawi

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Abstract

Background: Burn injuries disproportionally affect the world's poorest regions. However, there is a lack of data from these areas to determine the true extent of this public health problem. Children in Malawi are at high risk of burn injuries and poor health because of the nature of their environment, and the paucity of burn prevention programmes. At present, the research that reflects the factors associated with these injuries has been limited to the interpretation of quantitative, hospital based data, which may provide patterns of burns risks, but does not reflect the context or perception of burn injuries necessary to create culturally appropriate and targeted prevention initiatives. Moreover, while it has been suggested that the use of improved cookstoves (ICS) in these areas might mitigate children's exposure to burn injuries more research is needed.

Aim: To explore the factors associated with paediatric burn injuries in rural and peri-urban Malawi.

Methods: This study employed a qualitative approach to explore the contextual factors, associated with paediatric burn injuries, across four villages in Malawi. Three of these villages had been previously exposed to an ICS intervention. In addition to conducting observations of household environments, multiple perspectives of burn injuries were sought from 32 parents, 12 health professionals and 6 key stakeholders using semi-structured interviews. Focus groups were conducted with household participants to gain a better understanding of safety in relation to their cooking methods. The data obtained were analysed using thematic analysis.

Results: The study revealed a number of environmental and social factors which put children at risk of burn injuries across rural and peri-urban Malawi. Parents are often limited in their ability to provide adequate protection against such injuries because of: a lack of knowledge

about injury prevention, a lack of safety equipment, a lack of control to make alterations to their housing and an inability to adequately supervise children. Additionally, health professionals reported that, due to a lack of time and resources, they were unable to consistently provide information to parents and caregivers about preventing burn injuries in the home. Those working with existing ICS initiatives in Malawi revealed that, although kitchen safety is currently discussed as part of organisations' promotional activities, there is a lack of data measuring the effectiveness of this teaching.

Conclusion: The factors associated with paediatric burn injuries and prevention, both actual and perceptual, are multifaceted and intertwined with the complex nature of the household environment and those who live within it. This study has provided a starting point from which to understand these factors and gives a voice to those affected. Overall the results demonstrate that there is an urgent need to raise an awareness of the burns problem to policy makers, key stakeholders, health professionals and parents, to initiate the development of comprehensive prevention initiatives. Future strategies need to consider the integration of multilevel support to address the challenges faced by families living in rural and peri-urban Malawi.

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List of acronyms

Acquired Immunodeficiency Virus	**AIDS**
Christian Health Association of Malawi	**CHAM**
Community Health Worker	**CHW**
Computer-assisted Qualitative Analysis Software	**CAQAS**
Demographic Health Survey	**DHS**
Essential Health Package	**EHP**
Global Alliance for Clean Cookstoves	**GACC**
Health Sector Strategic Plan	**HSSP**
Health Surveillance Assistant	**HSA**
High Income Country	**HIC**
Household Air Pollution	**HAP**
Human Immunodeficiency Virus	**HIV**
Improved Cookstove	**ICS**
Integrated Social Cognition Model	**ISCM**
Integrated Household Survey	**IHS**
Low and middle-income country	**LMIC**
Millennium Development Goals	**MDGs**
National Cookstove Steering Committee	**NCSC**
National Statistical Office	**NSO**
Non-government Organisation	**NGO**
Sustainable Development Goals	**SDGs**
Tuberculosis	**TB**
United Kingdom	**UK**
United Nations	**UN**
United Nations International Children's Emergency Fund	**UNICEF**
World Health Organisation	**WHO**

Glossary of terms

Burn Injury	"An injury to the skin or other organic tissue caused by thermal trauma. It occurs when some or all of the cells in the skin or other tissues are destroyed by hot liquids (scalds), hot solids (contact burns) or flames (flame burns). Injuries to the skin or other organic tissues due to radiation, radioactivity, electricity, friction or contact with chemicals are also considered as burns" (Peden et al., 2008 p79).
Charcoal Mbaula	A portable charcoal burning stove. It has a metal exterior with a ceramic liner where the charcoal is placed.
Child	"A child means every human being below the age of 18 years" (United Nations, 1989 p4)
Chitenge	Also known as Kitenge, is a large piece of cloth usually covered with vibrant patterns. The chitenge is worn by women and can be wrapped around the waist, chest or head. It is often used as a sling to carry babies.
Clinical Officer	"Clinical officers have a separate training programme to medical doctors, but their roles include many medical and surgical tasks usually carried out by doctors, such as anaesthesia, diagnosis and treatment of medical conditions, and prescribing." (Wilson et al., 2011 p1)
Emic Perspective	"The native's view, which reflects the cultural groups language, beliefs and experiences. The only way ethnographers can begin to access the emic view is by interviewing group numbers, observing their behaviour and collecting cultural artefacts" (Speziale et al., 2011 p199)
Global Alliance for Clean Cookstoves	"Public-private partnerships hosted by the UN Foundation to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions. The Alliance's 100 by '20 goal calls for 100 million households to adopt clean and efficient cookstoves and fuels by 2020." (Global Alliance for Clean Cookstoves., 2015b)

Health Surveillance Assistant	"Are employed under the Environmental Health Section of the Ministry of Health. Their responsibilities include health promotion and delivery of services for family planning, HIV, tuberculosis, malaria prevention and nutrition. HSAs collect vital statistics and maintain village household registers. Each HSA is responsible for providing services to a population of approximately 1000 individuals" (Gilroy et al., 2013)
Kondi	A local word used to describe a veranda or slightly raised area in front of the house.
Nsima	A staple food in Malawi. It is made by mixing ground maize flour and water together over heat. The final product has a thick starchy porridge texture.
nVivo	Computer aided qualitative data analysis software
Permanent Housing	"Has a roof made of iron sheets, tiles, concrete or asbestos and walls made of burnt bricks, concrete or stones." (National Statistical Office, 2012 p115)
Semi-Permanent Housing	"A mixture of permanent and traditional building materials" (National Statistical Office, 2012 p115).
Three Stone Fire	A traditional stove is made up of three stones on which a pot can be rested. Fuels such as firewood, crop waste and animal dung are then set alight and fed through the gaps of the stones.
Traditional Authorities	"Traditional Authorities act as custodians of the cultural and traditional values of the community. They have the control of customary land ensuring that authority over land is passed in succession from one generation to another." (Food and Agricultural Organization of the United Nations, 2017)
Traditional Housing	"Made from traditional housing construction materials such as unfired mud brick, grass thatching for roofs or rough poles for roof beams" (National Statistical Office, 2012 p115).
Village Head or Chief	The term used to define a local leader whose position has been appointed by their village or inherited.

1. Chapter one: Introduction and background

1.1. Introduction

This study uses a qualitative approach to explore the contextual factors associated with the causes and prevention of unintentional childhood burn injuries in rural and peri-urban areas of Malawi.

This chapter sets the scene for the study by providing an overview of the burden of childhood burn injuries across low and middle-income countries (LMICs) and their connection with current development targets. This is followed by an outline of cooking technologies that have been associated with the potential to reduce the severity and occurrence of burn injuries. The chapter then provides a description of the study country in relation to its geography, culture and health care systems. Existing gaps in the research are described, followed by the aim and objectives of this study. The final part of this chapter provides a précis of the proceeding chapters.

1.2. The burden of unintentional childhood burn injuries in LMICs

Globally burns are the eleventh leading cause of death for children aged 1-9 years (Peden et al., 2008). The burden of these injuries disproportionally affects the world's poorest populations with 95% of fire related deaths occurring within LMICs (Peden et al., 2008). For Africa, these mortality rates demonstrate one of the largest discrepancies for any injury mechanism between high and LMICs (Peden et al., 2008). However, existing data is currently limited to the interpretation of hospital based records. It is possible, if these figures also included data from population based studies, the number of burn deaths identified would appear to increase.

In addition to the number of fire related deaths recorded it is predicted that there are many more children who are left with a lifelong disability (Mock et al., 2011). For children who are economically fragile prior to the burn injury, a disability is likely to cause further economic decline (Golshan et al., 2013, Mock et al., 2011). This places a long term financial burden and responsibility on families who already have access to limited resources (Mock et al., 2011).

LMICs are restricted to small health budgets and international aid to support their healthcare systems (Alonge and Hyder, 2013). Currently, interventions aimed at child health in LMICs are associated with the issues of communicable diseases (HIV, tuberculosis and malaria) (Alonge and Hyder, 2013). However, deaths due to communicable diseases are seen to be declining with time, while deaths due to injuries are seen to be rising (Alonge and Hyder, 2013). Moving forwards, international policy has recommended national governments should stimulate action towards the achievement of sustainable development goals, including;

"By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being"

Target 3.4: United Nations Sustainable Development Goals (SDG) (United Nations, 2015)

To achieve this, governments need to respond to the ever-changing causes of child mortality and as such the burden of unintentional injury. The treatment for a severe burn usually includes specialist surgical management (Barrow and Herndon, 2007). However, surgical interventions and rehabilitation services are expensive and therefore complications can be encountered at health centres which lack the essential resources required to manage extensive burn injuries (Albertyn et al., 2006, Lau, 2006). To reduce the need for surgical treatment and the burden on both health facilities and families, there is a need to

recognise injury prevention as a higher priority in LIMCs policy than it currently appears.

However, the allocation of funds for the development of prevention strategies are inhibited by a lack of existing data that reflects the true extent of burn injuries (Alonge and Hyder, 2013). As a result many governments underestimate the burden and the level of response needed to address unintentional injuries (Alonge and Hyder, 2013, Mock et al., 2008).

1.3. Improved cookstoves a promising intervention

Traditional biomass cookstoves, or 'three stone fires', are used by almost 2.7 billion people worldwide (World Energy Council, 2011). These stoves have been linked with the occurrence of burn injuries in LMICs due to their unstable nature and open flames (Albertyn et al., 2012, Forjuoh, 2006, Justin-Temu et al., 2008, Kiser et al., 2012, Mock et al., 2011, Mock et al., 2008, Nthumba, 2016, Outwater et al., 2013, Peck et al., 2008a, Peck et al., 2008b, Ringo and Chilonga, 2014). Moreover, as these stoves are placed at ground level children, especially toddlers, can access the stove and anything resting on it with ease, resulting in devastating flame and scald burns (Albertyn et al., 2006, Albertyn et al., 2012, Atiyeh et al., 2009, Forjuoh, 2006, Mock et al., 2011, Peck et al., 2008a). In response to this, the World Health Organisation (WHO) has indicated that the dissemination and use of improved cookstoves (ICS) might have the potential to reduce the incidence of burn injuries in LMICs (Mock et al., 2011, Peden et al., 2008).



Figure 1: A child sat with a 'three stone fire'

Since the 1970s, due to the serious health and environmental problems associated with traditional stoves, there has been a continued pressure to motivate households in LMICs to employ ICS (Sesan, 2012). For instance, the emissions produced from traditional cooking results in high levels of household air pollution (HAP) which has been associated with approximately 4 million deaths every year (Gordon et al., 2014, Lim et al., 2012, Mortimer et al., 2017, World Health Organisation, 2014b). In response to these issues, The Global Alliance for Clean Cookstove (GACC) was launched in 2010 with the primary aim to motivate 100 million homes to adopt "clean" cookstoves (Global Alliance for Clean Cookstoves., 2015b).

However, due to the prioritisation of respiratory health, household air pollution and deforestation, much of the research addressing ICS implementation has been limited to the users' exposures to particulate matter, respiratory illnesses and fuel efficiency. Consequently, there has been limited research which has considered the use of ICS as a means to mitigate burn injuries (Global Alliance for Clean Cookstoves., 2013).

1.4. The research context

1.4.1. Rationale for conducting the study in Malawi

Malawi was selected as the study country for a number of reasons. Firstly, children in Malawi are at a high risk of burns injuries and poor health resulting from the nature of the environments they live in and the paucity of burn prevention programmes.

Secondly, in 2013, Malawi became a GACC partner country, this increased government interest in ICS and initiated a National Cookstove Steering Committee (NCSC) (Global Alliance for Clean Cookstoves., 2016b, Mbaula, 2017a). The NCSC, chaired by the Ministry of Energy, aims to assist with a commitment to disseminate ICS to 2 million households by 2020 (Mbaula, 2017a). It is anticipated that, due to this increasing interest

and development of ICS strategies in Malawi, this study is well placed to engage those who are working within the stove sector and has the potential to inform the NCSC on the safety of the ICS promoted.

Thirdly, Malawi was selected for practical and logistical reasons. The researcher has previous experience conducting community surveys and voluntary work in Malawi. As a result, they had developed valuable connections at all levels including: health care workers, interpreters and university lecturers who could provide logistical support for the study.

1.5. Country overview

1.5.1. Geography and demography

Malawi is a country in south-east Africa (see Figure 2). It is one of the most densely populated countries in Sub-Saharan Africa, with an estimated population of 17,215,000 (World Health Organisation, 2017), of which almost half are under the age of 15 years (National Statistical Office, 2017). The majority of this population live in rural areas with only 15.3% living within Malawi's urban centres (Blantyre, Lilongwe, Zomba and Mzuzu) (National Statistical Office, 2008).



Figure 2: Map of Africa highlighting Malawi (Nations Online., 2017a)

The country is sub-divided into Northern, Central and Southern regions. Each region contains 6 to 13 of Malawi's 28 districts (see Figure 3).



Figure 3: Map of Malawi (Nations Online., 2017b)

The Northern region is the least occupied region containing six districts and 13% of the total population (National Statistical Office, 2008). The central region contains nine districts and the country's capital city, Lilongwe. The southern region is the most densely populated region with approximately 45% of the total country population residing there (National Statistical Office, 2008). Although it contains the nation's commercial centre, Blantyre, the southern region has a disproportionate share of the underprivileged and poverty (National Statistical Office, 2008).

Malawi is one of the poorest countries in the world, ranked 170 out of 186 countries (United Nations Development Programme., 2013). Over half of the country is poor and a quarter live in extreme poverty (National Statistical Office, 2012, The World Bank., 2014). Organisations working within Malawi have identified that the existing causes of poverty include: limited access to productive resources, population increase, inadequate finances to invest in public services, high levels of illiteracy and poor policy implementation (Voluntary Services Overseas, 2011).

The impact of poverty on Malawian children has resulted in poor access to basic educational services, food and health (Voluntary Services Overseas, 2011). For example, approximately half of children aged five years have stunted growth due to the long term effects of malnutrition (The World Bank, 2011). For children, this current situation continues to perpetuate the poverty cycle. With a high prevalence of diseases and a growing burden of non-communicable diseases, life expectancy at birth is approximately 57-60 years (World Health Organisation, 2017).

The most recent demographic health survey (DHS) conducted between October 2015 and February 2016 indicates that, for the five year period before the survey, the under-5 mortality rate was 63/1000 live births, this rate is much higher in the rural areas where the rate has been estimated at 77/1000 live births (National Statistical Office, 2017). While the health status of Malawi's under-5 population is similar to that of its bordering countries (Mozambique 79/1000, Zambia 64/1000 and Tanzania 49/1000) it compares unfavourably with developed countries. For example, child mortality rates for the under-fives in the United Kingdom (UK) is 4/1000 live births (The World Bank., 2017). The causes attributable to childhood deaths in Malawi, in order of prevalence, are as follows: malaria, other causes, acute respiratory infections, HIV/AIDS, prematurity, birth asphyxia, diarrhoea, neonatal sepsis, injuries, congenital anomalies and measles (World Health Organisation, 2015).

The average household size in rural Malawi is 4.5 (National Statistical Office, 2017) although, characteristically Malawians live nearby their extended families grouped within villages. Their housing structures vary, but typically in rural and peri-urban areas they are a mixture of semi-permanent and traditional structures. Materials used to construct their traditional buildings include: unfired bricks, mud bricks, rough wooden poles and grass thatching. Whereas those used to construct the semi-permanent structures might also include: fired bricks, concrete, stones and iron sheets.

Electricity and drinking water supplies are limited and varied across rural areas of Malawi, as indicated by the national data. For example, the DHS 2017 reports that, only 4 per cent of rural households have access to electricity and 85 per cent have access to an improved source of drinking water (National Statistical Office, 2017).

Deforestation and water pollution are at the top of Malawi's environmental issues (Ministry of Finance Economic Planning and Development, 2014). A growing population density and increase in poverty has created significant pressure on Malawi's natural forests and woodlands for fuel wood and charcoal production (Ministry of Finance Economic Planning and Development, 2014). Moreover, poor farming methods and limited conservation techniques continue to put pressure on Malawi's natural resources (Ministry of Finance Economic Planning and Development, 2014).

1.5.2. Social and cultural life

There are nine different ethnic groups in Malawi including: Chewa, Nyanja, Yao, Tumbuka, Lomwe, Sena, Tonga, Ngoni, Ngonde. Chewas are the largest of these groups and reside in the central and southern regions of Malawi. Based on the last housing census conducted in 2008, 83 per cent of the population identified themselves as Christians and 13 per cent Muslims (National Statistical Office, 2008). The official languages in

Malawi are Chichewa and English, although each tribe has their own vernacular language.

Nearly half of Malawian women (47%) are married by the time they are 18 and 29% of women are already mothers or pregnant between the ages of 15-19 years (National Statistical Office, 2017). Women who have more secondary education are more likely to have children and marry approximately 7.2 years later than those with no education (National Statistical Office, 2017). Polygamy is practiced across Malawi with 13 per cent of women and 7 per cent of men between the ages of 15-49 in these unions (National Statistical Office, 2017). Typically, once married, women assume the role of housewife and are responsible for the majority of the household tasks (National Statistical Office, 2012) including cooking and the collection of firewood and water. These responsibilities often expose women to health risks including: exposure to high levels of indoor air pollution, burns, multiple-skeletal injuries as well as vulnerability to sexual abuse and violence (Diaz et al., 2007, Global Alliance for Clean Cookstoves, 2016, Peden et al., 2008).

Agricultural activities are the main source of employment for both men and women in rural Malawi (Food and Agricultural Organization of the United Nations, 2011, National Statistical Office, 2012). However, farming in Malawi can be severely affected by frequent and extreme climate events, such as periods of drought and flooding (Pauw et al., 2010). Moreover, as the majority of agricultural work is for family subsistence, rural men and women may also need to find additional employment to improve their income (Food and Agricultural Organization of the United Nations, 2011). However, employment opportunities in rural areas are sparse and unpredictable, especially for women (Food and Agricultural Organization of the United Nations, 2011).

Malawians are highly dependent on maize for food energy (World Food Program, 2012). Their main meal component, “nsima”, is made from

ground maize flour and is usually served with a small portion of vegetable relish or "greens". Occasionally households may also consume additional protein from fish, legumes, groundnuts, poultry and egg. The process of making nsima is physically demanding, after being boiled with water to form a porridge mixture, the maize is then pounded quickly and heavily against the side of the cooking pot. Depending on the availability of maize, this process may be conducted once or twice a day. In relation to burn injuries, the process of making this staple food is important to consider as, in addition to bringing the food to boiling point, the cook has to be close to the fire during final preparations.

This contextual information formed a vital part in ensuring that the methodology and research tools selected sensitively grasped the current situation and cultural attributes of the study population.

1.5.3. Health care systems

In 2000 the Malawi government signed the Millennium Declaration; this established the country's commitment to achieving the millennium development goals (MDGs). Following the implementation of this declaration, Malawi has demonstrated progress in reducing child and infant mortality through the use of immunisation programmes, effective prevention and treatment of malaria and diarrhoeal diseases, vitamin supplements, and exclusive breastfeeding for the first six months of life (Ministry of Finance Economic Planning and Development, 2014). However, despite a number of recognisable achievements, Malawi continues to face a number of health challenges (The World Bank, 2012). These challenges include a high prevalence of preventable diseases, HIV, pneumonia, malaria and tuberculosis (World Health Organisation, 2014a). In addition, there is an increasing burden of non-communicable diseases such as diabetes, cancers and hypertension (World Health Organisation, 2014a). Furthermore, existing health structures favour the

urban areas, with poor referral systems and delays in seeking healthcare within the rural areas of Malawi (World Health Organisation, 2014a).

The majority of Malawi's health care system is made up of government facilities, the Christian Health Association of Malawi (CHAM) and private hospitals (World Health Organisation, 2014a). To both facilitate progress and coordinate these health sectors post 2015 The Ministry of Health published the Health Sector Strategic Plan (HSSP) 2011 – 2016 (Ministry of Health, 2011).

The HSSP re-emphasises the 'Essential Health Package' (EHP). The EHP was created to ensure that health care provisions are provided for those conditions that disproportionally affect Malawi's disadvantaged populations (Ministry of Health, 2011). These provisions aim to ensure that preventative, curative and rehabilitative services are universal across all areas of Malawi (Ministry of Health, 2011). Furthermore, the EHP defines the level of health care delivery that should be provided across primary, secondary and tertiary care.

Primary level care includes community health posts, dispensaries and some outpatient care. Secondary level care is provided at district hospitals, these offer inpatient care and more advanced investigatory services and treatments. Tertiary level care can be accessed at central regional hospitals and are equipped to provide more specialised care and treatment. However, there remains a number of key challenges faced by the government health care systems including: inadequate human resources, lack of appropriate drugs and equipment, poor referral systems and patient delays in seeking health care (World Health Organisation, 2014a). Moreover, there are a number of communities who continue to use traditional healers and medicine before, or instead of, seeking medical care at a health facility.

1.6. The purpose of the study

At present there has been limited research undertaken in Malawi to explore the factors associated with burn injuries outside of hospital based studies. Nevertheless, while hospital based research might provide patterns of injury occurrences, it is often limited. For example, presentation to a medical facility is determined by factors such as thresholds for seeking healthcare, costs and accessibility (Zwi et al., 1995). Therefore, hospital based data might only account for the factors associated with the most severe burns, with the exclusion of those who choose not to attend a formalised health care facility or perish before arrival (Hyder et al., 2004). Additionally, unless hospital records have been unusually detailed, the information obtained may merely offer superficial or incomplete information (Bartlett, 2002). Consequently, there is a lack of contextual information which can be applied to the development of an appropriate burns prevention strategy in Malawi.

This thesis aims to address the existing gaps in the evidence by exploring areas not yet considered in the Malawian setting. Through the use of interviews and observations this thesis aims to systematically present a wealth of information provided by parents, health professionals and key stakeholders, concerning the risks and the barriers households face in preventing burn injuries. Most importantly, through the development of the study objectives, this information was generated and is presented using the participant's own words and perceptions, which until now, had not previously been reported. Subsequently, these narrative experiences can be used to inform potential and promising interventions aimed at mitigating the occurrence of burn injuries in rural and peri-urban areas of Malawi.

It is anticipated that the recommendations of this study could be applied to other areas across Sub-Saharan Africa where households also rely on non-electrical appliances for cooking, heating and lighting their homes.

1.6.1. The aims and objectives of the current study

Study Aim

To explore the factors associated with paediatric burn injuries, in rural and peri-urban Malawi.

Objectives

1. To identify the factors which expose children to burn injuries in the Malawian context
2. To explore parental perceptions of paediatric burn injuries and their prevention
3. To explore health professionals' perceptions of paediatric burn injuries and their prevention
4. To examine households' perceptions of safety in relation to their cooking methods
5. To identify existing quality control and safety standards utilised by improved cookstove initiatives in Malawi

1.7. Chapter outlines

Chapter two: presents a review of existing literature surrounding the factors associated with unintentional burn injuries and their prevention in Sub-Saharan Africa, with a focus on Malawi and bordering countries. This is followed by a consideration of current injury prevention theory and its application to the development of strategies in LMICs. The chapter concludes with an explanation of the study's origin and development of the research aim.

Chapter three: provides a description and rationale for the methodological approach taken. This is followed by an in-depth description of the chosen research methods and data analysis processes. The ethical considerations for this study are discussed.

Chapter four: explores the themes which emerged from the interviews with health professionals. The chapter describes their perceptions in relation to: the factors associated with childhood burn injuries, parental attitudes towards injury events and existing methods to provide injury prevention advice.

Chapter five: describes the household participants and their environmental characteristics with a focus on the methods employed for cooking, heating and lighting.

Chapter six: explores the socio-cultural and developmental factors associated with childhood burn injuries as described by household participants.

Chapter seven: considers the participants' perceptions of hazards which may cause injuries to children in addition to existing and potential prevention strategies. Consideration is given to the factors which may prevent parents from initiating injury prevention strategies around the home.

Chapter eight: describes the characteristics associated with the burn injuries which occurred within the participant households.

Chapter nine: presents the findings from household focus groups which aimed to evaluate the safety of their cookstoves.

Chapter ten: presents the findings generated from interviews with key individuals working for organisations who are currently developing, manufacturing and distributing ICS across Malawi. The focus of the chapter is to present the existing strategies to promote safety and maintain quality control.

Chapter eleven: synthesises the findings in relation to the research aim, objectives and the context of wider injury prevention and development literature. The strengths and limitations of the study's methodological approach are considered.

Chapter twelve: concludes the thesis by presenting the practical implications of the study findings with respect to the development of injury prevention strategies, ICS interventions and future research.

1.8. Chapter summary

This chapter has set the scene for the study by presenting the burden of burn injuries in LMICs, interventions which have been recommended to mitigate burn injuries and the research context. This is followed by an outline of the purpose of the study and the associated aims and objectives. The final section has provided a précis of the subsequent chapters.

Burn injuries are especially high in Africa where exposure to unsafe cooking appliances and open fires pose significant dangers to children. However, contextual data on the factors associated with burn injuries in Sub-Saharan Africa is lacking. In addition, while it has been suggested that the use of ICS may mitigate a child's exposure to burn injuries, more

evidence is needed. As such, this study aims to explore factors associated with childhood burn injuries in rural and peri-urban Malawi. Malawi was selected for this study as it was considered that children are at particularly high risk of burn injuries because of the nature of the environments in which they live, the paucity of burn prevention programmes and the challenges faced by health care facilities.

2. Chapter two: Unintentional burn injuries, their context and prevention in Sub-Saharan Africa: A review of the literature

2.1. Introduction

To inform the development of the current study this chapter presents a review of the existing literature which surrounds the factors associated with unintentional burn injuries and their prevention in Sub-Saharan Africa, with a focus on Malawi and its bordering countries. The review was developed to investigate the following three key areas:

- What is known about the causes, risk factors and prevention of burn injuries in Sub-Saharan Africa, with a focus on Malawi and surrounding countries?
- The current approaches and theoretical considerations that guide injury prevention, with a focus on existing strategies used in Sub-Saharan Africa?
- The current factors influencing the development of cookstove interventions in Sub-Saharan Africa related to culture, health and safety?

2.2. Search strategy

To provide a comprehensive search method, a systematic approach was taken to identify relevant publications (Aveyard, 2014). Electronic searches of the following databases were conducted: Web of Science, Web of Knowledge, MEDLINE, EMBASE and Google Scholar to gather information concerning the epidemiology and prevention of burn injuries in Sub-Saharan Africa. Hand searches were also conducted by examining reference lists of the articles retrieved from the database searches. A search of the WHO website was also conducted to identify existing reports, documents and guidance on the occurrence of burn injuries in LMICs. In addition, websites of key organisations who are

involved in the distribution and development of ICS interventions were searched for any relevant grey literature. Table 1 presents a list of the keywords used to conduct the literature search. The searches were conducted across each database using a combination of keywords from each column.

Table 1: Key words use to identify papers examining epidemiological and risk factors for childhood burn injuries for the literature review.

Burns	**Location**	**Population**	**Outcomes**	**Prevention**	**Improved Cookstoves (ICS)**
Burn* Burn injur* Burn wound* Trauma Burn mortality Burn morbidity Thermal* Flame Scald Hot liquid burns Unintentional	Africa Africa south of the Sahara Undeveloped Malawi Zambia Tanzania Mozambique East Africa Poverty Low and Middle income Global South	Child* Infants Adolescent Pediatric Paediatric Under fives Under* Childhood Child*	Epidemiology Causes Factors Risk Factors Hazards Environmental hazards Predictors Barriers Facilitators	Burn prevention Active prevention Passive prevention Preventative Campaign Paediatric burn prevention program* Evaluation Prevent* Barriers Facilitators Parental knowledge	Improved cookstoves Cook* Biomass Flame stove

To further guide the literature search a set of inclusion and exclusion criteria were applied to the articles retrieved from the electronic databases (Aveyard, 2014). Texts were excluded if: they were not available in the English language, the research did not include countries from Sub-Saharan Africa, the focus was not on burn injuries or they were not full manuscripts.

At the time of writing, no empirical evidence or evaluation of burns prevention measures in Malawi has been published. As such, to examine the current situation of burns prevention programmes in Sub-Saharan Africa three review articles (Atiyeh et al., 2009, Parbhoo et al., 2010, Rybarczyk et al., 2016, Rybarczyk et al., 2017) and three WHO documents (Mock et al., 2011, Mock et al., 2008, Peden et al., 2008) were identified. The purpose of examining these articles was to aid the understanding of existing approaches towards burns prevention in LMIC, as well as the factors which lead to their success or failure. The former review articles cover information on the prevention strategies employed in LMIC including the following in Sub-Saharan Africa: Nigeria, Zimbabwe, South Africa, Senegal, Angola, Ghana and Cote d'Ivoire.

Where applicable additional references have been used to enhance explanations, and build on specific risk factors and prevention strategies prevalent across both HIC and LMICs.

2.2.1. Review and synthesis of epidemiological literature

Firstly, to develop a broad understanding of current trends, causes and risk factors of burn injuries across Sub-Saharan Africa, literature and systematic review articles were retrieved. This resulted in the identification of six review articles (Albertyn et al., 2006, Forjuoh, 2006, Nthumba, 2016, Outwater et al., 2013, Peck et al., 2008b, Rybarczyk et al., 2017) covering literature from the following African countries: Ethiopia, Ghana, Kenya, Tanzania, Sierra Leone, South Africa, Nigeria, Angola, Cote d'Ivoire, Liberia, Malawi, Mozambique, Zimbabwe, Gambia and Uganda.

Secondly, as epidemiological risk factors for burn injuries are influenced by regional differences and vary from one community to another (Albertyn et al., 2006, Chalya et al., 2011), a secondary selection process was undertaken to identify empirical data reporting on Malawi

specifically. No restriction was placed on the type of study or dates conducted. However, as only four papers concerning Malawi were found, the search was broadened to countries on the border with Malawi (Tanzania, Mozambique and Zambia). Although bordering countries may have distinct cultural norms and practices there are relevant similarities across each of these countries including their rural infrastructure and household fuels. As such, their results may have a degree of transferability to the Malawian setting and therefore add to the understanding of the factors associated with burn hazards and injuries. This additional search returned a further six papers, from Tanzania (4), Mozambique (1) and Zambia (1). Once the articles had been retrieved details relating to the types of study, sample, key findings and recommendations were recorded. A summary of this information is presented in Table 2.

Table 2: Summary of papers examining the epidemiological risk factors of burn injuries in children in Malawi, Tanzania and Mozambique

Author, date, country	Study Aim	Study Design	Sample / Population / Timescale	Key Findings	Recommendations	Comments
Komolafe et al, 2003, Malawi	To determine the most common causes population most at risk and the pattern of mortality of burn injuries.	Retrospective cross-sectional study.	1825 patients admitted to the QECH (January 1994 and December 1999).	Burns occurred most frequently in children below age five (55 %). Hot water (38%) was the most common cause of burns. Most burns occurred at home. 145 patients had epilepsy. No relationship between season and burn incidence was found. 52% of patients were male.	To develop effective awareness campaigns to target the root causes of burns in children. Intensive mass media campaigns directed towards the regulation and improvement to safety in the home. Educational programmes for parents on the prevention of burn injuries.	Sample includes both adult and children. Only accounts for burns admitted to hospital. Data extracted retrospectively from case notes. Data accuracy dependent on the completeness and comprehensiveness of case notes. Does not include socio-economic variables.
Virch and Lavy, 2006, Malawi	To make observations on a selection of burns with respect to aetiology, presentation, and management.	Prospective hospital-based study.	12 burn patients admitted to burns unit over a four-week period. Dates not provided.	Children under 6 years formed a major sub-group (7/12) of burns patients. Hot water was the commonest cause of burns (6/12). A lack of anti-epileptic medication resulted in potentially avoidable burns.	Commercial advertising and marketing campaigns could be channelled towards burns prevention and initial treatment.	Sample includes both adult and child patients. Only accounts for burns admitted to hospital. Highlights key problems associated with burns management in Malawi. The study's small sample is not

						powered to determine statistically significant results.
Samuel et al, 2011, Malawi	To describe the epidemiology and burden of burn injuries, to quantify treatment and outcome measures, and to determine strategies for improving burn care.	Retrospective analysis of hospital data.	370 burn patients (July 2008-June 2009).	Most patients were < 15 years of age. 56 % of patients were male. Burns occurred most frequently in the cool, dry season and in the evening. The most frequent cause of burn was scalding. 74% of burn injuries attended the hospital within 24 hours.	Prevention initiatives should be targeted towards. 1) Parents and caregivers. 2) Periods when the use of fires increases i.e. cold season.	Sample includes both adult and children. Data was collected retrospectively from the hospital trauma registry, operative records and inpatient charts. Not all records were complete. Only 55 patients had known outcomes. No data was collected on factors such as: epilepsy, unsafe home conditions and child supervision.
Kiser et al, 2012, Malawi	To utilize a hospital based trauma registry dataset to describe the epidemiology of paediatric injuries at a tertiary hospital in Malawi.	Prospective analysis of emergency department attendances.	7233 paediatric patients presenting at KCH emergency department (July 2008 to December 2010).	Younger patients had higher rates of burn injury and were more likely to be injured at home. Females were statistically significantly more likely to sustain a burn injury. The most common mechanism of injury was falls followed by burns.	Prevention initiatives should be targeted in the cold season and times when the use of fires increases. Prevention should include home-based safety initiatives. To distribute cook stoves made from local brick and mud which encloses the flames.	Limited in the ability to make population-based burden of disease assessments as the data is hospital based. The data collected was obtained at initial evaluation therefore there is a lack of outcome data.

				Burn injuries were more common in colder months. 66% of injuries occurred in the home.	To develop rigorous trauma registries to collect surveillance data that can be used to assess the effectiveness of interventions.	
Karan et al, 2015, Mozambique	To identify the social, economic and cultural factors common to households in which burn injuries have occurred.	Prospective questionnaire based analysis of paediatric burn patients.	39 patients recruited over two 1-month periods— (one during the hot, rainy season at the end of 2013 and the other during the cold, dry season mid 2014).	The most common cause of burns in children was scalds followed by fire. The highest reported time of burn occurrence was during the afternoon, evening and night hours. Over a quarter of burns were occurred when a parent was absent. Overcrowded households and poverty were related to burn injuries. Seizure disorders were common among the burned children. The majority of patients were male (28/39). 35/37 of burns patients presented in the same day.	People who have or are caring for those with epilepsy should be advised to take their medication and kept away from cooking fires. To promote the supervision of children during periods of cooking. Disseminate ICS which enclose fires, decreasing access to the flame. Poverty assistance and resource provision programmes. Culturally sensitive burn prevention, education and self-management should be prioritised by governments and civil society.	A convenience sample was used to recruit patients under the age of 14 years presenting with burn injuries at the burns unit and paediatric ward. The questionnaire used was presented to the head of surgery and piloted to establish face validity. Two interviewers were used to prevent interview bias. Some patients did not speak a language that the interviewer or nurses could speak fluently and therefore were not included. The sample size was too small to draw statistically significant conclusions.

Justin-Temu et al, 2008, Tanzania	To find out the causes, magnitude and management of burns in under-fives at home and in the three district hospitals in Dar es Salaam region.	Descriptive cross-sectional Study.	204 under-fives were enrolled (February and March 2004).	55% of the children were between the ages of 1-2 years. Two main types of burn injury occurred; scald injuries from hot fluids or foods which were 78.4%, while the remaining 21.6% were due to open flame from charcoal, lanterns, candles and kerosene stoves. The majority of burn injuries occurred in the kitchen followed by the living room. 90% of childhood burn injuries were related to cooking. The results show an equal sex distribution between males (49%)and females (50.5%)	The application of cool water to a burn should be promoted as a secondary intervention strategy. Public enlightenment campaigns on prevention methods are required.	Questionnaires were used to collect data during face-to-face interviews with parents and caretakers of children who were admitted to wards with burn wounds. Questionnaires which contained ten closed questions were pre-tested in a pilot study. Questionnaires were checked for completeness at the end of each day.
Chalya et al, 2011, Tanzania	This study was conducted to describe the pattern and outcome of childhood burn injuries in a local setting.	A cross sectional hospital based study.	342 burned children were studied who attended the Accident & Emergency department or the paediatric surgical wards (January 2008 – December 2010).	The majority of burn injuries (90.6%) occurred in the home, mainly in the kitchen, bathroom, sitting room and outdoors. Scald was the most common cause of burns. Clothing ignition was reported in 38 patients who sustained	Appropriate and timely treatment of these patients can ensure a better outcome in the majority of cases. There is a need for public enlightenment on the prevention and initial intervention in burns and children.	Patients admitted 7 days post-burn and patients admitted for post burn reconstructive surgery were excluded from the study. Sample included all patients aged 10 years and below presenting with acute burn injury and those who consented for the study and HIV testing.

				flame burns. Males were mainly affected (57.9%) Most patients (89.8%) arrived later than 24 hours following injury. The majority of patients were aged less than 2 years. Epilepsy was the most common pre-existing illness.		Data was collected using a pre-tested coded questionnaire. Only representative of children admitted for burn injuries in one hospital and were willing to be tested for HIV.
Roman et al, 2012, Tanzania	To identify the incidence of burn injuries among children in a sub-Saharan urban area and describe contributing factors in the home environment.	A community based cross-sectional household survey.	Information on n=416 injuries was gathered on 3927 children (8th-22nd July 2009). Participants who reported a burn injury (n=68) was the focus of this paper.	The most common contributor to burn injury was open flame 36.9%, followed by hot liquids 33.8%. Most burns occurred in urban areas with 88% occurring in the home. A significant association with burn injury was found in the 0–4 age category. There was no significant difference between burn injury and gender. No significant difference in burn injury risk was found	Future research should focus on understanding the context and relevant mechanisms of safety provision in the home with further examinations of the material environment.	Questionnaire collected socio-demographic information including caregiver: age, level of education, occupation in addition to a physical description of the household. A one-month recall period was utilised. Initial data from the survey yielded a response of 96%. The sample size was large and covered a range of populations. Due to the cross-sectional design, it:

				amongst caregiver level of education or occupation.		1) It was not possible to make causal interpretations. 2) Does not allow for changes in exposure to burns at different points of the year. All data obtained was self-reported = potential for bias
Ringo and Chilonga, 2014, Tanzania	To review the epidemiology presentation management and outcome of burn patients.	A cross-sectional prospective study.	41 patients admitted to the KCMC hospital (October 2011 to April 2012).	Majority of the patients were males. The largest age group study consisted of children less than five years of age. 19.5% of the study population had epilepsy. More than half of the burns were caused by flames followed by scalds. Majority of the burns occurred at home. Less than half of the patients attended hospital in the first 24 hours after injury. 65.9% of patients were male	No recommendations, the study indicates that inadequate first aid, wound contamination and ward overcrowding may have contributed to the high levels of wound sepsis and outcome.	Sample included both adults and children All patients who were admitted to the general surgical wards or ICUs with burns were purposively selected. Demographic data, including the main sources for fuel and light was obtained.

Edwards et al., 2011, Zambia	1) To acquire burn-patient demographics for the Eastern Province, Zambia. 2) To assess the early impact of sponsored burn teams.	Retrospective review hospital charts.	Information of 510 hospitalised burns patients admitted to one mission hospital in Katete between July 2002 and June 2009.	Average of burns patient was 15.6 years. 44% of burns patients were under 5 years of age. Most common mechanism for burns injuries were: flame (52%) and scald (41%). There was a seasonal variation in burn injuries. The cold, dry seasons (May – August) had the highest burn incidence (43.3%) 22% of patients had burns during an epileptic seizure. 56% of burns patients were male	Additional research is needed to develop beneficial prevention programmes, including where burn injuries occur. High risk behaviours such as annual bush burning should be targeted for prevention. Education should be provided to children to reinforce burn safety programmes. Educating parents at the points of care to reinforce prevention techniques.	Only medical records that could be physically located were available for review. Demographic factors collected included age, sex, dates of admission/discharge and history of epilepsy.

Of the ten studies found from Malawi, Tanzania, Zambia and Mozambique nine were hospital based enquiries of either a retrospective or prospective nature. One study, Roman et al (2012), was conducted in the community. Only quantitative data which had been derived from either hospital records or questionnaires is represented in these papers. Papers were appraised using the checklist provided from the Critical Appraisal and Skills Programme (CASP) to provide further clarity around the quality of the existing evidence (Aveyard, 2014, Critical Appraisal Skills Programme, 2017). To present the key epidemiological factors associated with burn injures key themes were generated from the literature, these included:

- the mortality and morbidity of burn injuries globally
- the mortality and morbidity of burn injuries in Sub-Saharan Africa
- the causes of burn injuries in Malawi, Tanzania, Zambia and Mozambique
- existing factors associated with burn injuries
- existing protective factors associated with burn injuries

2.3. Unintentional burn injuries in context: Epidemiology and risk factors

2.3.1. The mortality and morbidity of childhood burn injuries globally

For 2004 the WHO Global Burden of Disease estimated that just over 310, 000 people worldwide died from fire-related burns (Peden et al., 2008, World Health Organisation, 2008). More specifically it has been identified that burn injuries are the eleventh leading cause of death for children aged 1-9 years, with infants experiencing the highest number of deaths (Peden et al., 2008).

It is suggested that, in addition to the number of fire related deaths recorded, that many more children are left with lifelong disabilities

(Mock et al., 2011). Non-fatal burns can leave a survivor with long term health related problems including prolonged hospitalisations, pain, scaring and functional impairment (Davydow et al., 2009). In addition survivors can also face rejection, stigma and low self-esteem as a result of their disfiguration (Corry et al., 2009).

2.3.2. The mortality and morbidity of childhood burn injuries in LMIC

The burden of burn injuries disproportionally affects the world's poorest populations with 95% of fire related deaths occurring within LMICs (Peden et al., 2008). In Africa, it has been estimated that approximately 43,000 people die every year from burn injuries (Mock et al., 2008), with those who survive living with lifelong disability, disfigurement and pain (Mock et al., 2008, Outwater et al., 2013). However, it is likely that figures from this region are grossly underestimated (Edwards et al., 2011, Peck et al., 2008b) as existing data are limited to the interpretation of hospital based records, where there is a lack of accurate recording or missing data about the burn injuries which did not attend a medical facility.

The treatment for severe burns usually requires specialist surgical management (Barrow and Herndon, 2007, Edwards et al., 2011). However, surgical treatment and rehabilitation services in LMIC are functioning with minimal financial and human resources (Edwards et al., 2011, Lau, 2006). Consequently, survivors can face difficulties following extensive burn injuries, leading to devastating results, such as: wound contractures, multi-organ failure, sepsis, limb loss, disability, pain, anxiety, post-traumatic stress and depression (Barrow and Herndon, 2007, Lau, 2006, Mashreky et al., 2008b).

2.3.3. The causes of childhood burn injuries in Malawi, Tanzania, Zambia and Mozambique

Although fire burns contribute to the majority of burn related deaths (Peden et al., 2008), scalds are a common cause of non-fatal burn injury

and disability in children globally (Mock et al., 2011, Nguyen et al., 2008, Peden et al., 2008). In developed countries additional causes of burn injuries have been attributed to: contact with hot water-pipes, radiators and electricity (Nguyen et al., 2008, Papp et al., 2008, Peden et al., 2008). In contrast, in LMICs burns caused by flames appear much more prominent (Ndiritu et al., 2006). For example, based on global burden of disease (GBD) data, approximately 46% of global fire deaths for children aged between 1-4 years occurred in Western sub-Saharan Africa (Alonge and Hyder, 2013). .

The studies presented in Table 2 which report on the causes of burn injuries in Malawi, Tanzania, Zambia and Mozambique also report that the most common causes of burn injuries sustained by children were scalds, flame and contact burns. However, the order in which these burns were most prevalent varied slightly across each study. For example, while six of the studies reported scald injuries as the most frequent cause of burn injury (Chalya et al., 2011, Justin-Temu et al., 2008, Karan et al., 2015, Komolafe et al., 2003, Samuel et al., 2011, Virich and Lavy, 2006) others identified flame injuries to be more common (Edwards et al., 2011, Ringo and Chilonga, 2014, Roman et al., 2012). Unlike the data presented from HIC, burns caused by electricity or electrical appliances were minimal (Karan et al., 2015, Roman et al., 2012).

The causes of scald burns described by the studies conducted in Malawi and Tanzania were often attributed to hot water, food, cooking oils and flammable liquids whereas the causes attributed to flame injuries included: open fires, candles, paraffin lamps and stoves (Justin-Temu et al., 2008, Komolafe et al., 2003). The causes associated with contact burns were unclear and often not reported (Outwater et al., 2013).

2.4. Existing factors associated with burn injuries

Following an evaluation of the papers presented in Table 2 and the review papers described in Section 2.2.1, the key factors associated with

paediatric burn injuries in LMICs can be categorised into the following areas: young age, gender, socio-economic status, poor housing infrastructure, parental supervision, season and time of day, previous burn injuries and presence of an underlying health condition. This section will discuss each factor in turn, drawing on wider literature to compare these categories with the global picture.

2.4.1. Young age

Globally, young children are most at risk of burn injuries, with children under the age of five years appearing most vulnerable (Chalya et al., 2011, Edwards et al., 2011, Forjuoh, 2006, Justin-Temu et al., 2008, Kiser et al., 2012, Komolafe et al., 2003, Mock et al., 2008, Nthumba, 2016, Peden et al., 2008, Ringo and Chilonga, 2014, Roman et al., 2012, Rybarczyk et al., 2017, Virich and Lavy, 2006). The death rate from burns is then seen to decrease between the ages 10-14 years before increasing again in adulthood (Peden et al., 2008).

This risk of burn injuries for children under the age of five years has been associated with the rapid changes in children's developmental capabilities and characteristics during these years (Ablewhite et al., 2015b, Sethi, 2008). For example, children aged between 6-12 months develop the ability to crawl and grab objects (Rushforth, 2006, The Royal Society for the Prevention of Accidents., 2017). Consequently, these children are susceptible to burns as they reach out and touch hot objects, crawl towards fire or pull over containers of hot water (Nguyen et al., 2008). As children reach 2-3 years they begin to stand, walk, climb and pull to explore objects and their environment, as a result, their risk of burn injuries continues to increase (Nthumba, 2016, Peden et al., 2008, Rushforth, 2006, The Royal Society for the Prevention of Accidents., 2017).

Attempts to understand cognitive development, and the processes by which children begin to understand their environment and the dangers

around them have been made by a number of well-known psychologists and behaviourists such as Piaget, Erikson and Freud (Rushforth, 2006). In relation to burn injuries, Piaget's 'Theory of Cognitive Development' is possibly best placed to describe the exploratory processes children may go through to understand and come to know their external environment. For instance, from birth to 6 years Piaget's theory recognises two main phases of development these are: a 'sensorimotor period' from birth to 2 years, and a 'preoperational period' from 2 to 6 years (Rushforth, 2006). During these initial phases children begin to get to know their environment and objects within it (Gray and Macblain, 2015). As such, without preventative measures, in an attempt to make sense of a fire or a hot object it is possible that a child will try to touch it. However, due to the thinner layers of skin on a child's palms and their slower withdrawal reflexes, touching a hot object has the potential to cause deep burns (Argirova and Hadzhiyski, 2005). This issue is borne out in literature, where it has been highlighted that hot objects which are left within the reach of small children, for an increased duration, have resulted in burn injuries (Chalya et al., 2011, Justin-Temu et al., 2008, Outwater et al., 2013, Roman et al., 2012).

As a child grows, they begin to learn more about their environment from observing and copying the behaviour of others. For example, Bandura's 'Social Learning Theory' describes how children learn to engage in behaviours based on the observation and imitation of others (Gray and Macblain, 2015). However, the articles reviewed in Table 2 have not indicated imitating behaviour as a factor associated with burn injuries. Nonetheless it may be that this level of information would not be routinely recorded in hospital based records.

2.4.2. Gender

The studies presented in Table 2, which specifically studied paediatric burn injuries, reported slightly different variations of burn injuries across

genders. For instance, two reported a higher incidence in males (Chalya et al., 2011, Karan et al., 2015), one reported a higher incidence in females (Kiser et al., 2012) and two demonstrated no significant differences between children, their gender and the occurrence of burn injuries (Justin-Temu et al., 2008, Roman et al., 2012).

Nonetheless, wider literature suggests that, at certain ages, there is an association between burn injuries and gender (Peden et al., 2008). For example, studies reporting on the prevalence of burn injuries in LMICs have identified an increased frequency of burn injuries amongst younger male children (Albertyn et al., 2006, Nthumba, 2016, Outwater et al., 2013, Peden et al., 2008). However, as children in LMICs begin to reach teenage years it appears this situation is reversed (Ahuja and Bhattacharya, 2004, Albertyn et al., 2006, Forjuoh, 2006, Nthumba, 2016, Peden et al., 2008, Rybarczyk et al., 2017).

The higher burn rate in adolescent females across LMICs has often been attributed with the development of their gendered roles (Ahuja and Bhattacharya, 2004, Forjuoh, 2006). For example, as female children grow up they are bought closer to the kitchen and become more involved in household tasks which expose them to open flames, hot objects and water (Ahuja and Bhattacharya, 2004, Albertyn et al., 2006, Forjuoh, 2006).

Global data indicate that burns are the only unintentional injury where the mortality rate is consistently higher in females than males (Peck et al., 2008b). However, for non-fatal burns the distribution is not as clear (Peck et al., 2008b).

2.4.3. Socio-economic factors

The impact of socio-economic factors on the prevalence of burn injuries is difficult to establish using the data obtained from the studies presented in Table 2 due to the homogeneity of their samples. However, a study conducted in Ghana employed a case-control method to compare

socio-environmental variables between households who have, and have not, experienced a burn injury in a child (Forjuoh et al., 1995). The study indicated that socio-economic factors such as lack of education, literacy, unemployment and rural residence are strongly associated with families whose children had sustained a burn injury (Forjuoh et al., 1995). Although there were some limitations in this study, particularly that it required parents to accurately recollect past events, which they themselves may have not directly witnessed. Nonetheless, the study does provide some insight into the factors associated with child burn injuries.

Global data has also indicated that poverty and low socio-economic status (SES) is heavily associated with burn mortality and morbidity (Peden et al., 2008). International figures demonstrate that the vast majority of fire-related deaths occur in LMICs, with those from the lowest socio-economic positions being at most risk (Mock et al., 2008). These inequalities are also present amongst HICs for children who are living in the lowest socio-economic groups (Peden et al., 2008). For example, in an analysis of class specific death rates from injury across England and Wales, it was found that children whose parents have been classed as 'never having worked' or in 'long-term unemployment', the risk of death due to fires was 37.3 times higher than children whose parents were in the highest socioeconomic group (Edwards et al., 2006).

In addition to parental levels of education and employment, SES is also associated with poor housing and domestic environments that expose children to hazardous environments (Edwards et al., 2006, Peden et al., 2008).

2.4.4. Housing infrastructure

Based on the studies illustrated in Table 2, the most commonly reported location for children to sustain burn injuries was their home, particularly the kitchen and sitting room spaces due to: overcrowding, ground level stoves, hot water and cooking utensils (Chalya et al., 2011, Justin-Temu et

al., 2008, Ringo and Chilonga, 2014, Roman et al., 2012). These studies also indicate that, pre-school children are most vulnerable to burn injuries as they spend most of their time around the home with limited spaces to play that are both close to their mothers and away from hazardous objects (Kiser et al., 2012, Roman et al., 2012).

The high prevalence of childhood burn injuries occurring in the domestic environment is common across Sub-Saharan Africa (Albertyn et al., 2006, Barss et al., 1998, Forjuoh, 2006, Justin-Temu et al., 2008, Karan et al., 2015, Nthumba, 2016, Peck et al., 2008b, Roman et al., 2012, Rybarczyk et al., 2017) particularly where living spaces are predominantly made up of a single room which not only acts as shelter for a number of family members, but is used for multiple activities including: eating, sleeping and recreation (Albertyn et al., 2006, Justin-Temu et al., 2008, Kiser et al., 2012, Komolafe et al., 2003, Roman et al., 2012). These environments have also been found in urban areas where migration to cities is occurring faster than the provision of proper housing (Peck et al., 2008b).

Overcrowded housing means there is limited space for households to prepare meals away from young children (Justin-Temu et al., 2008). It also suggests that, due to a lack of storage space, objects such as: candles, kerosene lamps, cookstoves, hot water cylinders and other heating appliances may need to be stored at ground level, and therefore within reach of small children (Albertyn et al., 2006, Roman et al., 2012).

In the absence of electricity, candles, kerosene lamps and open fires are also used for heating and lighting across areas of Sub-Saharan Africa (Albertyn et al., 2006, Forjuoh, 2006). However, due to poor architectural design and highly combustible building materials there is a risk that flammable appliances may cause the spread of house fires and severe burn injuries (Albertyn et al., 2006, Barss et al., 1998, Justin-Temu et al., 2008).

For HICs countries, the occurrence of unintentional injuries is also primarily associated with the home environment, particularly for children under the age of 5 years as, similarly to the literature reported above, this is where they spend most of their time (Ablewhite et al., 2015b, Kendrick et al., 2013).

2.4.5. Parental supervision

A number of studies from both HIC and LMIC have associated inadequate parental supervision with the occurrence of unintentional injuries in the home (Ablewhite et al., 2015b, Albertyn et al., 2006, Chalya et al., 2011, Forjuoh, 2006, Justin-Temu et al., 2008, Karan et al., 2015, Munro et al., 2006, Peck et al., 2008b, Ringo and Chilonga, 2014, Rybarczyk et al., 2017, Saluja et al., 2004). However, the ability to provide adequate supervision is often reported to be in conflict with parental obligations to carry out fundamental household tasks (Ablewhite et al., 2015b, Albertyn et al., 2006, Karan et al., 2015, Munro et al., 2006, Peck et al., 2008b, Ringo and Chilonga, 2014, Van Niekerk et al., 2007).

Studies conducted in Tanzania, Mozambique and Zambia identified that, in addition to caring for their young children, women were also responsible for many domestic and farming tasks (Edwards et al., 2011, Karan et al., 2015, Ringo and Chilonga, 2014). The concentration required for these tasks may mean that their attention cannot always be on their child and as a result burn injuries may occur (Karan et al., 2015). Moreover, Edwards et al (2011) highlights that mothers in this region typically carry young children on their back using a large piece of fabric, known as a chitenge, as they continue with their hard labour and household activities. However, there is a risk that the baby might fall off their back or the chitenge could catch fire (Edwards et al., 2011).

In addition to household demands parents may also need to take opportunities outside the home to earn money and support their family (Albertyn et al., 2006). In these instances, across LMICs, it is not

uncommon for small children to be left unsupervised at home or in the care of other young children (Albertyn et al., 2006, Edwards et al., 2011). Moreover, in areas where the HIV/AIDS pandemic has been rife there is an increasing number of children who have no surviving parents, resulting in a high prevalence of child-headed households (Hope, 2005, Peck et al., 2008b).

Subsequently, the literature from LMIC indicates that: demanding household tasks, employment and child-led households can result in the inadequate supervision of young children in these environments (Albertyn et al., 2006, Hope, 2005, Karan et al., 2015, Munro et al., 2006, Outwater et al., 2013, Peck et al., 2008b, Ringo and Chilonga, 2014, Van Niekerk et al., 2007).

2.4.6. Season and time of day

It has been reported that burns across Sub-Saharan Africa have a seasonal variation (Albertyn et al., 2006). For instance, burn injuries appear more common among the cold seasons due to the increased use of open fires for warming living spaces and heating bath water (Albertyn et al., 2006, Edwards et al., 2011, Forjuoh, 2006, Kiser et al., 2012, Peden et al., 2008, Samuel et al., 2011).

In Malawi, Samuel et al (2011) found a significant increase in burn presentations during the cold and dry seasons. In contrast, Komolafe et al (2003) found that most burn injuries presenting in their study occurred closer to Malawi's hot and dry season. Although the reason for this seasonal variation is unclear, Komolafe et al (2003) proposes that the excessive heat present during the hot and dry season may exacerbate open fires and indirectly influence the incidence of burn injuries.

However, caution is needed when interpreting seasonal variations where the study covers only one 12-month period, such as Samuel et al (2011), as it may be that certain years have a more pronounced seasonal variation than others. Therefore, hospitals may experience a variation in patient

numbers from one year to the next. Although Komolafe et al's (2003) study is older than Samuel et al's (2011) and therefore may not account for more recent environmental changes and temperatures, their data were collected over a six-year period and therefore present burn data for a number of Malawi's cold, hot and dry seasons.

Globally, the WHO indicates that for some regions burn injuries peak during cold seasons. However, they also report that for tropical regions, where there is less temperature variation, burn injuries are evenly distributed (Peden et al., 2008).

Nonetheless, it is not only temperature variations that have been associated with the occurrence of burn injuries in Sub-Saharan Africa. For example, it has been reported that during planting seasons children become trapped in fires that have been made to clear and prepare the farmland (Albertyn et al., 2006, Edwards et al., 2011).

Certain times of day have also been associated with peaks in burn incidence in Malawi, Tanzania and Mozambique (Chalya et al., 2011, Karan et al., 2015, Samuel et al., 2011). In particular these peaks have been linked with times at which food is being prepared and served (Chalya et al., 2011, Karan et al., 2015, Samuel et al., 2011). This trend is consistent with data from other LMICs, which also associate mid-morning and evening with domestic tasks and meal preparation (Forjuoh, 2006, Mashreky et al., 2008a, Rybarczyk et al., 2017).

2.4.7. Previous burn injuries

In LMICs an association has been recognised between a sibling's injury or death due to burns and the occurrence of subsequent childhood burn injuries (Forjuoh, 2006, Karan et al., 2015, Rybarczyk et al., 2017). For example, in Mozambique Karan et al (2015) found that 25% of the households in their sample had previously experienced a burn injury. Although the association of this was unclear, they suggest that, among

other factors, resource limitations may prevent families making changes to their home following a burn event (Karan et al., 2015).

Parental attitudes towards such incidents may also influence the implementation of preventative measures. For example, Outwater et al (2013), who conducted a review into the morbidity, mortality and causes of burn injuries in Tanzania, indicated that parents tended to have a fatalistic attitude towards burn injuries and therefore did not perceive that they are able to control these events. Such attitudes can be understood through the concept of 'learned helplessness' which asserts that, when someone is exposed to uncontrollable or traumatic events they can begin to feel powerless (Seligman, 1975) consequently lessening a person's motivation to respond or change their behaviour (Seligman, 1975). Therefore, despite a burn injury occurring within a household, parents may not feel able to change or alter their environment to prevent subsequent injuries.

Although this association between a history of burns and subsequent burn injuries has been identified in LMICs, limited work has been undertaken to understand why such a connection exists.

2.4.8. Presence of underlying health conditions

Pre-existing medical conditions and disabilities have been associated with burn injuries globally. Most commonly, conditions that alter coordination or cause seizures have been connected with an increased risk of sustaining a severe or fatal burn (Albertyn et al., 2006, Barss et al., 1998, Boschini et al., 2014, Edwards et al., 2011, Forjuoh, 2006, Karan et al., 2015, Komolafe et al., 2003, Mushi et al., 2011, Nthumba, 2016, Outwater et al., 2013, Peden et al., 2008, Ringo and Chilonga, 2014, Rybarczyk et al., 2017, Virich and Lavy, 2006).

In Malawi, Boschini et al (2014) conducted a retrospective analysis of patients admitted to Malawi's Kamuzu Central Hospital (KCH) between July 2011 and December 2012. Their analysis demonstrated that 10.7 % of

patients admitted to the KCH burns unit, during the study period, had a seizure disorder. This group of patients were more likely to have sustained flame burns and require a longer hospital stay (Boschini et al., 2014). This connection between seizure disorders and burn injuries has also been identified by other research across Malawi and its bordering countries (Edwards et al., 2011, Komolafe et al., 2003, Mushi et al., 2011, Ringo and Chilonga, 2014). For instance, Mushi et al (2011) interviewed 41 known epileptics in Tanzania as part of a community based study aiming to understand the socio-cultural issues associated with epilepsy. The paper reported that 17 of the 41 patients had suffered severe burns during a seizure episode (Mushi et al., 2011). However, epilepsy continues to be poorly controlled for patients living in LMICs due to a poor understanding of the biomedical processes, medication compliance and a lack of access to anti-convulsive therapies (Barss et al., 1998, Kalayi and Muhammad, 1996, Virich and Lavy, 2006). Other impairments such as hearing, vision loss and lameness have also been reported to have a profound effect on the likelihood a child will sustain a burn injury (Forjuoh et al., 1995).

2.4.9. Existing protective factors associated with burn injuries

Two papers, from Ghana and Peru (Delgado et al., 2002, Forjuoh et al., 1995), have provided insight into potential protective factors which may reduce the risk of burn injuries in LMICs. These factors included a higher maternal education and literacy, although the effect was not strong (Forjuoh et al., 1995) and the presence of a separate living room (Delgado et al., 2002). Nonetheless, it could be considered that both factors could simply be a representation of a higher level of socioeconomic security that together provides an overarching protection.

For HICs protective factors have included: knowledge about the risk of burns, house ownership, the use of fire-retardant clothes, installation of fire and smoke detectors, appropriate first aid, emergency response

teams and good quality health care services (Peden et al., 2008). As such, further research is needed in LIMCs to clarify what, if any, protective factors currently exist.

2.5. Limitations of the existing epidemiological data

There are some limitations in using the studies presented in Table 2 to gain a comprehensive understanding of burn injuries. For example, some of the studies utilised small samples that were not powered to provide a statistically significant cause of burn injuries (Karan et al., 2015, Ringo and Chilonga, 2014, Virich and Lavy, 2006) whereas others had a short recall period and were therefore unable to demonstrate or account for a variation in season and burn aetiology (Justin-Temu et al., 2008, Karan et al., 2015, Ringo and Chilonga, 2014, Roman et al., 2012, Virich and Lavy, 2006).

All of the studies presented in Table 2 were hospital based except for Roman et al. (2012). However, whilst comprehensive data on the scope and patterns of injury of those attending medical facilities are essential for highlighting priority issues, the examination of hospital based data alone may not create a true profile of childhood burn injuries in Africa (Bartlett, 2002, Mock et al., 2008). For example, the very nature of the patient's hospital location suggests that these studies might only account for the most severe cases of burns (Hyder et al., 2004). Furthermore, presentation at a medical facility is determined by factors such as thresholds for seeking healthcare, costs and accessibility (Albertyn et al., 2006, Zwi et al., 1995). Moreover, unfortunately, some children will die before reaching the hospital (Hyder et al., 2004).

Retrospective hospital based studies are also limited, as these records often only offer superficial information about burns patients (Bartlett, 2002). Therefore, while hospital based studies are useful to demonstrate patterns that may underlie the more serious but potentially less common

injuries (Bartlett, 2002), further research is needed that is tailored to local contexts and which combines hospital and community based data (Bartlett, 2002, Outwater et al., 2013).

Lastly, as the majority of publications which have explored burn injuries are quantitative, the deeper socio-cultural factors typically investigated by qualitative methodologies, have yet to be uncovered.

2.6. The prevention of burn injuries

2.6.1. The public health approach to injury prevention

Before examining injury prevention in relation to Sub-Saharan Africa it is important to consider the processes required to develop a comprehensive intervention that is culturally, socially and economically relevant. The Public Health Model for a Scientific Approach to Prevention used by the WHO (Figure 4) demonstrates an approach that has been used to successfully reduce the spread of communicable diseases (Mercy et al., 1993, Peden et al., 2008).

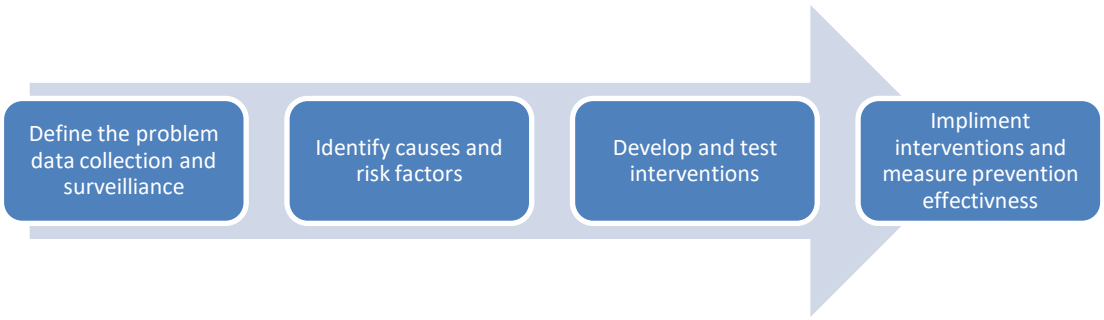


Figure 4: Public health model for a scientific approach to prevention (Mercy et al., 1993)

The initial emphasis of this public health approach is to identify 'who' is most at risk of injuries. However, few publications from this region meet the criteria that allow for a rigorous comparison of epidemiological data (Burd and Yuen, 2005).

Secondly, the approach highlights a need to understand 'why' these events occur and what causes them (Mercy et al., 1993, Peden et al., 2008). These factors can be better understood when combined with the use of the Haddon Matrix (Mock et al., 2011). The Haddon Matrix (illustrated in Table 3) has been used by the WHO as a means of developing ideas to prevent injuries (Mock et al., 2011, Peden et al., 2008). The Matrix adopts an holistic approach by incorporating host, agent, environmental and socio-cultural factors, during three temporal stages of an injury event (pre-event, event and post event) (Mock et al., 2011)

Table 3: The breakdown of a burn injury event as published by Mock et al. (2011) using the Haddon Matrix.

Factors / Phases	Host (Person)	Agent (Equipment)	Physical Environment	Socio-cultural environment
Pre-event	Lack of knowledge about the risks of fire in the home.	Storage of flammable substances in the house. Combustibles, matches or lighters accessible to children. Unsafe lamp or stoves.	Housing in slums or congested areas. Overcrowded households. No separation between cooking area and other areas.	Poverty, unemployment, literacy. Lack of fire-related building codes and their enforcement.
Event	Not wearing flame-retardant sleepwear.	Lack of fire hydrants or other access to water supply.	Lack of access to telephone to call for help.	Inadequate communications Infrastructure for calling emergency services.
Post-Event	Lack of first aid knowledge.	Flammability of household materials and children's clothing.	Low level of first aid, emergency medical services, and hospital burn care.	Inadequate access to burn centres and rehabilitation services.

Haddon also developed 10 countermeasures which have been used on a wide range of injury prevention projects (Haddon and Baker, 1981). The 10 countermeasures are:

- Eliminating the production of the hazard
- Reducing the amount of energy contained in the hazard
- Preventing the release of the hazard
- Modifying the rate or spatial distribution of the hazard
- Separating the hazard in time or space from those to be protected
- Separating the hazard from those to be protected by a material barrier
- Modifying the relevant basic qualities of the hazard
- Making individuals more resistant to the hazard
- Countering the damage already done by the hazard
- Stabilising, repairing and rehabilitating the individuals damaged

Haddon and Baker (1981)

Peck et al. (2008b) applied the Haddon Matrix and countermeasures to identify potential options to prevent residential fires in South Africa for those using non-electrical appliances for cooking, heating and lighting. However, their study focuses on areas where fuels such as LPG and paraffin are more commonly used as fuel sources, rather than countries, like Malawi, that continue to primarily rely on solid fuels. As such, although Peck et al.'s (2008b) work is useful in providing insight into the risks associated with non-electrical appliances, those reliant on biomass fuels are likely to have a differing set of associated hazards and risks. Therefore, the Haddon Matrix will be applied to the findings of this study to identify the key areas of risk and potential prevention options.

In addition to considering the elements which make up the Haddon Matrix the WHO demonstrates that interventions should consider "Three Es" of injury control, these are: engineering, enforcement

(legislation) and education (Gielen and Sleet, 2006, Mock et al., 2011, Peden et al., 2008).

Engineering modifications have been used in HICs to reduce the risk and severity of an injury by creating safer physical surroundings and consumer products (Christoffel and Gallagher, 1999). For example, child resistant caps on medications and toxic products have been used to successfully reduce the risk of childhood poisoning (Christoffel and Gallagher, 1999, Peden et al., 2008). A similar approach was used in South Africa whereby parents were provided with child-resistant paraffin containers to reduce the ingestion of the liquid fuel by children (Krug et al., 1994). However, the effectiveness of engineering interventions on child injury is dependent the parent's willingness and ability to use them as recommended.

Enforcement, or legislative action, is a valuable tool used to increase the uptake of preventative measures (Peden et al., 2008). For example, legislation around the use and instalment of smoke alarms, hot water regulators and sprinkler systems in HIC's, have resulted in a reduction of burn fatalities (Mock et al., 2011, Peden et al., 2008). However, the effectiveness of legislation is highly dependent on the country's ability to regulate and enforce preventative measures. In developing countries, the degree to which legislation can be enforced is problematic due to a lack of regulatory structures and resources (Atiyeh et al., 2009, Peden et al., 2008).

Education campaigns had previously led injury prevention efforts as it was understood that the causes of injuries were rooted in individuals' behaviours (Gielen and Sleet, 2006). Therefore, it was considered that the provision of education would be sufficient enough to cause a change (Gielen and Sleet, 2006). However, as indicated by Gielen and Sleet (2006), these early efforts were often ineffective as they included inappropriate content which created excessive levels of fear and victim

blaming. Nonetheless, more recent educational campaigns now draw on behavioural theory and communication research which considers individual beliefs, skills, resources and the need for continuous reinforcement (Gielen and Sleet, 2006). As a result more recent educational campaigns in HICs have demonstrated successful results in increasing safety knowledge and skills (Kendrick et al., 2007). Yet, while educational programmes on their own have shown some successes, Peden et al. (2008) suggests that, for some injury problems, a combined approach is needed with another "E".

Injury prevention strategies can also be further categorised into passive and active measures (Mock et al., 2011). Active measures require a persistent behaviour or lifestyle change, such as vigilance in food preparation and placement of hot drinks (Ytterstad et al., 1998). As such, these measures are typically encouraged through the delivery of safety education and media campaigns (Peck et al., 2008b). Whereas passive measures require no action on those being protected as they are built into objects or environmental designs. Examples of passive measures include: fire guards, regulation of hot water taps and playpens (Jetten et al., 2011, Ytterstad et al., 1998). These passive measures therefore largely rely on engineering and enforcement (Mock et al., 2011). Active and passive measures may also be combined, for example, a smoke alarm may be considered a passive measure, but requires the user to maintain and use it correctly i.e. checking and changing the batteries.

The need to combine both active and passive measures in a LMIC has been demonstrated by Jetten et al. (2011) who conducted an evaluation of a community-based prevention programme for domestic childhood burns in India. The intervention included an educational video and the distribution of a barrier or play pen. They found that these interventions resulted in a significant decrease in burn injuries and dangerous situations occurring around the house. Nevertheless, there were limitations to this evaluation. Firstly, data was collected from the month

prior and the month following the intervention as such the evaluation only provides insight in to the short-term effect of the programme. Secondly, as Jetten et al. (2011) indicates, there was the potential for bias as socially desirable responses can be common amongst lower socio-economic groups, as they deal with many problems with limited attention and support. Lastly, there was no control group which means the evaluation could not rule out that the positive results were due to other extraneous variables.

2.6.2. The involvement of parents, health professionals and key stakeholders

Injury prevention is the responsibility of many, including: parents, health professionals and key stakeholders (Parbhoo et al., 2010, Peck, 2011, Peden et al., 2008). Parents, for example, must work to create safer environments for their children through the correct storage and use of potentially harmful objects and substances, as well as providing adequate supervision (Peden et al., 2008). However in order to do this, parents must first recognise the hazard and perceive they have the ability to make changes (Gaines and Schwebel, 2009). While a number of studies conducted in HICs have aimed to uncover parental perceptions of injury prevention strategies (Ablewhite et al., 2015a, Coffman et al., 1998, Cox et al., 2016, Hooper et al., 2003) the same level of information could not be found for sub-Saharan Africa.

Nevertheless, the recognition of the need for research in this area is emerging. For example, Munro et al. (2006) conducted focus groups and interviews with parents living in two low-income areas of South Africa, with the aim to understand caregiver perceptions of injury risks and apply them to the design of future safety interventions. The results of their study indicated that, while injuries were described as multifaceted events, parents attributed most risks to their environment rather than their individual actions (Munro et al., 2006). As such, their study demonstrated the importance of gaining insight into parental

perceptions of risk and the ways in which they attribute injuries to their environment or individual actions. Furthermore, as highlighted by a review conducted by Saluja et al. (2004) on the conceptual and methodological issues related to supervision and child injury risks, the perception of 'adequate supervision' is highly subjective and determined by an individual's social norms and milieu (Saluja et al., 2004). Therefore, to add context to future injury prevention strategies in Malawian homes, this study has also sought to understand current prevention practices and perceptions of hazards pertaining to unintentional burn injuries in children.

Health professionals have a role in providing injury prevention initiatives (Christoffel and Gallagher, 1999, Woods, 2006). For example, in primary and community care settings across HICs, health professionals impart anticipatory advice about the types of hazards present in the home and methods to prevent them (Christoffel and Gallagher, 1999, Mock et al., 2011). Advice is typically passed on through home visits or during appointments at primary health care centres (Hyder et al., 2009). This advice might also be supplemented by the provision of safety equipment or referrals to other agencies (Watson et al., 2005).

However, a systematic review conducted by Woods (2006) indicated a number of barriers which can restrict a health professional's ability to provide effective injury prevention advice. These barriers included: inadequate knowledge, lack of time, lack of materials and a lack of confidence (Woods, 2006). Although the majority of studies reviewed by Woods (2006) came from Europe and North America it is possible that such barriers may also be present in LMICs with the added difficulties of: limited health budgets, a lack of resources, high demands on curative health services and a high turnover of medical staff (Edwards et al., 2011). However, in comparison to HICs there is far less literature available from LMICs on this issue. As such, it was important to investigate the perception of health professionals within the study, not only to uncover

risk factors associated with burns but, to understand existing prevention methods and potential barriers to their implementation.

There are a multitude of individuals and organisations that could be involved in injury prevention interventions (Peden et al., 2008). These include: government, non-government organisations (NGO), donor organisations, the private sector, the media and community leaders (Peden et al., 2008). However, given the nature of this study, it would not have been possible to access and interview members from all of these key groups. Therefore, it was decided to focus on those who are involved in the design and distribution of ICS in Malawi. The rationale for this comes from the understanding that these groups are inherently responsible for providing and promoting equipment which is "designed for safety" (Peden et al., 2008, p153). Furthermore, according to Peden at al. (2008) not only should their equipment comply with safety and quality control standards, but NGOs and private sector organisations should be encouraged to identify local safety problems and ensure the development of safety promotion and evaluation. As such, it was important to gather information on the existing strategies implemented by these key organisations.

2.7. Burns prevention in sub-Saharan Africa: existing strategies and barriers to their implementation

Burns treatment and rehabilitation is extremely costly for individuals, families and health services (Atiyeh et al., 2009, Edwards et al., 2011, Peck et al., 2008b). However, while cost-effective prevention methods have been successfully trialled and implemented in HICs (Peden et al., 2008), there continues to be limited evidence of their cost, use or acceptance in LMICs (Mock et al., 2011).

2.7.1. Existing strategies and recommendations for burns prevention in sub-Saharan Africa

For the purpose of this description existing strategies and recommendations for burns prevention programmes in LMICs have been categorised into the three Es of injury control as described in Section 2.6.1. Educational campaigns in LMICs have included the use of local community awareness programmes, face to face interactions, home assessments and school programmes (Atiyeh et al., 2009, Parbhoo et al., 2010, Peck et al., 2008b, Rybarczyk et al., 2016). The purpose of these campaigns were to make communities aware of environmental risks, the consequences of children's fire-play, basic first aid practices, the structure and arrangement of the kitchen and the proper use, functioning and maintenance of non-electrical appliances (Atiyeh et al., 2009, Parbhoo et al., 2010, Peck et al., 2008b, Rybarczyk et al., 2016). However, few have reported on the long-term effectiveness of these campaigns.

Education provided through mass media such as newspaper, radio and television advertisements has been widely used in HICs and some upper middle income economies (Kai-Yang et al., 2008, Mohan and Varghese, 1990, Parbhoo et al., 2010, Rybarczyk et al., 2016, Sarto Piccolo et al., 1991). However, the application of such mass media campaigns is somewhat limited in rural areas of LMICs. For example, the costs associated with these campaigns and the opportunities for parents, caregivers and children to access such messages are prohibited by language, access to resources and mass media itself (Edwards et al., 2011, Parbhoo et al., 2010). As such, research in Zambia has recommended, where rural households have limited access to mass media, educational campaigns should be delivered in primary schools, immunization clinics, church meetings and points of care (Edwards et al., 2011). However, despite education, there may be little parents can do about the agent or

environmental dangers that exist around their child (Mock et al., 2011, Rice et al., 1994).

Engineering modifications have been suggested in relation to the design of kitchens and cooking appliances. For instance, Peck et al. (2008b) suggests that kitchen spaces should be built using less combustible materials and be designed to provide a distance between the cookstove and children. Furthermore, it has been proposed that cooking appliances themselves should be out of reach from children (Edwards et al., 2011, Parbhoo et al., 2010, Peck et al., 2008b). However, there is limited research that has considered the evaluation of different kitchen designs on burn injuries. Moreover, from a cultural perspective, altering the cooking space or raising the cooking surface may not be a desirable action for all households. For example, the existing ground level position of the cookstove has many appealing qualities as they allow the cook to remain seated and provide some degree of portability (Outwater et al., 2013).

Legislative recommendations for the prevention of burn injuries in LMICs has included: stopping the careless lighting of bush fires (Edwards et al., 2011, Parbhoo et al., 2010), the distribution of paraffin by village vendors and the regulation of design specifications for stove appliances (Peck et al., 2008b). However, such safety legislation or standards are lacking in sub-Saharan Africa (Atiyeh et al., 2009).

As explained in Section 2.6.1, it is suggested that a combination of education, engineering and legislative strategies are needed to be effective in reducing the risk of burn injuries (Jetten et al., 2011, Mock et al., 2011, Peden et al., 2008). However, a case-control study conducted in a low-income area of South Africa, which provided a combination of education and safety devices, found mixed results in relation to household safety practices (Odendaal et al., 2009). For instance, although Odenaal et al. (2009) found that the storage of poisonous materials,

electrical wires and paraffin appliances left within reach of children had been reduced, the intervention did not appear to reduce significantly hazardous practices associated with burn injuries such as, heating bath water on a stove, or keeping children safe during meal preparation (Odendaal et al., 2009). The inability to make changes to these practices was associated with the continued pressures on caregivers to manage household demands and poor housing conditions (Odendaal et al., 2009). Therefore, whilst it is important to integrate combined approaches into injury prevention strategies, it is crucial that broader cultural and socio-economic factors are considered.

2.7.2. Barriers to the development of burns prevention programmes in sub-Saharan Africa

In addition to combined educational, engineering and enforcement approaches, the literature acknowledges other key factors required to ensure the success of an injury prevention programme. These include: rigorous surveillance, strong government leadership, resources, a targeted approach, community coalitions and elevation of housing and economic difficulties (Atiyeh et al., 2009, Parbhoo et al., 2010, Peck et al., 2008b). Rigorous surveillance systems, for example, allow for the development of both targeted initiatives and a system for monitoring the effectiveness and allocation of resources (Atiyeh et al., 2009). However there is a current lack of injury surveillance systems across LMICs (Burd and Yuen, 2005).

To successfully develop and implement legislation, government leadership needs to be strong and well informed (Atiyeh et al., 2009). However, a lack of surveillance data and the traditional viewpoint that burns are accidental random events, means that political leaders and governments are not fully aware of the burns problem, or the potential costs that could be saved through prevention strategies (Atiyeh et al., 2009). Thus, burns prevention continues to receive little attention.

The success of a burns prevention programme can also be attributed to the resources available to develop and run an initiative. For example, prevention programmes require a wide range of resources to initiate research, product design, dissemination, promotion and legislation (Atiyeh et al., 2009, Forjuoh, 2006). However, while such investment can be ambitious for a HIC, critical shortages of human infrastructure and financial resources in LMICs make the development of full and comprehensive strategies extremely challenging and potentially unrealistic (Atiyeh et al., 2009, Parbhoo et al., 2010, Peck, 2011). As such, more modest, targeted and attainable interventions are required at community level (Atiyeh et al., 2009).

To create sustainable changes community involvement is also critical (Atiyeh et al., 2009). Community organisers, leaders, chiefs and headmen should ideally be involved in the planning and subsequent stages of a prevention strategy (Mock et al., 2011). Utilising community members at the beginning of an initiative provides both ethical and practical reassurance. Ethically, community members should be allowed to have a say in programmes delivered in their area (Mock et al., 2011). Practically, community involvement should result in a more effective, sustained and targeted intervention (Mock et al., 2011). Nonetheless, while such collaborations may be developed as a means to empower and encourage ownership of the programme by community members, it should be acknowledged that power imbalances may exist between community members and outside organisations which may prohibit the community's full participation in programme development (Atiyeh et al., 2009, Jetten et al., 2011).

There is little doubt that low socio-economic status, poverty, poor housing and overcrowding produce many risk factors associated with burn injuries. As such, it has been recommended that, not only should targeted prevention measures be emphasised, but also broader measures that have the potential to alleviate existing deficits in education, housing

and basic amenities (Atiyeh et al., 2009, Parbhoo et al., 2010, Peck et al., 2008b). However, such issues are unlikely to change dramatically in the near future (Parbhoo et al., 2010). Therefore, investment will continue to be required for targeted multi-level approaches that do not rely on the overall development of the country (Parbhoo et al., 2010).

At present, many of the factors which are integral to the development of a successful injury prevention initiative are limited amongst LMICs. Therefore, without wider knowledge and understanding of these factors it may be difficult to develop and evaluate a sustainable approach to burns prevention in Malawi.

2.7.3. Limitations of existing injury prevention research in sub-Saharan Africa

The main limitation currently associated with injury prevention research, is the severe lack of it (Atiyeh et al., 2009, Harris et al., 2016, Parbhoo et al., 2010, Peck et al., 2008b, Rybarczyk et al., 2016). In addition to the inconsistent documentation of burn injuries themselves, there are minimal data available which may assist in the evaluation of prevention initiatives on burns prevalence in LMICs. Moreover, much of the evaluations that have been discussed throughout Section 2.7 are from areas outside of sub-Saharan Africa or have been conducted in South Africa which has a much different infrastructure than the rest of sub-Saharan Africa and therefore initiatives there may not be simply transferred to Malawi.

Limitations associated with the publications reviewed here also include a lack of rigorous evaluation of the identified prevention strategies. For example, of the thirty studies reviewed by Parbhoo et al. (2010) only two appeared to evaluate the effectiveness of their intervention. Moreover, the systematic review conducted by Rybarczyk et al. (2016) indicated that several methodological flaws are prevalent amongst existing programme evaluations including: a lack of control groups, non-random sampling,

small sample sizes, measurements of hazard reduction instead of injury; and short follow up periods. Therefore, it is difficult to establish the long-term sustainability and impact of these interventions.

2.8. Promising interventions: improved cookstoves (ICS)

In HICs evidenced based interventions such as smoke alarms, hot water heater regulators and flame retardant sleepwear has resulted in dramatic and sustained reductions in childhood burn injuries (Mock et al., 2011). However, due to the differing epidemiological, socio-cultural and environmental causes of burn injuries in LMICs these interventions could not be simply transferred (Mock et al., 2011).

It has been suggested that, as the un-safe use and design of traditional cookstoves have been attributed to a significant number of contact, flame and scald burns, ICS could be used to mitigate the occurrence and severity of burn injuries (Mock et al., 2011). However, while research has investigated the use of ICS and respiratory health (Mortimer et al., 2017, Romieu et al., 2009, Schilmann et al., 2015, Smith-Sivertsen et al., 2009, Smith et al., 2011), evidence concerning their potential to influence burn injuries remains insufficient (Global Alliance for Clean Cookstoves., 2013, Mock et al., 2011).

At present, international standards measure ICS by their ability to be "clean", "efficient" and "safe" (Global Alliance for Clean Cookstoves., 2012, Global Alliance for Clean Cookstoves., 2016a). To measure this, these features have been aligned to a 1-4 tier system, illustrated in Figure 5, of which stoves are allocated based on quantitative values determined by the Water Boiling Test (WBT) (Global Alliance for Clean Cookstoves., 2009) and the Biomass Stove Safety Protocol (BSSP)(Global Alliance for Clean Cookstoves., 2015a). It should be noted that stoves may score different tiers for different tests and the tiers themselves cannot be used

to predict health outcomes or environmental impacts (Global Alliance for Clean Cookstoves., 2012)

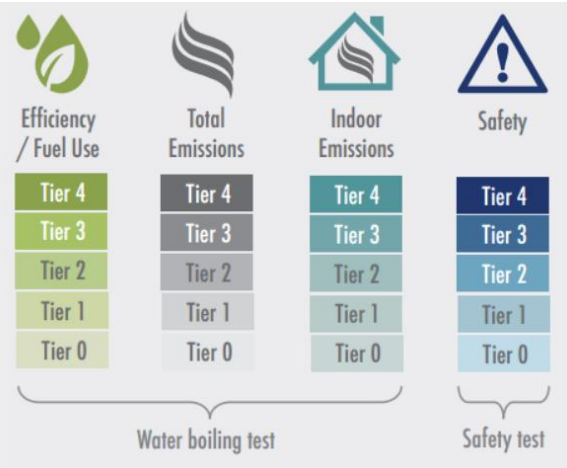


Figure 5: The IWA Tiers of Performance (Global Alliance for Clean Cookstoves., 2012)

The GACC states that "We encourage partners to use the quantitative metrics and tiers as the basis for communicating specific performance goals, rather than solely relying on terms like "improved," "clean," or "advanced" (Global Alliance for Clean Cookstoves., 2016a). Nonetheless, while determining the level of 'improvedness' using quantitative measures may provide a means to objectively define ICS the tests themselves have been criticised for being subjective and lacking real life application (Gallagher et al., 2016, Lombardi et al., 2017). Moreover, this process asserts ethnocentric views that 'clean', 'efficient' and 'safe' are improved. Yet, while undoubtedly these elements are core issues, they do not necessarily capture the same values as those who are using the stoves.

Nonetheless, in addition to the WBT and BSSP, the GACC has begun to develop more field-based testing protocols to evaluate stove performance and actual impacts on household stove use and fuel consumption (Global Alliance for Clean Cookstoves., 2015c). These tests are: The Controlled Cooking Test (CCT), Durability Protocol (DP) and Kitchen Performance

Test (KPT). However, these testing procedures still require further evaluation and peer review (Lombardi et al., 2017).

At a local level, Malawi's NCSC defines ICS on the basis of the acronym CLEANER (Convenient, less smoke, efficient on fuel use, affordable or available, not harmful, easy to use and robust) (Mbaula, 2017b). As such, their definition encapsulates key issues relating to health, the environment and the stove's usability.

2.8.1. ICS uptake and culture

Cooking and food form parts of deeply embedded cultural traditions across all nations (Urmee and Gyamfi, 2014). For LMICs cookstoves have several layers of practical importance. For example, they act as a heat and light source as well as provide a point for social gathering (Bielecki and Wingenbach, 2014). Therefore, to ensure the sustainability of ICS interventions, design and dissemination need to fit within existing cultural practices and needs. However, until recently few studies have described how cultural perceptions affect the adoption of ICS (Bielecki and Wingenbach, 2014).

During the review process four empirical studies and two review papers were identified which aimed to understand these issues (Adkins et al., 2010, Bielecki and Wingenbach, 2014, Concern-Universal, 2012, Jagger and Jumbe, 2016, Kumar and Kumar, 2013, Urmee and Gyamfi, 2014). These papers demonstrate that: cooking time, stove size, food preparation, usability, convenience, costs, social practices, familiarity, supply of firewood, peer effects and space heating, as well as the use of smoke for seed preservation and mosquito deterrent, can have a direct influence on the decision to use a particular cooking method. For this study, it was anticipated that taking a qualitative approach would uncover cultural influences that can define how hazards are perceived in the home, as well as the households' rationale for adopting certain cooking and heating methods.

It has been widely acknowledged that many of those who adopt the ICS continue to employ traditional cooking methods alongside their new intervention, also known as fuel stacking (Alem et al., 2016, Cheng and Urpelainen, 2014, Mortimer et al., 2017, Romieu et al., 2009, Schilmann et al., 2015, Smith et al., 2011). For instance, studies undertaken in both India and Ethiopia have investigated fuel stacking behaviours over time (Alem et al., 2016, Cheng and Urpelainen, 2014). The studies demonstrate that, although fuel stacking might be associated with a boost of alternative technologies (Cheng and Urpelainen, 2014), such behaviours could also be linked to: maintaining a sense of energy security, household preference, familiarity and traditional baking (Alem et al., 2016). The use of multiple technologies is important to recognise when attempting to explore hazards and injury risks within the home setting, as the study tools and questioning will need to take into account each method employed for cooking, heating and lighting, which may pose a burns risk to children.

2.8.2. ICS and health

The combustion of traditional biomass fuels on inefficient cookstoves creates high levels of household air pollution (HAP), which is associated with the development and exacerbation of serious respiratory illnesses and diseases resulting in over 4 million deaths per year (Gordon et al., 2014, Lim et al., 2012, World Health Organisation, 2014b). This is a serious health issue for those who primarily rely on traditional biomass for cooking, heating and lighting (World Health Organisation, 2014b).

To reduce levels of HAP and associated health problems, a number of ICS have been designed with the aim to reduce the level of particulate matter and carbon monoxide (CO) emissions produced. However, while certain ICS have demonstrated promising CO reductions in laboratory testing, there is little evidence that these interventions could significantly reduce

the incidence of pneumonia or improve lung function (Mortimer et al., 2017, Romieu et al., 2009, Smith-Sivertsen et al., 2009).

Whilst it is disappointing that such promising interventions did not demonstrate a significant impact on respiratory health, such outcomes may be attributable to fuel stacking behaviours and the continued exposure to other sources of HAP such as rubbish burning and bush fires (Mortimer et al., 2017, Romieu et al., 2009, Schilmann et al., 2015, Smith-Sivertsen et al., 2009, Smith et al., 2011). Therefore, as with burn injuries, the cause of HAP cannot necessarily be attributable to, or improved by, the installation of one object but may require further environmental modification to the kitchen design.

2.8.3. ICS and safety

Studies examining stove use in relation to other health issues have highlighted that certain ICS may have the potential to produce a reduction in burn injuries. For example, the Randomised Exposure Study of Pollution Indoors and Respiratory Effects trial (RESPIRE) conducted in Guatemala found that the incidence of burns decreased almost by half in comparison to their control group following the implementation of the 'plancha stove' (Bruce et al., 2004, Mock et al., 2011). They also found that the burns sustained by the intervention group were less severe and resulted in less scarring (Bruce et al., 2004, Mock et al., 2011). Similar reports were also found by the Cooking and Pneumonia Study (CAPS) in Malawi (Mortimer et al., 2017) which during their assessment of adverse events related to cooking found a substantial reduction (42%) of non-serious burn injuries in comparison to the control group (Mortimer et al., 2017).

The BSSP, used by the GACC, was designed to capture the hazards that expose the user to: burns and scalds, lacerations and abrasions, house fires and property loss (Johnson, 2005, Johnson and Bryden, 2015). The

BSSP contains 10 tests, listed below, each of which can be conducted with minimal technical equipment.

1) Sharp edges and points
2) Cookstove tipping
3) Containment of fuel
4) Obstructions near the cooking surface
5) Surface temperature
6) Heat transfer to the environment
7) Handle temperature
8) Chimney shielding
9) Flames surrounding the cookpot
10) Flames exiting the fuel chamber, canister, or pipes

Global Alliance for Clean Cookstoves. (2015a)

The development of the BSSP adds vital criteria to classify ICS as the simplicity and lack of equipment required to conduct the tests means that local designers and manufacturers should be able to carry out these tests in the field. However, during the researcher's initial field work in East Africa it became apparent that the interpretation of the BSSP could be relatively subjective. Therefore, in order to assess the replicability of the BSSP a small study was undertaken at the University of Nottingham (Gallagher et al., 2016). The results from this demonstrated that, while individually some tests produced relatively coherent scores, others led to large areas of discrepancy.

Furthermore, the BSSP only assesses the safety of a cookstove as a solitary item, rather than how safe it is to cook with or the environment in which it is used and therefore does not consider safety of other elements related to the ICS. For example, the improper storage of liquid fuels could mean that substances such as ethanol and kerosene may be easily ingested by children resulting in fatal poisoning (Peden et al.,

2008). As such, while the BSSP is a valuable starting point, further research is needed to account for hazards that appear during the 'real life' use of an ICS within the context and interpretation of the end users.

2.9. Theoretical approaches to injury prevention

To co-ordinate and direct interventions there is a need to understand the processes which might initiate or prevent behaviour change in relation to injury prevention. Therefore, this study has considered theoretical approaches which aim to describe the multiple dimensions attributable to health and behaviour change.

2.9.1. Individual approaches

Theories which guide health promotion operate at various levels including: individual, organisations and communities (Nutbeam, 2006b, Tones and Green, 2006). Primarily, as researchers have aimed to understand health behaviours, the theories and models applied have predominately focused on the individual (Nutbeam, 2006b). These models and theories include: The Health Belief Model (HBM), the Theory of Planned Behaviour (TPB), the Theory of Reasoned Action (TRA) and Social Cognitive Theory (SCT) (Nutbeam, 2006b, Tones and Green, 2006). Though each model is constructed slightly differently, they include some similar elements. In 1991, a theorist workshop was convened by the National Institute of Mental Health to develop a unified framework for behavioural analysis and change (Conner, 2010, Sleet et al., 2006). Key theorists involved in the process included: Becker (HBM), Fishbein (TRA) and Bandura (SCT). Their discussions led to an enumeration of their theories that together contain eight variables considered necessary to change a variety of human behaviours, including those which may regulate and predict risky behaviours (Sleet et al., 2006). These variables are shown in Figure 6, which provides a visual representation of the 'major theorists' integrated social cognition model (ISCM).

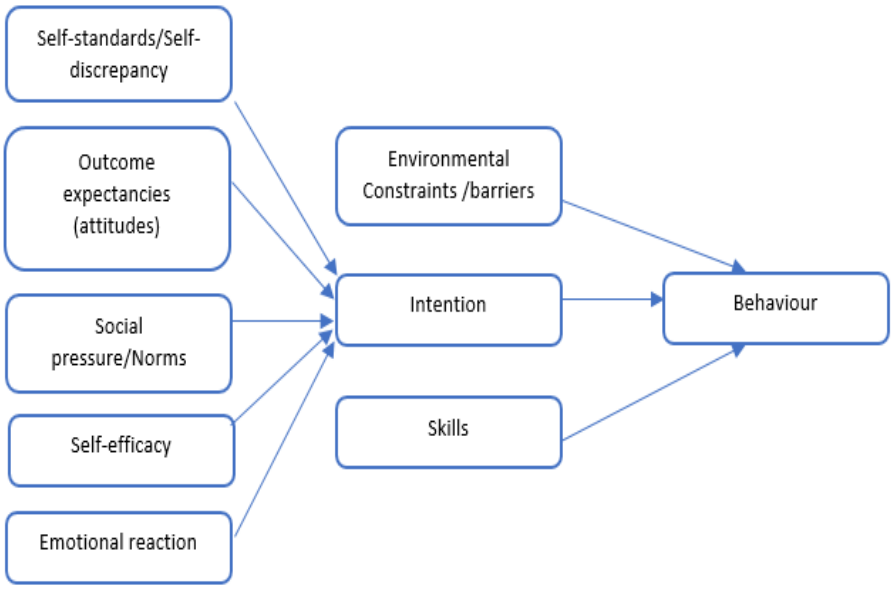


Figure 6: The "major theorists" integrated social cognition model (Conner, 2010 p6)

As the ISCM is relatively new it has not yet been applied extensively to injury-related behaviours or programmes. However, the application of the ISCM has many advantages in development of prevention initiatives, as it provides a process of understanding the key constructs from several well-established theories, which determine health related behaviours (Conner, 2010, Sleet et al., 2006). For example, an individual's belief that they could perform behaviours to prevent burn injuries can be considered in relation to the concept of 'self-efficacy'. Self-efficacy, developed by Bandura (1977a), is "concerned with the judgements of how well one can execute courses of action required to deal with perspective situations" (Bandura, 1982 p122-3). Moreover, people must also believe that they have a certain amount of control over environmental factors which may cause injuries. Such aspects are crucial when considering the development of prevention programmes in areas which experience high levels of poverty and a lack of resources.

However, while the ISCM considers an individual's self-efficacy, it does not appear to directly consider how individuals may perceive injury events. For example, one may believe that they can execute a course of

action. However, they may not believe that such courses of action will have an impact on the injury event occurring and therefore any behaviour change may not be sustained. Such judgments can be examined based on whether an individual considers these events to be within or outside of their control (Rotter, 1966, Tones and Green, 2006). Therefore, it was important to develop research methods that could uncover participants' thoughts about the control they have, or may not have, over burn injuries occurring.

2.9.2. An ecological approach

While the ISCM provides a theoretical understanding of individual behaviours, there has been an increasing emphasis for health promotion and injury prevention strategies to use 'ecological' models. Like the Haddon Matrix, these models consider the individual as well as much wider physical, environmental and social factors (Hanson et al., 2005, Hosking et al., 2011). The injury iceberg, illustrated in Figure 7, is an ecological model developed specifically for use in planning community safety interventions and injury prevention initiatives (Hanson et al., 2005).

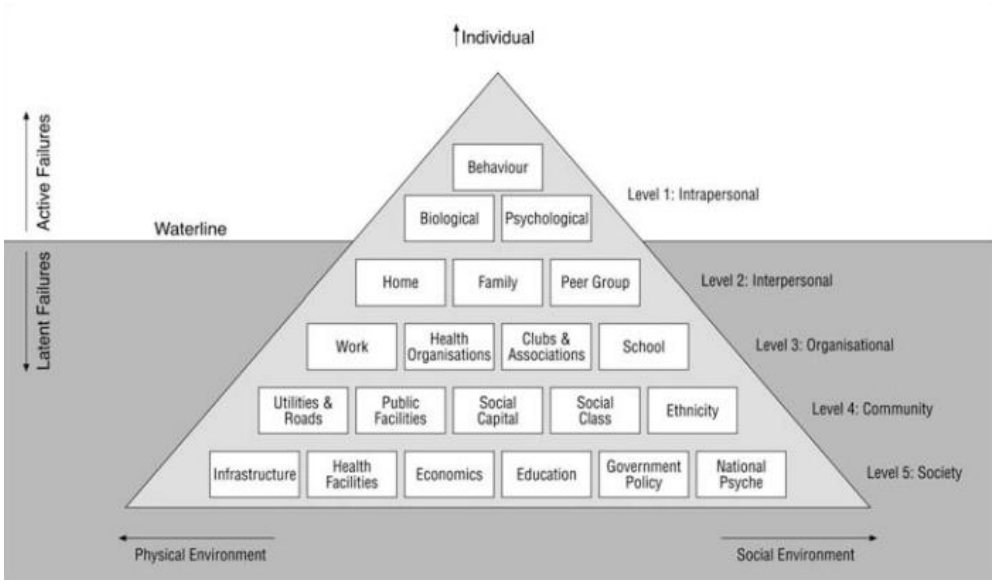


Figure 7: The Injury Iceberg (Hanson et al., 2005 p6)

The use of the term "Iceberg" in this model represents a metaphorical interpretation of interlinking factors involved in injury events (Hanson et al., 2005). The individual's behaviours, biological and psychological processes sit at the 'tip of the iceberg', while other vital determinants sit much deeper 'below the water line' (Hanson et al., 2005 p6). Consequently, Hanson et al (2005) assert that injuries do not occur on an isolated level but are often a result of a number of factors.

The comprehensive nature of the iceberg model also provided a foundation in which to develop the study's methodology. For instance, literature examining risk factors associated with burns in LMICs is typically limited to the interpretation of quantitative data. Yet, as expressed by the injury iceberg, unintentional injuries are more than a biomedical process and therefore require a more holistic approach in their investigation (Hanson et al., 2005). Therefore, it became apparent that a qualitative methodology was required. Additionally, due to the integral nature of parents (families), health professional and designers' influence on an injury event their inclusion in the study was also crucial. Further discussion on the rationale of a qualitative methodology is provided in Chapter 3.

2.9.3. Diffusion of Innovation Theory

The above models and approaches consider the individual and the context in which they live, however, not all individuals in their community or context will adopt a new idea or behaviour simultaneously. The Diffusion of Innovation (DOI) Theory was created to explain how a behaviour, idea or a product gains momentum and 'diffuses' through a social system or community (Rogers, 2003). The theory has been successfully used to provide guidance and accelerate the adoption of public health innovations that have aimed to change the behaviour of a social group (Nutbeam, 2006a). The theory is based upon

five factors which are understood to influence the speed and success of a new idea or intervention. These are:

- the characteristics of potential adopters
- the rate of adoption
- the nature of the social system
- the characteristics of the innovation
- the characteristics of the change agents

(Nutbeam, 2006a p38)

An important aspect of this model, as illustrated in Figure 8, is that it considers the characteristics of certain population sub-groups which adopt an innovation or behaviour at different temporal stages. It can therefore highlight potential groups who may act as role models or require special attention (Gielen et al., 2006, Rogers, 2003). These adoption sub-groups are categorised as: innovators, early adopters, early majority, late adopters and laggards (Rogers, 2003).

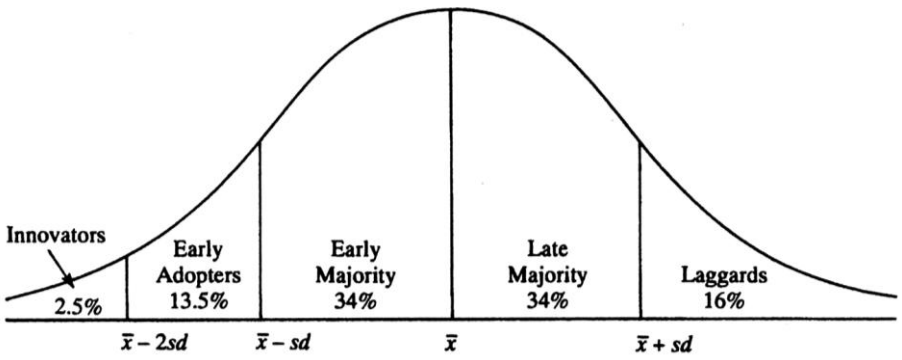


Figure 8: Adopter Categorisation on the basis of innovativeness (Rogers, 2003 p281).

Innovators have an interest to be the first to try something new which often leads them to seek out innovations outside of their local peer networks (Rogers, 2003). They would also appear to be able to apply complex technical knowledge, and be willing to accept a certain level of uncertainty when adopting new ideas (Rogers, 2003).

Early adopters appear more integrated into their social system. This group are often the role models within their social group and therefore have the potential to influence the opinions of other members in their social network (Rogers, 2003). This group will also typically have the resources (personal, social and financial) to enable them to adopt the innovation (Nutbeam, 2006a).

The early majority may not be leaders, but they do provide an important "interconnectedness in the system's interpersonal networks" (Rogers, 2003 p284). Therefore, the adoption of the early majorities puts peer pressure on those in the late majority segment who are typically cautious and sceptical of new innovations (Rogers, 2003).

Laggards would be the last segment to adopt, if at all, an innovation (Rogers, 2003). Laggards typically refer to existing and traditional processes and, as a result, can be relatively suspicious of changes (Rogers, 2003).

Thus, the model assumes that, ideas and support of an innovation will reach the different adopter segments through informational and motivational messages which pass from the earlier to the later adopters (Gielen et al., 2006). In practice, an innovation may be focused towards the societal 'role models', or early adopters, in order to accelerate an initial acceptance. While the 'laggards' may require further attention to remove any potential barriers to their adoption such as providing resources and implementing enabling strategies (Gielen et al., 2006).

Nonetheless, while Rogers (2003) provides a theory in which to understand the acceptance and adoption of new innovations, it does also have limitations in its application. For example, Rogers indicates that, the DOI model places the success or failure of an innovation on the success of certain adopter segments. For example, rather than asserting that the failure of an innovation is due to inadequate information or promotion, late adopters are often blamed or stereotyped as "resistant to change" or

"difficult" (Rogers, 2003 p121). Whereas in reality, the lack of adoption may seem to be the most rational approach for this group (Rogers, 2003). Hence, it is important that health promotion and injury prevention research carefully analyses the appropriateness of a proposed innovation for each societal segment that they are targeting, most importantly to ensure that any programme which is developed has the end users in mind (Rogers, 2003). The application of the DOI for this research therefore provides a system for understanding the characteristics of adopter groups and the factors which influence the acceptance, or failure, of health interventions.

2.10. Origins and development of the research aim

Preliminary evidence outlined in Section 2.8 has suggested that ICS may have the potential to reduce the occurrence of burn injuries in children (Bruce et al., 2004, Mock et al., 2011, Mortimer et al., 2017, Peden et al., 2008). Although, without wider evaluation it is difficult to determine whether these interventions provide a realistic means to reduce burn injuries (Mock et al., 2011). In 2013, the GACC published recommendations for further research on ICS stating a specific need for further evaluation with regards to safety.

"More evidence is needed.... [to obtain] information on the incidence, severity and causes of cookstove burns, scalds and other injuries (e.g. liquid fuel ingestion), further developing and testing existing safety protocols, and carrying out field evaluation to determine the impacts on these outcomes of cleaner stoves/fuels"

(Global Alliance for Clean Cookstoves., 2013)

However, the process of determining whether a stove can influence the occurrence of burn injuries is complex. For example, a lack of complete and standardised data from hospital facilities makes it impossible to reliably determine a baseline, or any potential changes that may have

occurred following the implementation of an ICS programme. As such, even if an increase or decrease in burn injuries over time could be identified it would be difficult to determine if this was associated with the cookstove or a combination of other variables and environmental changes. Therefore, the aim of this research needed to be developed in such a way that it allowed for a clearer understanding of the factors which contribute to burn injuries, rather than burn injury figures alone. Consequently, the research methodology developed from the aim needed to allow for a deeper exploration of the environmental context, as well as carers' perceptions and control of burn events.

Moreover, as indicated by preliminary fieldwork, it became clear that, while cookstoves play an integral part in the incidence and severity of burns in Malawi, there are a number of broader factors associated with the cooking process and environment that contribute to the risk of burn injuries in children. Consequently, while it may be possible to create a "safer" stove, if that stove is then placed within an unsafe environment or context its safety attributes may no longer be as effective. As a result, to ensure that important contextual factors were included, the aim needed to consider the broader issues associated with burn injuries and the cooking process. Approaching the research in this way also allows for the study recommendations to expand beyond a single engineered product to areas such as kitchen design and the educational needs of the stove users.

Lastly, as parents, health professionals and key stakeholders have the potential to play a vital role in the management and delivery of injury prevention, it was important to understand how each group recognised burns risks, their ability to control risks and their existing strategies, if any, utilised to prevent burns. Thus, the following aim and objectives were produced.

2.10.1. Study aims and objectives

Aim

To explore the factors associated with paediatric burn injuries, in rural and peri-urban Malawi.

Objectives

1) To identify the factors which expose children to burn injuries in the Malawian context
2) To explore parental perceptions of paediatric burn injuries and their prevention
3) To explore health professionals' perceptions of paediatric burn injuries and their prevention
4) To examine households' perceptions of safety in relation to their cooking methods
5) To identify existing quality control and safety standards utilised by improved cookstove initiatives in Malawi

2.11. Chapter summary

This chapter has provided a context to the study, highlighting what is currently known about the factors which contribute to burn injuries and their prevention in sub-Saharan Africa. The chapter has also introduced ICS as a potential means to mitigate burns injuries in children. The final part of the chapter explained the origins of the research followed by the aim and objectives of the study. The following chapter will present the methodological approach taken to meet the study's aim and objectives.

3. Chapter three: Methodology and methods

3.1. Introduction

This chapter provides a description and rationale for the research approach, methods and data analysis process. The chapter begins by explaining the philosophical approach taken to address the research aim. The study design and the development of the research tools are then discussed. This is followed by a description of the processes employed to recruit the study sample, manage and analyse the data. The ethical aspects of the study are then considered. The chapter ends with a reflection of the researcher's background, characteristics and experience in relation to the study.

3.2. Philosophical approach for addressing the research aim

3.2.1. Under-pinning philosophical assumption

Research investigating the incidence, cause and severity of paediatric injuries is often addressed through a positivist epistemology. For instance, hospital based data, whether retrospectively or prospectively collected, are typically quantitative in nature. These resultant data are then used to correlate epidemiological factors with the occurrence of injuries to children (Bartlett, 2002). However, while this information is extremely important when considering hospital provisions and targeted health messages, it may neglect what parents have understood or perceived about the risks of injuries to their children. This is where additional qualitative research can prove vital in the creation of contextually appropriate interventions. For example, Rice et al. (1994) utilised a qualitative approach with parents whose children were perceived to have a high risk of accidental injuries within a low–income area of Glasgow. Throughout their study it became clear that while parents were aware of the hazards within their environment, they lacked

the control or ability to make changes. Whereas Malawi itself presents very different types of risk factors for childhood injuries, the approach taken by Rice et al. (1994) to 'uncover' parental experiences of injuries, will be used so as to add depth to the existing epidemiological literature that may quantify contributory risk factors but lack substantial explanation (Bartlett, 2002).

Qualitative research itself is underpinned by a number of epistemological and ontological assumptions. Moreover, the application of a particular assumption depends upon the research aims and the extent that the researcher considers truth or reality to be constructed through human interpretation and knowledge or a pre-social reality that can only be accessed through hypothesis testing (Braun and Clarke, 2013).

Within the biomedical world definitions have been created and agreed upon that classify what burns and injuries are. However, depending on a person's culture, context and educational background the interpretations of such events may not be so easy to classify. Furthermore the concepts of risk, or at least the perception of risk, can equally be interpreted or constructed in a number of different ways.

Epistemology and ontology, while often discussed separately within the literature, are not disconnected entities (Braun and Clarke, 2013, Crotty, 2009). Both encapsulate philosophical ideas that can be applied to generate theoretical perspectives and methods used for collecting and analysing data (Crotty, 2009). This research is based on constructionist epistemology and relativist ontology. The rationale for adopting these philosophical approaches is based on the notion that interpretations of objects, events, and risk, will be constructed in different ways depending on the individual's time and place. For example, constructionism is an epistemological approach concerned with 'making of meaning' and asserts that people create interpretations of the world through their engagement with it (Crotty, 2009 p42). Relativism is an ontological

approach closely linked to constructionism. Its position argues that there are multiple realities and what we know is determined by where and how our knowledge is generated (Braun and Clarke, 2013). In essence these approaches allow for multiple interpretations of burn events and risks based on an individual's view of the world.

The importance of these approaches in cross cultural research is that they both assert that there is no one 'true' or 'valid' interpretation of reality (Crotty, 2009 p47). Such that, the interpretation of risk in an individual's reality depends on what reality they have been or are living in. This is possibly why, in relation to injury prevention, it is not feasible to simply transfer successful interventions from one culture and expect to see the same results in another. For instance, a family living in the UK who do not typically cook on or use open fires may perceive such situations as high risk and as a result alter their behaviour. However, families living in Malawi who have prolonged exposure to these hazards may come to overlook the risks associated with these processes. As such, this research should uncover the existing and potentially multiple perceptions of burn events by those living in rural and peri-urban Malawi in order to make culturally and contextually appropriate recommendations.

Theoretical perspectives take into account the philosophical standpoints that are applied to the understanding of knowledge and create a platform in which to develop a research methodology (Crotty, 2009). In this instance it is appropriate to employ an interpretivist perspective. Interpretivism can be defined as;

"Those approaches that concentrate on the interpretation of human actions and cultural products"

(Benton and Craib, 2011 p234)

This approach encourages the development of individual realities to be explicated through inductive methodological designs. It is this

interpretivist perspective that is missing from the existing literature in relation to the factors associated with burn injuries in a LMIC context.

As a theoretical perspective interpretivism has its roots in phenomenology (Blaikie, 2007). Although this study itself does not profess to follow a 'pure' phenomenological methodology it does draw upon a number of key elements from the research tradition. Through systematic investigation, phenomenological methodologies aim to provide a detailed description of a 'lived experience' (Holloway and Wheeler, 2002, Parahoo, 2006, Speziale et al., 2011). It is through the gathering of qualitative information on these experiences that the researcher is able to explore the meaning or 'essences' of the phenomenon from each of the individual 'realities' (Creswell, 1998).

In order to obtain these rich data, traditional phenomenological methodologies employ the use of in-depth, long and unstructured interviews to allow the participants to describe their everyday experiences (Creswell, 1998). Nevertheless, more recently qualitative researchers have moved away from this tradition and conceptualised the use of multiple methods in phenomenological research (Mayoh and Onwuegbuzie, 2013). It is this approach that has shaped the methods for this study, that a single method in isolation would be unable to adequately explore the phenomenon (Mayoh and Onwuegbuzie, 2013).

In their attempt to conceptualise the use of multiple methods in phenomenological research Mayoh and Onwuegbuzie (2013) outline a number of research models. The model most pertinent to this study is what they have described as, a "Quantitative-Phenomenology" (Mayoh and Onwuegbuzie, 2013). This research model is particularly useful when the researcher needs to be "orientated" towards a specific experience prior to the qualitative phases of data collection (Mayoh and Onwuegbuzie, 2013 p98). For example, the quantitative phase can be used within a broader framework to help identify a purposive sample for

further phases of qualitative data collection. These elements were particularly important when designing this study, as the identification of households who have experiences of burn injuries in the home and have adopted different cooking technologies were required.

This section has highlighted the need for a theoretical perspective and methodology which outlines methods whereby participants describe and interpret their lived experiences to add context to the existing positivist research. However, the interpretation of these experiences does not only occur at participant level. In order for the researcher to make meaning from these qualitative data, there are a number of stages of interpretation. For example, the researcher begins to provide an interpretation of participants' interpretations, these interpretations are then examined further in relation to existing literature and theory (Bryman, 2012). To demonstrate the trustworthiness of the researcher's interpretation of these data, further discussion of the analysis process can be found in Section 3.9. Moreover, as the constructionist approach relies on the researcher to play an active role in the development of participant interpretations a reflection of their individual characteristics and potential influence on the study, has been provided in Section 3.11.

3.2.1. Overview of data sources used in the study and linkage to research objectives

It is rare that a single method in isolation can adequately explore a particular phenomenon (Mayoh and Onwuegbuzie, 2013). Therefore, this study employed a number of different methods, including: household surveys, observations and focus groups, in addition to semi-structured interviews with households, health professionals and key stakeholders (e.g. stove manufacturers, distributors, project managers and technical advisers). Employing a multi-methods approach in the exploration of a social phenomenon such as this, allows the researcher to cross-check findings across different sources (Bryman, 2012). However, although triangulation is accepted as a means of ensuring comprehensiveness, the

idea presupposes that a weakness in one method will be compensated by another (Mays and Pope, 2006). Therefore, as the chapter continues it aims to provide a thick description of the research methods to enable judgements to be made on the trustworthiness of the research findings (Bryman, 2012, Mays and Pope, 2006). Figure 9 has been created to illustrate how each of the study components and specific research methods link to the research objectives which were outlined in Chapter 2.

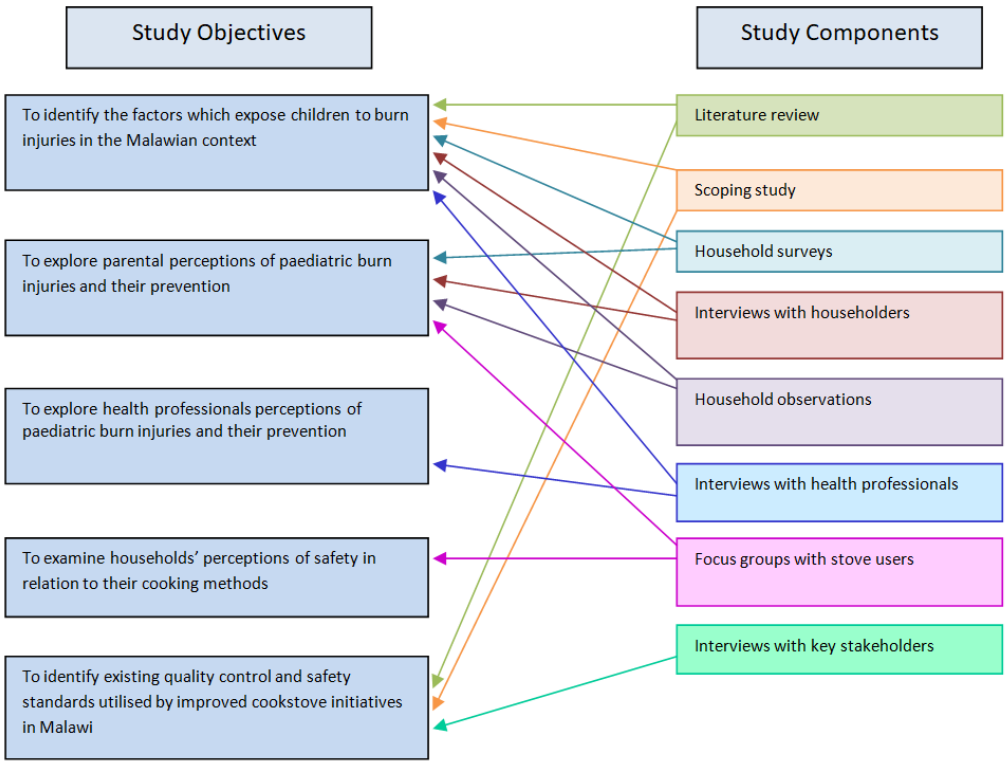


Figure 9: Study objectives and associated study components

3.3. Research methods and data collection

The main aspects of the fieldwork were conducted from November 2014 to June 2015. Figure 10 provides an outline of the data collection process and the sample strategies used. This section will describe each of the research methods employed and the rationale for their use in this study.

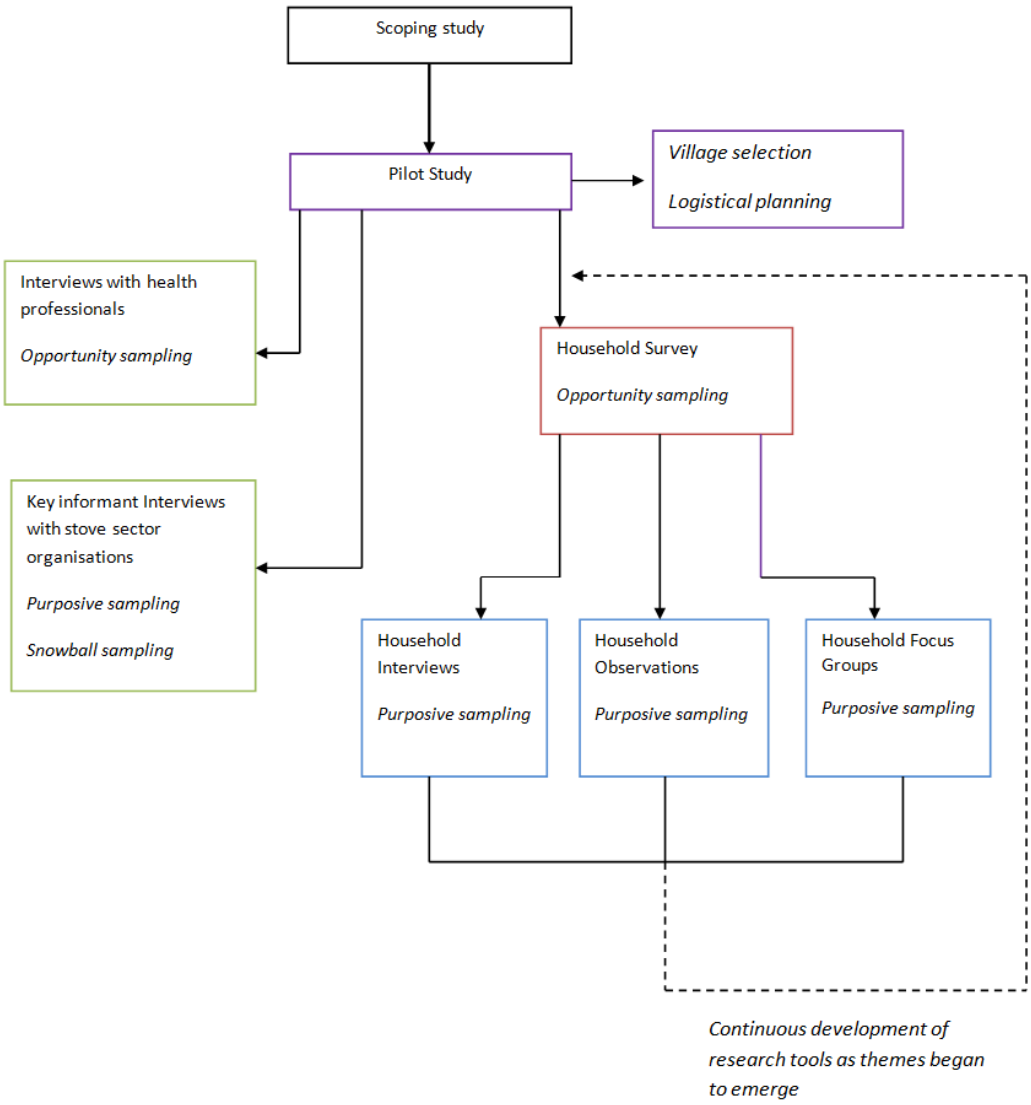


Figure 10: The data collection process

3.4. Development of the research methods

3.4.1. Scoping study

Prior to developing the specific data collection methods, a scoping study was carried out from April to May 2014. The scoping study was undertaken to gather a broad base of evidence from a range of academic, non-academic and policy literature (Davis et al., 2009). In addition, the scoping study also employed an empirical element which included informal discussions with stove organisations, households and health professionals as well as unstructured observations of villages employing different cookstove interventions. This process allowed the researcher to develop a contextual insight of the study areas, the social settings, the economic constraints and some of the complex behaviours associated with the cooking process, before preparing the research tools (Davis et al., 2009, Person et al., 2012)

Throughout this scoping exercise a field journal was used to record discussions, interviews and observations. Photographs were also taken to illustrate the cooking environment and other potential burn hazards within the home. The analysis of this information was then used to assist in the formulation of the interview and focus group guides.

3.4.2. Pilot study

A pilot study was undertaken during November and December 2014 to ensure that the research tools were appropriate for the study sites and to give the researcher an opportunity to rehearse and adjust the methods before the main data collection phase began.

An opportunistic sampling technique was used to select two villages to take part in the pilot phase. Both villages were located in the Northern Region of Malawi where the researcher has had previous experience and was able to approach the village headmen to obtain consent and speak to households within their areas without additional gatekeepers.

Following this pilot study additional questions and probes were added to the household survey and interview guides. The pilot study also indicated where the research tools required adjustment to ensure that they were suitable for the study population. Changes included replacing a self-completion questionnaire with a face-to-face survey, and expanding the research tools used to characterise and record hazards within the household environment. These changes were developed and discussed with the research supervisors.

The pilot was also used to organise logistics for the main phase of data collection including: arranging safe transport, accommodation, approaching potential study sites and obtaining consent from village headmen. Each of these aspects proved fundamental in ensuring that the data collection ran smoothly.

3.4.3. Household surveys

A survey was developed to identify household participants who had experiences of burn injuries. Based on the responses to this survey, households would then be invited to take part in a further interview and focus group. In addition, this survey was used to add context to the village sites by generating information on the household demographics and the methods used for cooking, heating and lighting.

The researcher and translator visited the households door-to-door conducting the surveys face-to-face. Although conducting the survey in this manner was more time consuming than initially anticipated, it generated much richer data and a better response rate than might have been expected from self-completion surveys. For instance, using a face-to-face method minimized the need for respondents to have certain literacy skills (Bryman, 2012). Moreover, this mode of data collection provided the researcher with the opportunity to probe and add short follow up questions increasing the depth of data obtained (Bryman, 2012).

3.4.4. Household interviews

Household interviews were conducted with village members to explore their experiences of childhood burn injuries, their perceptions of hazards around the home and, if any, their existing methods to prevent the occurrence of burn injuries.

A semi-structured interview style was used as this approach allowed the researcher to obtain a rich amount of data to inform the research aim, whilst also providing the flexibility to probe, diverge from the initial questions and explore participants' responses in depth. This uncovered experiences which may not have been accounted for if the interview methods had a more structured style (Braun and Clarke, 2013, Britten, 1995, Bryman, 2012, Kallio et al., 2016, Mason, 2003, Tod, 2006).

As with the household survey, these interviews were conducted face-to-face at the participant's homes, with the assistance of a translator. The advantage of this approach ensured that the interview setting could assist the participants in describing their experiences fully (Mason, 2003) as the researcher was able relate what the participants were describing to the environment and generate additional questions based on the hazards observed.

3.4.5. Household observations

Household observations were conducted as it is understood that, not all knowledge can be constructed through discussion alone (Mason, 2003). For example, by adding observational methods the researcher could reveal added dimensions that were not accounted for during the interviews (Mason, 2003). For instance, interviewees may not comment on aspects of their experiences that seem unremarkable to them or notice hazards which are present in their everyday life (Green and Thorogood, 2014). Therefore, in relation to the study's theoretical perspective, observational methods were used to obtain a visual account

of the household context, in addition to participant's experiences (Green and Thorogood, 2014).

However, whilst using observational methods uncovered additional details concerning the household environment and allowed for the triangulation with interview data, caution was needed. For example, the researcher could not assume that the observations would completely offset the potential limitations of the interview methods (Mays and Pope, 2006). For instance, as with interviews, observational methods can be influenced by the presence of a researcher being in the home or around the community, as such, some participants may have felt that they needed to act or present their home in a certain way to create a good impression (Bryman, 2012). Although, this type of issue is difficult to mitigate in these circumstances, the researcher explained to the village head and individual households that they would like to see the house as it is typically kept and the importance of this to the study.

A robust process in which to guide the researcher's observations was needed. There are a number of different checklists that have been created and reviewed for the use of health professionals to observe and identify hazards around the home, these include: the Safe at Home tool (Anemaet and Moffa-Trotter, 1999), The HOME FAST (Mackenzie et al., 2000), the HOME safety checklist (Kidsafe Queensland, 2007), the Home Accident Prevention Inventory Checklist (HAPI) and the Safety Assessment of Function and the Environment for Rehabilitation (SAFER) Tool (Oliver et al., 1993). However, these checklists have been formulated for high income countries and areas where the household design is much more structured. More recently, research has been conducted in Pakistan to pilot a hazard checklist that would enable health professionals to quantify potential injury risks in low-income urban settings, with the hope of presenting opportunities for injury prevention initiatives (Hyder et al., 2012, Khan et al., 2013). Nonetheless, there is no tool of this nature designed for the low-income rural setting. As such, the researcher

needed to adapt the tools as written above in order to develop a revised checklist.

An initial checklist was designed and piloted. It was found that, although the checklist revealed additional information about the household context it lacked depth. For instance, the structured nature of the checklist itself did not uncover the parents own recognition or understanding of the hazards present around their home. Moreover, the unstructured nature of the village environment meant that conducting the checklist without household input appeared to present only part of the picture. Therefore, following the pilot, the checklist was re-structured and included participation by the householder. For example, using the revised observational guide, the researcher along with the participant sketched each household area and noted their uses. Participants were then asked to identify additional locations pertinent to the research objectives including: the location of fire sources and children's play locations. Once identified, householders were then asked to discuss how these locations may vary throughout the different seasons. The researcher and participant would then walk around the house, the researcher would record hazards and, if applicable, methods the household employed to prevent children accessing the hazard. The final observational guide used is presented in Appendix 4.

Ultimately, the observational methods employed in this study allowed the researcher to contextualize what the participant had previously discussed in their interview and seek clarification where observations did not match previous responses. Field notes and photographs of hazards were also taken by the researcher to create an accurate record of the types of hazards present in the home for later analysis.

3.4.6. Household focus groups

The purpose of conducting focus groups was to engage participants in a discussion about their cookstoves in relation to the BSSP employed by

the GACC. As indicated in Chapter 2, the BSSP is currently used for examining the safety of cookstoves. However, the test currently lacks real life evaluation (Gallagher et al., 2016). Therefore, this method was employed to uncover: how participants manage hazards while cooking, if there are hazards that have not yet been accounted for in the test and how these factors might influence cooking a typical meal.

Following the individual household interview and observation, participants were invited to take part in a focus group. The existing village sample of six to eight households, reported in more detail in Section 3.8, provided an ideal number of participants for a focus group (Krueger and Casey, 2009).

Focus groups were only held once all household interviews and observations had been completed within the study village. This was to prevent what would be discussed in the focus group, the stove safety test, from influencing participant's interview responses. The focus groups were held at a natural meeting point. This was typically a shaded area in a central place within the village houses or a participant's compound, depending on which was most comfortable and prevented onlookers from influencing the flow of discussion (Krueger and Casey, 2009).

Before initiating the discussion the participants assisted the researcher in bringing together stoves and cooking equipment that would aid the exchange of ideas. Where the stoves used were fixed, the groups were held near to a kitchen with access to the stove.

Unlike the household interviews where the discussion topics were broad, the focus group followed a more structured pattern. The questions prompted participants to examine their stoves in more detail than they had during their interviews and discuss, in relation to the BSSP, to what extent the stove's features might influence their cooking and how. The purpose of conducting focus groups to discuss this was to capitalise on the interaction between participants (Kizinger, 2006). For example,

participants may perceive the risks associated with their stoves and the impact this has on their cooking, differently. As such, it was anticipated that these differences may spark debate between participants, resulting in further questioning and provide a deeper understanding of the key priorities associated with their cooking methods and processes (Kizinger, 2006).

To ensure that each member of the focus group was able to provide their input, the researcher encouraged the participation of quieter members (Bryman, 2012, Krueger and Casey, 2009). For example, when a participant revealed that they had a particular experience or problem while cooking, the rest of the group was then asked to raise their hand if they had also experienced a similar problem. If they had, then the researcher would select individual participants to expand on their own experiences (Bryman, 2012, Krueger and Casey, 2009). These techniques were practiced and rehearsed during the scoping and pilot study phases.

3.4.7. Interviews with health professionals

Hospital data collection ran in parallel with the other phases of the fieldwork. This was to ensure that hospital visits could be arranged to fit around ward schedules and meetings minimising disruption to the daily running of the hospital.

To add depth to the quantitative data typically obtained from the health facilities, this study included semi-structured interviews with health professionals. These interviews aimed to uncover health professionals' perspectives on a number of issues relating to the causes of paediatric burns, existing prevention measures and issues faced by child burn survivors. The rationale for obtaining such information from this group of key stakeholders was to understand, based on their expert knowledge, the nature of the burns problem in the Malawian context and, if possible, recommendations for future interventions (Chandler et al., 2014). All interviews were recorded with participant consent.

3.4.8. Key stakeholder interviews

Key stakeholder interviews were included in the study's design to provide a context of: the current ICS initiatives active in Malawi, the existing methods to measure the quality and safety of their ICS designs and, if any, the advice currently provided to the user around burns prevention.

As with both the health professionals and the householders, the key stakeholder interviews also followed a semi-structured design. The rationale for this was to be able to compare responses across the participants, while also tailoring the interview to the individual stakeholder. For example, some key stakeholders had more experience in the design of ICS, while others were more familiar with the distribution and marketing processes. Therefore, based on the stakeholder's area of expertise, additional prompts were added. This provided the researcher with a range of information around the quality of the stoves designed as well as key successes and failures in the adoption of this technology.

These interviews were also fundamental in building a rapport with key stakeholders within the stove sector who, in some instances, were able to provide logistical and practical support in accessing village sites exposed to different ICS initiatives.

3.5. Finalising the research tools

3.5.1. The development and use of the interview guides

The study required the design and development of three interview guides: one for each category of participant (health professional, householder and key stakeholder). Although qualitative interviewing should not be a rigid process, semi-structured interview guides can ensure that the researcher maintains a focus on the study aim, whilst also being flexible enough to probe and alter the order of the questioning as themes develop (Brinkmann and Kvale, 2015, Bryman, 2012).

Three initial interview guides, one for each participant category, were created based on the literature regarding, the epidemiology of burns in children, injury prevention and the uptake and distribution of ICS. Typically each guide followed a similar pattern with an introductory phase, intermediate phase and conclusion (Bryman, 2012, Kallio et al., 2016). For example, the interviews began with a broad introduction to explain the study in more detail and established a rapport with the participant; this phase included talking about the household or organisation more generally as well as the interviewee's role within it. The intermediate sections asked participants to speak more specifically about their area of knowledge. For example, health professionals were asked to discuss the types of burns seen at the hospital and existing injury prevention strategies. Householders were asked to discuss their children's play environments, home hazards, safety practices, their perception of burn injuries and initial treatment of burns. The key stakeholders were asked about their existing ICS interventions, their approach to quality control and safety standards. The concluding phase aimed to encourage participants to explain their views concerning potential barriers and or enablers to households making sustainable changes to their cooking environment and practices. When finalising the interview, participants were asked if they would like to add any further information that might not have been discussed, or ask the researcher any further questions about the study. As the research progressed and new themes were presented, additional questions and probes were added to each of the interview guides.

To ensure the quality of the data collected, the guides were piloted prior to undertaking the main phase of data collection (Kallio et al., 2016). While the guides developed for the health professionals and the key stakeholders needed only slight modifications, the household guides required substantial formatting. For instance, it was found that the initial guide only yielded short and concise answers. This meant the broader

contextual factors were not explored. In revising the interview guide more questions and activities were added to the introductory phase to assist in developing a rapport and put participants at ease. Moreover, to ensure that questions provided the fullest responses, they were modified further to fit the vocabulary and background of the participants (Brinkmann and Kvale, 2015). The revised interview guides were developed to follow a more open and indirect approach. For example, participants were asked to outline a typical day of the household, their cooking processes and the children's play spaces, before speaking more specifically about burn injuries. Participants appeared to find this process much easier, as indicated by the flow of discussion. It is acknowledged that although these broader introductory questions do not ask specifically about burn injuries, they did provide a rich description of the participant's interactions and experiences. A copy of the household participant interview guide has been provided in Appendix 3.

The final interview guides were reviewed by academic supervisors, nursing lecturers from the College of Malawi and local translators. The discussion with both lecturers from the College and translators was particularly important to ensure that the meaning, or at least the essence, of the questions and probes remained the same when translated to vernacular languages. This group was also able to advise if the topics covered were culturally sensitive.

3.6. Logistical factors

This section outlines the process of data collection in terms of logistical details, such as the location for the interviews, the methods for recording interviews and the means of providing remuneration to household participants.

3.6.1. Interview locations

Interviews were conducted in different places depending on the interviewee. Interviews conducted with health professionals were typically carried out in the ward staff room or the participant's office. In some cases, interviews were interrupted by other members of staff. This was more often the case when the participant held a managerial role. Although this disrupted the flow of the interview, overall it did not appear to impact the depth of the participant's responses.

Interviews with key stakeholders were also held at their offices, although unlike the hospital locations, participants were able to arrange a time where they could meet the researcher during their work times to minimise interruption. In addition, interviewing key stakeholders in their office space meant that they could refer to posters, leaflets, stove guides and products around them to expand their answers.

Interviews with households were typically conducted on the kondi or in the garden, the courtyard or in-door living space. This depended on the weather and where the participant felt most comfortable. Moreover, interviewing participants in their home environment prompted ideas for the interviewee whilst allowing the researcher to relate what was being discussed to the household surroundings, adding further depth and context to data generated (Mason, 2003).

However, while interviewing participants in these locations provided a familiar and more relaxed space, the nature of village life meant that often interviews could be interrupted by other family members, animals or visitors. This had been anticipated prior to undertaking data collection and as such the researcher was flexible and allocated longer periods than may be typically required for an interview. During the data collection it was noted that although disruptions occurred they did not hinder the overall flow of the interview conversation.

The duration of the interviews depended on the participant. For instance, the interviews with health professionals and key stakeholders lasted between 30-60 minutes, whereas the household interviews could last up to two and a half hours. Whilst the household interviews could be long, this was often due to interruptions or seemingly 'off topic' discussions. Notwithstanding, it was found that this time allowed the researcher to observe the householder and their children during different periods, capturing key behaviours and interactions. Moreover, where discussions initially appeared to diverge away from the main interview topics they revealed important aspects which the researcher could not have previously accounted for and therefore added depth to the data retrieved.

3.6.2. Audio recording

To accurately capture the interview data without breaking the flow or contact with the interview participants, a Dictaphone was used (Holloway and Wheeler, 2002, Kelly, 2013, Rapley, 2004). Any additional notes or observations were recorded within the participant's interview guide or the researcher's fieldwork diary. Some researchers note that the use of audio equipment can influence interviewees' accounts, as participants may become nervous about the recording (Rapley, 2004). However, it was considered that taking excessive notes would equally disrupt the flow of communication between the interviewer and participant (Kelly, 2013). Furthermore, as the process of paraphrasing responses is subjective, relying solely on written notes could have influenced the credibility of the findings or interpretation (Kelly, 2013, Seidman, 1998).

3.6.3. Remuneration

At the outset, it was made clear to the village that there would be no direct payment for participation in the study, as it was important that households did not feel coerced into taking part. In addition, the researcher did not want to appear as someone bringing gifts into the

village in case this then altered responses from participants. However, it was important that participants were thanked appropriately for the time that they had given to the research. Therefore, after discussion with the village chiefs it was decided that participants would be provided with a small contribution after all data collection was completed in the village. The contribution included: a bar of laundry or hand soap, 500g bag of iodised salt, 1kg bag of brown sugar and a small pack of sweets for the children in the household.

3.7. Selection and recruitment

3.7.1. Rationale and justification for site selection

To explore the factors which contribute to burn injuries in rural and peri-urban Malawi, the study needed to identify a selection of villages that encapsulated a range of different environments found across the country. Moreover, to inform the use of ICS and their potential to reduce burn risks, sample sites were also selected based on their exposure to different cookstove designs and initiatives. For instance, it was identified during the scoping study that both fixed and portable biomass stoves were promoted by organizations across Malawi, therefore it was decided that the study sample should be generated so as to provide the perspectives of both fixed and portable stove users. In addition to providing a range of contexts and exposures to cooking technologies, logistically the sample sites needed to be safely accessed by the researcher. Based on these initial criteria, a purposive sampling method was used to allow the researcher to identify suitable villages for the study (Bryman, 2012).

Gatekeepers also played an important role in the selection of the study areas. For instance, stove organizations helped to identify potential case sites, as well as provide an introduction to the villages. However, although organisations may choose sites based on their achievements in that area, in order to be successful in obtaining access to the villages, this approach was necessary.

The final sample included four village sites: two in the central region, one in the northern region and one in the southern region, as illustrated in Figure 11, on page 116. Three of these sites had recently been exposed to an ICS initiative, while one had not been targeted directly by such a programme. Each site was based in either a rural or peri-urban area of Malawi. An urban population was not included in the sample as it was considered to be outside the scope of the current study.

Two of the villages had been exposed to a portable ICS design and one to a fixed stove design, an illustration and description of these stoves is provided in Table 4.

Stove name	Picture	Description	Costs
Chitetezo mbaula		A Portable stove produced in Malawi using locally sourced clay.	~1000mkw (or 1GBP)
Fixed rocket stove		A fixed stove made with clay brick and metal. The bricks are prepared using locally sourced clay. The metal parts are provided by donor organisations.	There is no financial cost associated with the stove. Households are provided with the guidance and equipment needed to build their stove by community volunteers.

Table 4: ICS promoted in sample villages

It should be noted that there are other ICS in circulation in Malawi. However, based on the study's timescale it would not have been possible to visit all stove projects. Therefore, it was decided to select sites which are employing stove designs supported and promoted by partners of the National Cookstove Steering Committee (NCSC) at the time of data collection.

3.7.2. Characteristics of the sample Villages

This section outlines the location and characteristics of the four sample sites. Figure 11 illustrates the location and characteristics of each site.



Name: Nkhata

Number of households: ~75

Location: Approximately 3km from the nearest trading centre, and 29km north from Mzuzu city. There is dirt road access to the majority of the village. Access is dependent on the weather.

Electricity: Some households have access to grid electricity, however, the supply can sometimes be variable and blackouts are common.

Name: Kapeta_Chonde

Number of households: ~100

Location: The villages are situated alongside the M1 road. This is a busy single lane road that connects the three regions of Malawi.

Electricity: None

Water: Borehole, river or well.

Name: Mtika

Number of households: ~60

Location: The village is 25km south of Salima town along the lake-shore road (M5). The village 2km from the M5 via a single track dirt road.

Electricity: None

Water: A shared tap is available at a Mosque central to the village.

Name: Compound

Number of households: ~80

Location: The compound is located within the centre of a tea estate. The compound is accessible by dirt road only and these can be restricted if heavy rainfall has occurred.

Electricity: None

Water: Bore hole and River

Map source: (Nations Online., 2017b)

Figure 11 : Location and characteristics of sample villages

3.8. Recruitment of study participants

To recruit a sample of households, health professionals and key stakeholders a combination of qualitative sampling techniques was used. This was to ensure that those selected would be able to provide necessary information to contribute to the understanding of the research aim (Parahoo, 2006, Procter and Allan, 2006).

3.8.1. Access and recruitment of the site areas

During the scoping study, organisations involved in the implementation of stove programmes were identified. These organisations were then approached, either prior to, or during the pilot phase of the study in November 2015, to inform them of the study and to request assistance in accessing villages. This resulted in assistance from three organisations that subsequently indicated members of staff, appropriately positioned, to provide information concerning their interventions and guidance on accessing the villages. Working alongside local organizations in this way was important to establish linkages with the village headmen, as well as other professionals working in the area (Chandler et al., 2014, Krueger and Casey, 2009)

The hierarchical structure of chiefdoms and villages is an important part of the Malawian culture. For that reason, before conducting data collection, an initial meeting was held to introduce the researcher and their translator to the village head and elders. During these meetings, the village head was made aware of the aims, objectives and purposed methods of the study. The process of making this initial contact and establishing a rapport prior to conducting fieldwork was considered integral to ensure that the research could run smoothly and ethically (Chandler et al., 2014). For example, after the introductory meeting the village head was given a copy of a participant information sheet (in vernacular language) and given time to discuss their village's

participation with elders if necessary. If the village head consented for the research to continue they signed a 'letter of no objection'.

3.8.2. Access and recruitment of households

Finding a group of household participants who would share experiences of burn injuries and burn risks in the home was essential for both the study aim and the overall contribution to the literature. Therefore, in order to access an adequate number of households in the village, timing of recruitment was essential. For example, depending on the time of year, households may be involved in farming activities. These activities often take family members away from the home for varying time periods. Consequently, to be successful in meeting householders at home and ensure that the research does not have a negative impact on their daily routines, it was important to understand and acknowledge these cultural aspects.

The initial purpose of using a household survey was to orientate the researcher to households, who in the year prior to the study had a child who had experienced a burn injury and could therefore provide information on the aspects which led up to and followed the event. This timescale was used as it was considered that the injury would have been recent enough for parents to recall key factors associated with the incident. However, prior to data collection it was unknown how many burn injuries would be found in each village area. Therefore, it was decided that households who had not experienced burn injuries might also be included in the sample to provide additional insight into the environmental and cultural context of village life in relation to burn hazards.

It was anticipated that the study should seek to recruit six households per village. This preliminary sample size was based on the assumption that it would provide enough detail to adequately answer the research objectives, within the time and resources available to the researcher

(Marshall, 1996). Although ultimately, as a qualitative study, this proposed sample size was flexible allowing the researcher to seek further perspectives as the research progressed (Marshall, 1996). As a result, the final number of participants, who took part in this study, was based on attempts to achieve data saturation and the availability of consenting households (Bryman, 2012, Marshall, 1996). Consequently, the household sample was made up of 24 households who had a child who had experienced a burn injury and 8 households who had not.

3.8.3. Access and recruitment of health professionals

Health professionals were approached for interview to identify key issues relating to children's exposure to burn injuries and strategies for prevention. The sampling methods employed aimed to select those health professionals who were best placed to discuss factors associated with burn injuries in children. For example, they should have experience of/or be working on a paediatric ward or burns unit at the time of interview. Additionally, to capture a range of perceptions and experiences, the sample criteria aimed to obtain a selection of nurses, clinical officers and doctors.

Before individual health professionals were approached, the researcher set up a meeting with a senior member of the hospital staff to explain the research and demonstrate that appropriate ethical approval had been obtained. Following these meetings, the researcher was directed to the nurse or clinical officer in charge, to aid in locating members of staff for interview. This process assisted the researcher in identifying informants who could provide information in much more depth than if participants had been selected at random and may not have had experience in caring for children with burn injuries (Chandler et al., 2014). Once potential participants had been identified the researcher provided them with a written information leaflet about the study. If participants agreed to take

part, then a time and place was agreed for an interview, so as not to interrupt their work or the running of the ward.

3.8.4. Access and recruitment of key stakeholders

Key stakeholders were approached to assist with the identification of existing quality control and safety standards utilized by ICS initiatives in Malawi. To identify an initial sample of key stakeholders a snowball sampling technique was used (Bryman, 2012).

In addition, the researcher attended Malawi's annual CLEANER Cooking Camp, March 2014, held in Lilongwe. This conference was attended by a number of national and international practitioners and therefore provided the researcher with an opportunity to network and make connections with key individuals and organisations promoting ICS.

3.9. Data Management and analysis

3.9.1. Translation

There are a number of different tribes that inhabit Malawi, each of which has their own unique languages and customs. Therefore, the use of a translator was integral to the success of the study, not only to provide assistance with the language but also to provide context and local knowledge of the area. As such, a translator was employed for each of the study sites. In order to minimise issues around misinterpretation, confidentiality and security, daily briefings were held with the translator before travelling to the site for data collection. At the end of the day, a similar discussion would be held to debrief, highlight any issues and identify interesting findings.

During the pilot study it was recognised that the use of a translator who is attached to an existing ICS intervention may influence participants' answers. Therefore, for the main data collection phase, the researcher aimed to select translators in a position most able to elicit an un-biased

response. However, it was not possible in all cases to find a translator who was completely intervention neutral. Table 5 has been created to provide transparency of the translators employed, their previous research knowledge and, if relevant, their association to an ICS organisation. It should also be noted that, while the translators were identified from a particular area, they were not from the same village or family as participants. This was to prevent the translator from entering into an 'interviewee' roll themselves and could remain, to an extent, impartial (Brinkmann and Kvale, 2015).

Table 5: characteristics of translators

Research District	Position/Vocation	Previous Research Involvement	Association to ICS interventions.
Dowa	Nurse	Conducting health surveys and focus groups relating to health issues.	None
Thyolo	Public Health Msc. Student	Monitoring stove programmes for carbon credit schemes. Undertaken research modules as part of degree and Masters programme	Previously worked for an organisation that assists with carbon credit monitoring. Aware of ICS programmes but intervention neutral.
Salima	Retired	Assisting NGO's to collect monitoring and evaluation data.	Has a relationship with organisations selling and distributing the chitetezo mbaula.
Mzimba North	Health Surveillance Assistant	Conducting health surveys as part of their existing role.	None

In Salima, where the translator had a relationship with an existing ICS organization, the researcher emphasized the importance of remaining neutral when asking and interpreting the questions and responses of the participants. They were also requested not to wear any promotional material to prevent influencing the participant's responses.

3.9.2. The process of data analysis

As a qualitative study, data collection yielded a substantial amount of complex and unstructured information. To interpret these data, whilst preserving the uniqueness of the participants experiences, data analysis needed to be rigorous (Parahoo, 2006). Although there is no exact prescription attached to qualitative data analysis, there are a number of approaches that can be used to examine the data (Holloway and Wheeler, 2002, Saldaña, 2013). While these approaches examine the textual detail in different ways, analysis is typically contemporaneous from the beginning of data collection until the study is completed (Holloway and Wheeler, 2002, Saldaña, 2013). This ensures that research tools continue to adapt to the experiences shared and allow for further questioning to reveal factors relating to the 'phenomenon' which, for example, may not have been included in the original interview guides (Parahoo, 2006).

Audio and field notes collected during both the interview and observation phases of the research were transcribed verbatim into an electronic format (Microsoft Word). This process, particularly when taking a phenomenological approach is vital as it provides the researcher with intimate knowledge of the data (Bazeley, 2013). Throughout the transcription process the researcher kept a reflective journal noting the essential nature of what was being spoken (Bazeley, 2013). These first insights, points of interest and interpretations formed the early stages of the data analysis.

Data were analysed using a method of thematic analysis as described by Braun and Clarke (2006) presented in Table 6. Thematic analysis was used as it is ideal for exploratory work where the aim is to produce a rich and detailed understanding of participant experiences (Green and Thorogood, 2014). More specifically, it recognises that the researcher should give equal attention to each data item during the coding process, recognising both consistent and inconsistent findings relating to the phenomenon (Braun and Clarke, 2013).

Table 6: Phases of data analysis

Phase	Description of the process
Familiarisation with the data	Transcribing the data, reading and re-reading the data, noting down initial ideas.
Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data.
Searching for themes	Collecting codes into potential themes, gathering all data relevant to each potential theme.
Reviewing themes	Checking if the themes work in relation to the coded extracts and the entire data set, generating a thematic 'map' of analysis.
Defining and naming themes	Ongoing analysis to refine the specifics of each theme and the overall story the analysis tells, generating clear definitions and names for each theme.
Producing a report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a report on the analysis.

(Braun and Clarke, 2013 p87).

The techniques employed in this study were inductive and came from close reading of the data, rather than deductive approaches whereby the researcher imposes a pre-determined framework which can distort participant responses and result in findings which do not represent the whole picture (Green and Thorogood, 2014, Holloway and Wheeler,

2002). Initial codes were generated by looking for repetition, actions, activities, and beliefs, including those which both conflicted or agreed with each other (Bazeley, 2013, Bazeley and Jackson, 2013, Ryan and Bernard, 2003, Saldaña, 2013).

In taking an inductive approach to data analysis, previously unidentified ideas began to emerge throughout the study, thus allowing the development of the 'emic' perspective (Parahoo, 2006, Speziale et al., 2011). Nonetheless, in practice, no process of data analysis can be purely inductive as the researcher's prior knowledge and experience will influence what is identified in the data (Green and Thorogood, 2014). Therefore, the researcher's experiences have been outlined in Section 3.11 to allow for judgment on the researcher's position and potential influences on the data.

While the strategy written above appears in a linear order, analysis itself was iterative. As themes emerged and developed they were reviewed against the wider transcript, amongst peers and with the supervisory team until a clear definition for each theme was reached. Visual strategies to enable this process included the development of code books that provided a brief and full definition of a code (Bazeley, 2013, Bazeley and Jackson, 2013). Followed by concept maps (within nVivo Pro software) which were used to: identify relationships across codes, and between the levels of codes i.e. categories, main themes and sub-themes (Bazeley and Jackson, 2013, Ryan and Bernard, 2003).

3.9.2.1. Computer aided analysis

The choice was made to use Computer-assisted Qualitative Analysis Software (CAQAS) to handle the data. Although, the use of CAQAS has been criticised by some qualitative authors for being restrictive (Bazeley, 2013, Bazeley and Jackson, 2013), the choice to use CAQAS was influenced by the ability to conduct a systematic and transparent analysis of a large amount of textual data (Bazeley and Jackson, 2013, Green and Thorogood,

2014). The software also provided the researcher with links between the original passages and the codes this permitted the quick retrieval of ideas and concepts during the (iterative) process of analysis (Bazeley and Jackson, 2013). Lastly, the nVivo Pro software chosen facilitated the creation of concept maps which subsequently informed the code hierarchy and themes presented in the following results chapters, an example of this has been provided in Appendix 6.

3.10. Ethical Considerations

3.10.1. The ethical review process

Ethical approval was obtained from both The University of Nottingham and The Malawi College of Medicine Research Ethics Committee (COMREC) (Proposal Number P.11/14/1661).

3.1.1. Ethical considerations related to the research

Existing ethical review processes, while vital to all research has been criticised by some social scientists for being over regulated and Eurocentric (Dingwall, 2008, Honan et al., 2013). For instance, ethical principles recognised as beneficence, non-malfeasance, autonomy and justice (Holloway and Wheeler, 2002, Parahoo, 2006, Speziale et al., 2011) are typically addressed through demonstrating that study has obtained informed consent and maintained participant confidentiality. However, Honan et al. (2013) indicates that, researchers often find difficulties applying these requirements in a manner which is both culturally sensitive and appropriate when conducting research across vastly different geographical areas. For example, to provide evidence that informed consent has been given and understood, researchers are required to obtain a signed consent form, despite that, in reality, some of the participants may not themselves be literate. Furthermore, it is likely that these western-originated standards do not fully take into account the different standards expected in a non-western context, for instance,

culturally appropriate ways of accessing communities and households (Roulston, 2010). This section aims to demonstrate how such issues were managed and the ethical principles maintained within the study's research environment.

3.10.1.1. Confidentiality

To ensure that participant confidentiality and anonymity were maintained participants or people named within the interviews were translated into unidentifiable participant codes or pseudonyms. The key stakeholders were given the option to allow/disallow their position or organisation to be named in the thesis and subsequent publications. This was recorded on their consent form. Equipment used to record data was stored in a locked room or password protected computer. Personally identifiable data was removed from the written transcript and kept in a separate protected database.

3.10.1.2. Consent

In line with local standards for gaining access to households, consent was sought from the village head or traditional authority. This process, while not necessarily indicated by western-originated standards, was vital in demonstrating respect and cultural sensitivity to participants and ensuring successful data collection. All consent forms and participant information sheets were translated into Chichewa and Tambuka. Nonetheless, as it was understood that many of the potential participants may not be literate, the forms were also read aloud in their vernacular language. During this process they were encouraged to ask questions or seek clarification if needed. Subsequently, if the householder decided to take part they were invited to provide a sign that they have consented. This could be conducted in three ways, depending on the participant's preference. The options were: signing the consent form, providing a thumb print on the consent form or verbally stating their consent on the

audio recorder. An example of the consent form and information sheet has been provided in Appendix 1 and 2.

3.10.1.3. The use of photography

To create an accurate record of the household setting, photographs were taken of the placement and location of heat sources, potential hazards and cooking technologies. In some cases, and if the participants agreed, they were also included in the photographs. To ensure that participants were aware of what the photographs were being taken for and how they might be used in the future, this was included in the participant consent form and information sheet. In addition, verbal consent was obtained at each point an individual picture was taken by the person who would be in the photograph. At the end of data collection in each village, where participants were visible in the photograph, they were supplied with a hard copy of the pictures. Participants were not told they would be receiving a hard copy of the photographs until the end of the data collection, to prevent participants feeling coerced into being in the photographs.

3.10.1.4. Vulnerable participants

Children under the age of 16 were not interviewed directly. However, they were observed as part of the study in relation to their location to heat sources and hazards. Therefore, informed consent to observe household interactions was obtained from the child's guardian. The researcher also considered that the child themselves had the right to refuse to be observed as part of this study.

On occasion, while the children were playing around their homes, they shared or added extra accounts of their home life and the hazards they experienced around the home. This additional information was recorded as part of the interview with verbal consent from parents and guardians.

3.10.1.5. Sensitive topics

One main ethical concern was that, the discussion of burn injuries could cause participants stress or upset. For example, during the household interviews participants were asked to recall events where their children had suffered from a burn injury. As such, participants were asked to indicate if they felt upset or stressed during the interview. If they did the interview would be paused, suspended until later, or remained un-finished. To try to reduce stress it was made clear to the participants that the aim of the work was to explore the factors which lead to injuries around the home and was not a judgement on them as parents. Fortunately, while some participants expressed at the time of the injury they had been very upset for their child, they did not become upset during the interviews.

The purpose of this study was to highlight factors that lead to accidental burn injuries therefore participants were not directly questioned or probed about intentional burn injuries. However, in the case where participants disclosed information about intentional burn injuries or abuse they would have been advised to seek legal and medical advice for further assistance. The researcher, bound through professional obligation, would also have informed relevant authorities if they suspected there had been or witnessed abuse of a minor. This condition in which the researcher may break confidentiality was clearly written in, or verbalised from, the participant consent form.

3.11. Researcher reflexivity

The following provides a précis of the researcher's background, characteristics and prior experiences in relation to the study. The researcher is a white British female, with a Masters in Nursing Science. As a practicing staff nurse the researcher has seven years' experience working in a UK paediatric emergency department. Here the researcher developed the communication skills required to discuss delicate topics

with patients and identify key issues related to child injuries. These experiences provided the researcher with the sensitivity needed to approach families who may have been affected by burn related injuries.

When conducting cross-cultural research, the researcher needed to be aware of factors that can lead to inter-cultural misunderstandings (Brinkmann and Kvale, 2015). This was facilitated by the researcher's previous participation in volunteer work in Malawi. Importantly, during this work, the researcher was involved in teaching, monitoring and evaluating a first aid training programme ran by a NGO. Here they developed skills in working with translators and local agents to successfully collect data, as well as experienced some of the difficulties associated with collecting data in Malawi. Having some understanding of important cultural practices in Malawi ensured the researcher conducted their entry to the village and subsequent visits for data collection appropriately, so as to respect the pre-existing hierarchical structures.

This study involved both outsiders (the researcher) and insiders (the translators) which allowed different aspects of the participant's environment to be recognised. For instance, as insiders are immersed into the culture, routine or mundane behaviours may go unnoticed. However, they are likely to be more aware of less obvious cultural norms that an outsider may not recognise. As such each day's data collection ended with a short de-brief, this provided the researcher with an opportunity to discuss their impressions of the day and recognise any potential biases with the translator (Shenton, 2004). Furthermore, by collating these discussions within a field journal, a more comprehensive understanding of the phenomena could emerge.

3.12. Chapter summary

This chapter has justified the qualitative approach, research design and methods used to explore parental, health professional and key stakeholder's recognition and perception of burns and burns risks across

rural and peri-urban Malawi. This was followed by an explanation of the processes undertaken to select, recruit and access sample sites and participants. Subsequently, the ethical principles and considerations relating to the study were explained. Finally, the chapter provided a précis of the researcher and their background, to allow judgments to be made on the researcher's position and any potential influences they may have had on the data collection and interpretation of the findings. The following seven chapters will examine the findings of the study.

4. Chapter four: The perspective of health professionals

4.1. Introduction

This first results chapter will explore the key themes which emerged from the interviews with the health professionals, who took part in this study. The themes include:

- factors associated with the occurrence of burn injuries
- perceptions of parental attitudes towards burn injuries and prevention
- practices and barriers to providing patient information and advice

Before exploring these categories in more detail, the chapter begins with a brief overview of both the hospital and participant characteristics.

4.2. Hospital and participant Characteristics

4.2.1. Hospital characteristics

Participants were selected from four government health facilities, including two district hospitals located in the central and southern region, and two central referral hospitals based in the northern and central regions. It should be noted that health services can be obtained from alternative institutions such as health centres, CHAM and private hospitals. However, due to the time available to conduct the study, participants were not sought from these facilities. However, as the sample does include health facilities based in each region, it was anticipated that the study sample could provide insights into the types of methods used to provide injury prevention and the issues faced, by government institutions across each area.

The services available for burns patients vary across each of these government institutions. For example, at district hospital level there are

often not the facilities for surgical interventions such as debridement, skin grafting and contracture release. Therefore, severe burns should be referred to the central hospitals that have the capacity, all be it limited, to conduct these procedures.

During the interview process, participants explained that their facilities often faced a number of challenges such as: overcrowding, staff shortages and a lack of resources:

"The hospital was built to accommodate 32 paediatric patients but because of increases in population sometimes we just put them on the floor provided we have given them mattresses. Sometimes we can reach up to a 100 during the malaria season"

Mzuzu_Nurse2

"We don't have resources, maybe we don't have paraffin gauze for the burn injuries, maybe we don't have bandages we don't have, I'm talking in the cases of the burns; and then there is a shortage of staff we are supposed to be at least 3 and 4 at least, but sometimes we just have two nurses working, with maybe 80 something patients on the ward, it is kinda difficult to give the best care"

Thyolo_Nurse1

It is important to understand how overcrowding, lack of staff and resources may impact on the clinical care of the burns patients. For the purposes of this study, it is acknowledged that these pressures are likely to impact on the health professional's capacity to provide health education directed towards the prevention of burn injuries.

4.3. Participant characteristics

A total of 12 health professionals took part in the study, their main characteristics can be found in Table 7. The final sample included 8 staff nurses, 3 clinical officers and 1 doctor. The total years of clinical

experience varied, with the majority having worked for 6-10 years in their current role.

Table 7: Participant characteristics: Health professionals

Characteristics	Category	Total
Hospital Location	Lilongwe	3 (2N, 1 CO)
	Thyolo	3 (2N, 1 CO)
	Salima	3 (2N, 1 CO)
	Mzuzu	3 (2N, 1 DR)
Occupation	Nurses	8
	Clinical Officer	3
	Doctor	1
Gender	Male	8
	Female	4
Years of clinical experience	Up to 5	3
	6-10	6
	11-15	2
Total Number of Respondents		**12**

DR = Doctor, N = Nurse, CO = Clinical Officer

The characteristics of participants have been illustrated in order to increase the dependability of the results presented in this chapter. However, at the time of writing, an accurate comparison of this sample to Malawi's national health workforce is not possible for each of the characteristics presented above.

Based on the latest Human Resources for Health Country Profile published in 2009, Malawi's health workforce constituted of 190 physicians, 2928 nurses and 700 clinical officers in addition to auxiliary nurses (428), medical assistants (707), laboratory technicians (473) and dental assistants (211) (Africa Health Workforce Observatory, 2009). As such, it was understood that the researcher would have greater access to nurses and clinical officers, than doctors for interview.

No information was found which accurately indicated the number of health professionals serving each health facility. However, it is clear that there is a severe shortage of all health workers in Malawi, with most government facilities considerably understaffed (Bradley et al., 2015)

4.4. Factors associated with the occurrence of burn injuries in children

4.4.1. The key themes

During the interviews health professionals were asked to discuss the types of burns seen at their facility, in addition to any factors which they perceived could lead to a burn event. The main themes generated from these discussions included:

- the types of burns seen in children
- the supervision of children in the village setting
- parental negligence
- factors associated with a child's development
- types of play which lead to burns
- seasonality
- flammable housing structures
- secondary health problems

4.4.1.1. The types of burns seen in children

The most common cause of burns reported in children was scald and flame burns. Scalds were typically a result of hot water tipping from a cookstove or hot porridge (nsima) spitting from the cookpot. Whereas flame burns were associated with children trying to heat themselves:

"Most of the times here they say it is hot water, tea yeah maybe they are cooking nsima so the porridge. So most of the patients who come here that is the problem, mostly it is hot water and porridge."

Salima_Nurse1

"For most of them it is hot water, maybe they have been poured with hot water accidentally or they have sat on hot water when they are playing. Most of the patients that we have here is because of the boiled water the second one is fire where they were heating themselves and the fire has caught their clothes."

Mzuzu_Nurse2

Two participants explained that burns could also depend on the type of cookstoves being used, for example:

"For those burned with fire it is mostly those who are using the firewood but the other who are using the charcoal mbaula it is the scalds and the water not the fire itself."

Thyolo_Nurse1

Nonetheless, further exploration on whether a type of burn injury can be associated with particular cookstoves is difficult. As the cookstove used, even if associated with a burn injury, is not typically recorded within patient notes.

4.4.1.2. Supervision of children in a village setting

Participants talked about the difficulties parents face in supervising children within the rural villages:

"In the villages it is difficult because these parents, they need to go to do things like farming because they cannot be every time taking the kids to the farming field. So they have to leave the kids with maybe their siblings at home and those siblings they also go to play so they leave even the smaller siblings at home, so it is difficult."

Lilongwe_CO1

While some participants understood that the process of leaving children at home with siblings is necessary to ensure that the family's nutritional needs are met. Others thought that this practice was careless:

"They're careless because sometimes they may leave two or a one year old baby in the hands of maybe a three year old or five year old child who is still growing and is not yet in full control. That child cannot take good care of the babies. So it is usually these babies who are left in the hands of children to take care of them that are prone to such injuries."

Thyolo_CO1

As a result, it was understood that, families can face difficulties to both supervise young children and attend to their household responsibilities.

4.4.1.3. Parental Negligence

Participants reported that parental negligence could lead to burn injuries. Although, it should be considered that, participants did not report that parents were intentionally negligent towards their children, but could be careless in providing supervision and managing household hazards for example:

"Most of the guardians or the parents they are negligent in their homes they can boil water and then can leave the water boiling and then go into

the house while the baby is still there and if the baby is crawling they can crawl and then they can be getting to the pot with hot water and then get burnt so carelessness is one of the major contributory factors."

Thyolo_CO1

"Sometimes it is just carelessness of the parents they may just have left the children playing while they are boiling water they will just leave a small kid next to the fire"

Mzuzu_Nurse2

4.4.1.4. Factors associated with a child's development

Participants described that a child was most at risk of burn injuries from the ages of 6 months to 5 years:

"The child is crawling and they touch the pot and it has then poured on the body [....] you know kids they are also on their own discovery they would like to touch that, they would like to touch this. So, even if you tell them but they would like to see why you are saying don't touch that so sometimes we fail."

Thyolo_Nurse1

"Those below five, the ones who are crawling they try to touch everything that is close. The child will just touch the fire because they are still young and then maybe in the cold season as they are trying to warm themselves, maybe there is hot water that they are boiling and then maybe accidentally when they are warming themselves they accidentally hit that pot and at the end they are poured with hot water and sustaining an injury."

Salima_CO1

Throughout the interviews it became clear that, the use of heat sources at ground level, present a significant hazard to children as they become more mobile.

4.4.1.5. Play

Participants explained that children playing with fire, and indeed play cooking, are key factors in the occurrence of burn injuries. Participants indicated two types of play that typically result in burn injuries. They included creating their own cooking fires and making fires to hunt mice:

"When it comes to 3 or 4 years they are maybe trying to play with fire. Their clothes can catch fire so the type of burns and the source of burns that we are expecting for such 3, 4and 5 years is when they are trying to move to try and cooking a try to do something whereby their clothes can catch fire."

Thyolo_CO1

"You know mice? They go to the bush they burn the bush and then they get the mice and then if they get close they get burnt."

KCH_CO1

4.4.1.6. Seasonality

Nine of the twelve participants associated cold season with a rise in burn admissions. These burns were often linked to children coming closer to fires to warm themselves:

"There are more burns from May, June, July because it is very cold so as they are heating themselves they can also have an injury from there if they are not careful"

Mzuzu_Nurse1

In addition, participants indicated that during cold season the use of hot water was more prevalent for warming bath water and making hot drinks:

"I think mainly during the cold season is when we have more burns because when it is hot they use warm water to bath their children. Especially when it is cold then they make sure that they boil the water."

Thyolo_CO1

"When it comes to cold season a lot of people are used to taking tea so in the process of maybe preparing tea or maybe you are boiling water for the children to bath is when they can sustain injuries."

Thyolo_CO1

Nonetheless, one participant indicated that while seasonality plays a part in burns admissions, the temperature of Malawi's districts can vary considerably and indicated that overall more burns patients come from the colder districts where fires are used for heating all year round:

"We get more referrals from Ntcheu because these areas are very cold compared to other districts we have Salima here and Salima is hot so then the others are cold so we get a lot more referrals from these cold districts."

Lilongwe_CO1

4.4.1.7. Poor housing infrastructure

Five out of the twelve participants explained that the type of building materials used to construct village houses is highly flammable. Consequently, should a fire become out of control and reach the housing structures it could easily spread causing burn injuries. These fires were typically associated with the use of candles and kerosene lamps:

"What happens with candles, they don't have a holder so they try and put it there so no one can touch it but when it is finished there is that wick remaining it is that wick that will fall and, if there is anything on the floor, then that fire will go there and burn everything."

Thyolo_Nurse2

Moreover, participants reported that burning candles beside mosquito nets resulted in house fires and burn injuries:

"Ah most of them, with the candles it is mosquito nets yes, burning the mosquitoes nets yes it is common."

Lilongwe_CO1

4.4.1.8. Secondary Health Problems

Participants associated secondary health conditions, particularly epilepsy, with the occurrence of burn injuries:

"If they are by the fire, a seizure happens; they are alone or else have just got some kids around, no parent it means he will get burnt there."

Thyolo_Nurse2

Moreover, participants explained that poor treatment compliance meant that those who had epilepsy may have experienced repeated burn injuries:

"People in the villages think if that child has stayed for a longer period of time without any epileptic episode then they feel that the child is healed. So they don't come back for the clinic or medication so it is like during that period they get burns again."

Mzuzu_Nurse1

"It (epilepsy) is poorly controlled in the villages because some they may start treatment but when they see now I have am not getting any fits then they don't go again for the drugs, so they get seizures because they are not taking drugs and so it is poorly controlled and then they get injured."

KCH_CO1

Nonetheless, one participant indicated that having a medical condition may, in some cases, provide an opportunity to explain to parents the risks and prevention of burns in the home:

"You know the funny thing is we know with these epileptics that these people they come to the clinics so every time they come they are told how to care for these children at home so you know "keep them away from the fire", "keep them away from water" so I think these are safer than anybody else when you look at it like that."

Mzuzu_DR1

4.5. Parental attitudes to burns prevention

4.5.1. The key themes

During the interviews health professionals considered factors that, they believed, influenced parental knowledge and attitudes towards of burns prevention. These factors could be grouped into three thematic areas: parental education, lack of awareness of burns risk and cultural beliefs.

4.5.1.1. Parental education

Participants commented that the level of education can influence parental behaviour for example:

"The educational back-ground plays a big role because if you are living in the city you know you can't leave a 5 year old with a 1 year old but in the village that is what happen they leave a 5 year old with a 1 year old and then they go to the farms and then they come back and then everything is fine so nothing changes [...]. But you know in the village they can't even afford a maid yeah so for them it looks like this is the way of life."

Mzuzu_Dr1

Nonetheless, besides education, people living *"in the city"* are also likely to have a higher income than those living as subsistence farmers in rural areas. Therefore, it is possible, that this group of parents could access formal methods of childcare such as, live-in nannies and nursery schools. Whist education may provide a protective factor against burn injuries this needs to be considered alongside other variables such as economic

stability. For instance, it may be that rural households are aware of the dangers of leaving young children alone, but have no other choice. For example one participant indicated that while education is an important aspect in burns prevention, burns can often be difficult to prevent in the village environment:

"Some are preventable, some they are not, there are barriers looking at our Malawi as a whole, the cooking style we use mostly it is difficult for them maybe to say that they can prevent injuries because it is an open fire cooking where there are no barriers to prevent them getting burned [...] maybe what matters much is the education, but some injuries are difficult to prevent in the set up that we have."

Salima_CO1

4.5.1.2. Lack of awareness

The health professionals indicated that having prolonged exposure to a hazard, without sustaining an injury, might lead those in the villages to overlook the level of risk that they are exposed to. Therefore they do not consider prevention strategies:

"To prevent certain injuries it means they must be aware there is that danger that is always there and at any time somebody can get hurt with this, But you see you can have knives left anyhow you can have hoes left anyhow so a child can just pick up a hoe and to start to dig [...] it is very common in our settings to leave an open fire anyhow with children around anyhow so prevention it is not practiced here in our villages."

Thyolo_CO1

"They know that these accidents are preventable but you know sometimes they just put it to the back of their minds and then don't think about it and then when it happens that's when they take some precautionary measure and then that wears off and then it happens again so yeah."

Mzuzu_Dr1

Moreover, health professionals indicated that although information is distributed concerning the prevention of childhood illnesses, there is a lack of information provided to parents about injuries:

"We don't fear much on burns, we fear much on the pneumonias and the malarias because we have been educating them. Burns we don't take it as life threatening, but it is life threatening because I have seen much of patients dying because of burns [...] we don't give them the knowledge about [...] they only have knowledge if their child is involved in burns."

Mzuzu_Nurse2

Nonetheless, it is not only a lack of awareness of the hazard that was recognised, but a lack of awareness around children's development, for example:

"They think that the child cannot be able to reach, so maybe sometimes they might say "left the child sitting somewhere then I didn't think the child can crawl up to the pot or the charcoal burner" maybe they don't think the child can do it, but they can and sometimes they get hurt."

Thyolo_Nurse1

4.5.1.3. Cultural beliefs and external forces

Seven out of the twelve participants indicated that families may consider some burn injuries the result of a bewitchment or curse:

"So some can understand that it is an accident and then they do say it could have been prevented, yeah. But some, they think that they was maybe bewitched yeah by like their grandfathers or mothers they do accuse someone in the village."

Mzuzu_Nurse1

The influence of supernatural forces is however perceived differently across Malawi:

"Of course perception of these injuries varies from tribe to tribe maybe some do admit that these are natural but others do think that maybe somebody has bewitched them something like that."

Thyolo_CO1

4.6. Delivering information on burns prevention

4.6.1. Key themes

Participants were asked to talk about the types of information, if at all, they provided to parents about burns injuries and prevention. These discussions resulted in the following key themes:

- methods to deliver health information
- difficulties experienced when providing patient information
- recommendations for future strategies to promote burns prevention

4.6.1.1. Methods to deliver health information

Information provided to guardians caring for burns patients appeared to feature homecare and burns prevention measures. Information about homecare was typically provided on discharge and included how to manage wounds, hygiene and diet. However, burns prevention advice was less consistent.

Health information was distributed, when possible, on a one-to-one basis or through group sessions. The one-to-one sessions were typically ad-hoc and occurred either when a practitioner identified the guardians needed more information or, when the patient was discharged from the ward:

"Yes well when we come across a patient sometimes we do - but yeah not so - the patients that come in with burns you talk to them about how they can prevent such situations in the future but not to these other patients."

Mzuzu_Dr1

"We tell them how to prevent further burns like most of the patients who come here most of them are epileptic so we tell them how to prevent them from being burnt again not to get closer to the fire and the guardians should be observing the patient most of the time and not just leaving them…"

Lilongwe_Nurse1

Group information sessions were reported to take place when a number of burns patients were admitted to the ward at one time:

"Yes we do train the guardians mostly like we usually tell them on hygiene and to prevent infections and nutrition whereby we know for the burn wounds to heal properly they should be eating more proteins so we encourage them on the nutrition basis and hygiene […] it is not one to one it is only the group […] it is like a group education…"

Mzuzu_Nurse1

In addition to teaching sessions, the participants based at KCH, indicated that posters had been created by a local artist to display informational messages about preventing burn injuries around the home. Figure 12 and 13 provide a sample of these posters.



Figure 13: Poster at burns unit alerting parents to the dangers of children crawling near fires



Figure 12: Poster at burns unit alerting parents to the importance of checking the temperature of bath water before immersing their children

4.6.1.1. Difficulties experienced when providing health information

Although participants described a number of ways health information was provided to guardians, they also expressed a number of difficulties they faced in providing this information. These difficulties included: a lack of time, a lack of staff and a lack of knowledge on behalf of the guardians. For example:

"We are supposed to do it but most of the time we don't to be honest we don't because we are busy so we prioritise which should come first so most of the time we don't do this..."

Mzuzu_Nurse2

"There are so many patients compared with the health workers so that is a challenge here in the ward the beds, there are few, and there a number of patients compared to the number of nurses working there is a shortage of staff comparing to the patients so sometimes we don't provide enough because of the pressure of the work..."

Salima_Nurse1

"Here in Malawi it is a problem because most of us are less knowledgeable so you start explaining something that you think it is easy but the guardian doesn't know it they haven't been attending any school so it is hard."

Mzuzu_Nurse2

"It becomes a challenge when you are giving information to somebody who did not go further with their education. For instance when somebody is maybe having low oxygen saturations you try to put on the oxygen the guardians refuse they think that the patient can get killed with oxygen so that is another challenge [...] they usually stick to their guns to say no we don't want our child to have the 02 therapy."

Thyolo_CO1

4.6.1.2. Suggestions to promote burns prevention

Despite finding difficulties in providing burns information at the time of their interviews, nine of the health professionals recommended that civic education campaigns could increase the awareness of burns injuries, hazards and treatments in the surrounding communities:

"If a team would maybe go to a village and explain to them about the dangers of all these things then I think people would be getting fewer burns because they know what to do and they know what precautions to take."

Mzuzu_Dr1

"Yeah there could be some changes because when they come here they are individual so it is difficult to make a big impact but if we did a big campaign then we could see some changes."

Salima_Nurse2

In order to deliver these campaigns participants suggested that Health Surveillance Assistants (HSA) could help. For instance, the HSA's run under five clinics in the communities to monitor child health, weigh and vaccinate children. As such, two participants suggested that, during the cold season, burns prevention talks could be added to these clinics, for example:

"The HSA's have clinics here at the district and in the community so during when it is cold, they can be giving health education to take care because most of the burns they are in that time because it is cold and children light fires to keep warm."

Thyolo_Nurse1

Other participants highlighted that the media and schools could also be used to inform communities:

"We need to be involved in the news papers/ radio we need to be writing something so people should know how to prevent burns [...] even going to school to teach all those pupils how to prevent burns."

Salima_CO1

However, when asked about how these suggestions could be sustained there were a number of issues. Firstly, it was noted that these campaigns may only have a short term impact and therefore would need to be repeated regularly to maintain awareness. However, this is likely to be difficult given the lack of resources available. Secondly, those that are most in need of this information may not have access to different media:

"Yes there are barriers because if they go home some of them they don't have radios so they can't listen to the radios or if it is in a newspaper others they can't buy so they have no access so even if we can give information for newspapers the media if they don't have radios they can't listen or the TV others they don't have that so they can't get that information."

Lilongwe_CO1

Thirdly, participants explained that households may not be in a position to make the recommended changes to their home environment. For example, three participants highlighted that households should have a separate kitchen, rather than cooking on the kondi or in an open space. However, participants also recognised that households may not have the financial resources or materials to build an appropriate kitchen space:

"There are barriers because there are female headed household, there is no father, so there is no one to build the kitchen the mother is alone so she just cooks on the kondi. Others it is materials are scarce and when it comes to brick making it needs energy you have to mould bricks you need energy"

Thyolo_CO1

4.7. Chapter summary

This chapter has discussed the factors associated with the occurrence of burn injuries in children, parental attitudes towards burns prevention and treatment, and the delivery of information on burns prevention. In particular, it has highlighted that, at present, there is a lack of consistent information provided to parents about preventing burns in the home. It has also demonstrated that there are often a number of difficulties in distributing this information associated with a lack of awareness about the burns problem and a lack of time and resources to provide information to patients. The next five chapters will focus on the householders' perspectives of burns injuries to provide a deeper understanding of burn injuries in the context in which they occur.

5. Chapter five: Household and environmental characteristics

5.1. Introduction

The following five chapters review the data collected from the household participants. This initial chapter has been created to outline the households' characteristics, infrastructure and cooking locations, in addition to the methods employed for cooking, heating and lighting. The purpose of exploring these aspects is to provide a context in which childhood burn injuries occur.

The subsequent household chapters have been created to illustrate the varied factors and perceptions participants associated with childhood burn injuries around the home. These have been categorised as:

- the socio-cultural and developmental factors associated with burn injuries
- parental perceptions of home hazards and burns prevention
- characteristics associated with burn incidents
- a safety assessment of household cookstoves

5.2. Participant characteristics

5.2.1. Number of household participants

The village boundary and number of households within each village was determined by the village head. Table 8 has been created to highlight the number of reported households per village, the number of survey respondents and the number households which subsequently went on to take part in the interview and observational phases of data collection.

Table 8: Number of households per village and number of study respondents

	Number of Households	Number of Participants		
		Survey Respondents	Interview Respondents	Observations
Kapeta2/Chonde	102	58	6	6
Compound	80	61	9	7
Mtika	60	51	9	8
A. Nkhata	75	70	8	8
Total	**317**	**240**	**32**	**29**

5.2.2. Participant demographics

The level of the demographic information collected from participants depended on their involvement in each phase of the data collection. Table 9 presents the demographic information obtained from all survey respondents. Where available, data from Malawi's most recent Integrated Household Survey (National Statistical Office, 2012) and Malawi Demographics and Health Survey (DHS) (National Statistical Office, 2017) have been provided.

Table 9: Characteristics of survey respondents

	Gender		Percentage of households with children under 5 years	Average household size
	Males	**Females**		
A.Nkhata	16	53	60	5
Mtika	6	45	78.4	5.3
Compound	16	45	58.3	3.8
Kapeta2/Chonde	6	52	67.2	4.7
Sample Average	-	-	66	4.7
National Average (National Statistical Office, 2012)	-	-	-	**4.6**

Table 9 demonstrates that the households surveyed had a similar average household size compared to the national average. It also shows the

percentage of sample households with children under the age of 5 years. However the data is not available to compare this to the national population. Although, it is noted that, in 2012 the IHS reported that 48 per cent of Malawi's population was aged less than 15 years and 16.4 per cent of the population were between the ages 0-4 years (National Statistical Office, 2012). Therefore, it is recognised that, as a country Malawi has a large population of young children and adolescents, in comparison to the adult population.

The participants who took part in the interview and observational phases of the study were asked to provide further demographic information relating to their age, education and occupation. The final sample included 24 families who had experienced burn injuries, and 8 who had not experienced burn injuries, in the year prior to the study. The demographic data for "burn" and "non-burn" participants are presented in Table 10 and 11.

Table 10: Characteristics of households who experienced a burn injury

Participant code	Number in household	Children under 5	Age of respondent	Cookstove(s)	Gender	Primary occupation	School completion
Compound							
COMP_PT1	4	1	18-25	3 Stone Fire	F	Housewife	S2
COMP_PT2	5	1	18-25	Chitetezo Mbaula	F	Not Applicable	S3
COMP_PT3	3	1	18-25	3 Stone Fire	F	Tea Picker	S7
COMP_PT4	5	1	18-25	Chitetezo Mbaula	F	Housewife	S5
COMP_PT5	5	2	26- 35	Chitetezo and 3 Stone Fire	F	Housewife	S8
COMP_PT8	10	4	26- 35	Chitetezo and 3 Stone Fire	F	Housewife	S8
COMP_PT9	6	1	18-25	Chitetezo and 3 Stone Fire	F	Small Scale Business	F4
Kapeta 2 and Chonde							
CHONDE_PT2	4	2	26- 35	3 Stone Fire	F	Farmer	NS
KAP_PT1	5	1	26- 35	Fixed Rocket Stove and 3 Stone Fire	F	Housewife	S7
KAP_PT3	6	1	26- 35	3 Stone Fire, Fixed Rocket Stove and Charcoal Mbaula	F	Farmer	F3
Mtika							
MT_PT1	11	2	36-45	Chitetezo and 3 Stone Fire	F	Selling Firewood	NS
MT_PT2	5	0	26- 35	Chitetezo Mbaula	F	Small Scale Business	S3

MT_PT4	5	2	18-25	3 Stone Fire	F	Subsistence Farmer	S5
MT_PT5	5	1	26- 35	Chitetezo and 3 Stone Fire	F	Subsistence Farmer	S5
MT_PT6	6	1	26- 35	Chitetezo and 3 Stone Fire	F	Subsistence Farmer	S2
MT_PT7	4	2	18-25	3 Stone Fire	F	Subsistence Farmer	S6
MT_PT8	8	1	46-55	Chitetezo Mbaula, 3 Stone Fire, Charcoal Mbaula	F	Subsistence Farmer	NS
MT_PT9	7	2	46-55	Chitetezo and 3 Stone Fire	M	Subsistence Farmer	NS
Nkhata							
NKT_PT1	4	2	18-25	Charcoal Mbaula and 3 Stone Fire	F	Housewife	S8
NKT_PT2	3	1	18-25	Charcoal Mbaula and 3 Stone Fire	F	Pieceworks	S8
NKT_PT3	9	2	36-45	Charcoal Mbaula and 3 Stone Fire	F	Preacher	S8
NKT_PT4	6	2	26- 35	Charcoal Mbaula and 3 Stone Fire	M	Hospital Attendant	S8
NKT_PT5	5	2	26- 35	3 Stone Fire	M	Piecework's	S7
NKT_PT6	4	2	26- 35	3 Stone Fire	F	Piecework's	S2
Sample average	**5.63**	**1.54**					

Table 11: Characteristics of households with no burn injuries

Participant code	Number in household	Children under 5	Age of respondent	Cookstove(s)	Gender	Primary occupation	School completion
Compound							
COMP_PT6	5	1	26- 35	Chitetezo and Other	F	Housewife	F2
COMP_PT7	5	1	26- 35	3 Stone Fire and Chitetezo Mbaula	F	Tea Planting	S2
Kapeta 2 and Chonde							
CHONDE_PT1	4	0	26- 35	Fixed Rocket Stove and 3 Stone Fire	F	Tobacco Production	S3
KAP_PT2	6	1	18-25	Fixed Rocket Stove and 3 Stone Fire	F	Farmer	S4
KAP_PT4	6	2	36-45	3 Stone Fire, Fixed Rocket Stove and Charcoal Mbaula	F	Farmer	S8
Mtika							
MT_PT3	8	1	36-45	Chitetezo Mbaula, 3 Stone Fire, Charcoal Mbaula	M	Subsistence Farmer	S8
Nkhata							
NKT_PT7	5	1	18-25	Charcoal Mbaula and 3 Stone Fire	F	Nanny	F1
NKT_PT8	7	1	26- 35	3 Stone Fire	F	Hospital Attendant	F1
Sample average	**5.75**	**1**					

NB: Primary education is made up of eight years = Standards 1 to 8; Secondary education in Malawi is made up four years = Forms 1- 4

S= Standard followed by the level of primary school achieved, F= Form the followed by the level of school achieved, NS = No schooling

Unlike the average household sizes presented in Table 9, the average household size of those who took part in the interview and observational portions of the study was higher than the national average. This is likely to be the result of purposefully selecting households who have children.

Table 9, 10 and 11, illustrate that there were more female respondents than males. Although no gender was particularly targeted to take part in the study, the very nature of the study topics typically meant that females, who are primarily involved cooking and childcare, were better placed to provide substantial responses.

The sample provides a broad range of school attendance from no formal schooling to the final year of secondary education. Although the sample was not selected to make inferences about the level of school completion and the risk of burn injuries, it provided a wide breadth of school experiences and the chance to explore whether injury prevention has previously, or the potential, to be taught in schools.

In terms of primary employment, like 85 per cent of Malawians, most households were engaged in some form of agricultural activity (National Statistical Office, 2012). Others were engaged in small businesses or piecework such as selling firewood, laundry and moulding bricks.

The age of the participants varied from 18 to 55 years with most participants being 26-35 years (n15). However, as the sample was restricted to include only those over the age of 18, the perspectives of younger mothers may not be fully represented by this study.

In summary, the participant characteristics have been displayed here to allow for comparisons with the wider population and provide transparency when considering the transferability of the findings to other populations. Nonetheless, the household sample was not designed to be an exact representation of Malawi's population. Rather it was to

purposely approach households who could share experiences of different cooking technologies, burn injuries and risks.

5.3. Housing infrastructure and Environmental characteristics

5.3.1. Housing infrastructure

Before exploring individual household components associated with burn injuries, it is important to consider the wider context in which children are exposed to such hazards. This section provides a description of a typical home and outside area for each village.

During the observational phases, where participants consented, fieldnote sketches of their household spaces were created. While walking around the home participants were asked to identify the usual location of their cooking, heating and lighting materials, as well as the areas children would spend their time during each season.

Table 12 provides a key of the symbols used in the fieldnote sketches to represent the different heat sources used around the home. Where applicable colours were also used to identify the typical location of children during the cold season (green), wet season (blue), hot season (brown/yellow) or all seasons (purple).

Table 12: Symbols and illustration of household cooking, heating and lighting sources

Object	Symbol	
Child		
3-Stone-Fire		
Fixed Rocket Stove		
Charcoal Mbaula		
Chitetezo Mbaula		
Open Fire / Bush Fires		
Candle or Kerosene lamp		
Torch		

5.3.2. Kapeta and Chonde

Figure 14 is a sketch taken from the field notes of Kapeta_PT4's home and surrounding area. Kapeta_PT4's sketch was chosen as it provides a characteristic representation of a house and outside layout of the homes in Kapeta and Chonde village. Typically, participants owned their homes and had occupied them from 7 to 15 years.

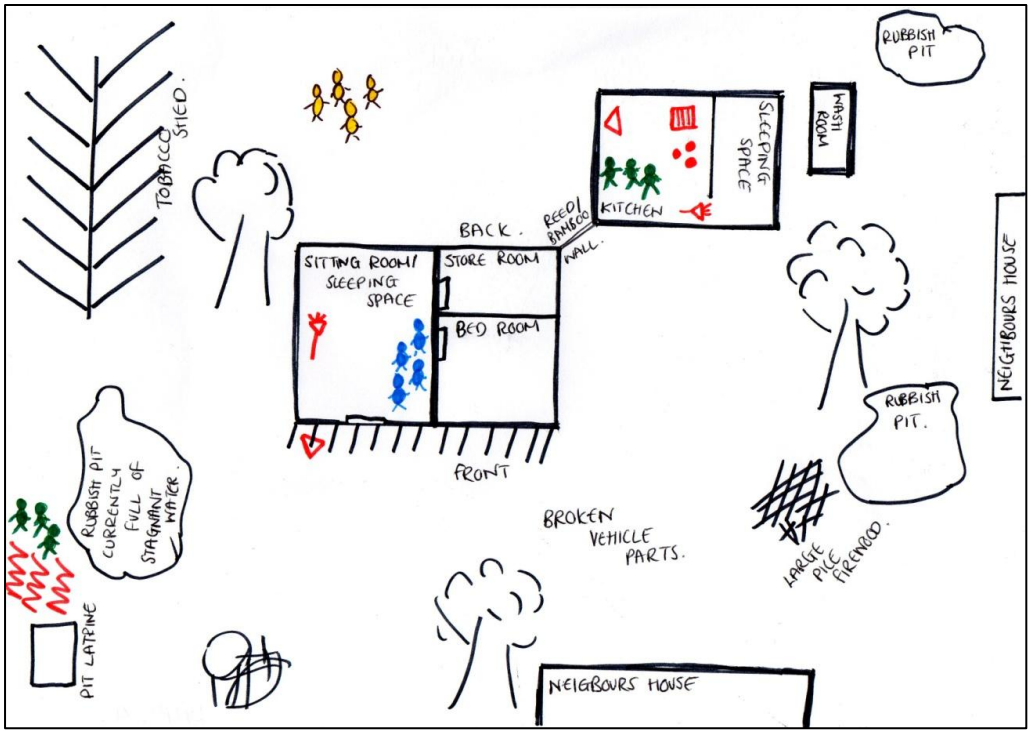


Figure 14: Fieldnote sketch of Kapeta_PT4's living spaces

5.3.2.1. The house

The housing structures in the villages could be described as semi-permanent or traditional structures. The houses are typically made up of a sitting room, one bedroom and a store room, with a separate building for the kitchen, bathroom and pit latrine. The flooring is smeared with mud or clay to provide a smooth and flat surface. In this house one area of the kitchen has been separated for an extra sleeping space. Inside the living space there is a bamboo mat covering the floor space to sit. The doorways between the sitting room, store room and bedroom are made of cloth and children have easy access to each of these rooms. The store

room is used to store a charcoal mbaula, spare bricks, plastic buckets, bike wheels, maize flower, chickens, farming tools and fertiliser.

In addition to the residential structures there are a number of open tobacco sheds around the village.

5.3.2.2. The outside area

As illustrated in Figure 14 there are three large rubbish pits around the house. During the observation each rubbish pit was full of stagnant water, as illustrated in Figure 15. These rubbish pits were common across the village, with each household having access to an area for waste disposal. On occasion households reported that they would set these rubbish pits alight when they became full. The area surrounding the homes was scattered with broken vehicle parts, firewood, farming equipment and old maize cobs.



Figure 15: Rubbish pit which has become filled with water

5.3.2.3. Kitchen areas

Cooking is done both inside and outside of the kitchen buildings. In particular, Kapt_PT4 explained that the 3-stone-fire may be put in a space just outside the kitchen during the wet season as damp wood increased amount of smoke produced:

"When the firewood is wet we sometimes move the 3 stone fire outside the house when cooking as there is a lot of smoke."

5.3.2.4. Location of children

During the cold season the children either grouped together to make a fire between the large rubbish pit and pit latrine, or sat inside the kitchen building to keep warm. In the wet season the children would spend their time in the sitting room space and during the dry periods the children

would be playing away from the house in a small open space between their home and their neighbour's house.

5.3.3. Compound

Unlike the other villages the homes in Compound were provided by the residents' employer. Regulation prohibits households from making open fires outside their allocated kitchens to prevent damage to crops.

Participants had lived in these homes from a period of 3 months to 10 years. The houses ranged from single detached structures to rows of dormitories. The majority of participants live in semi-detached properties as illustrated in Figure 16. The illustration below was taken from the field notes of Comp_PT1.

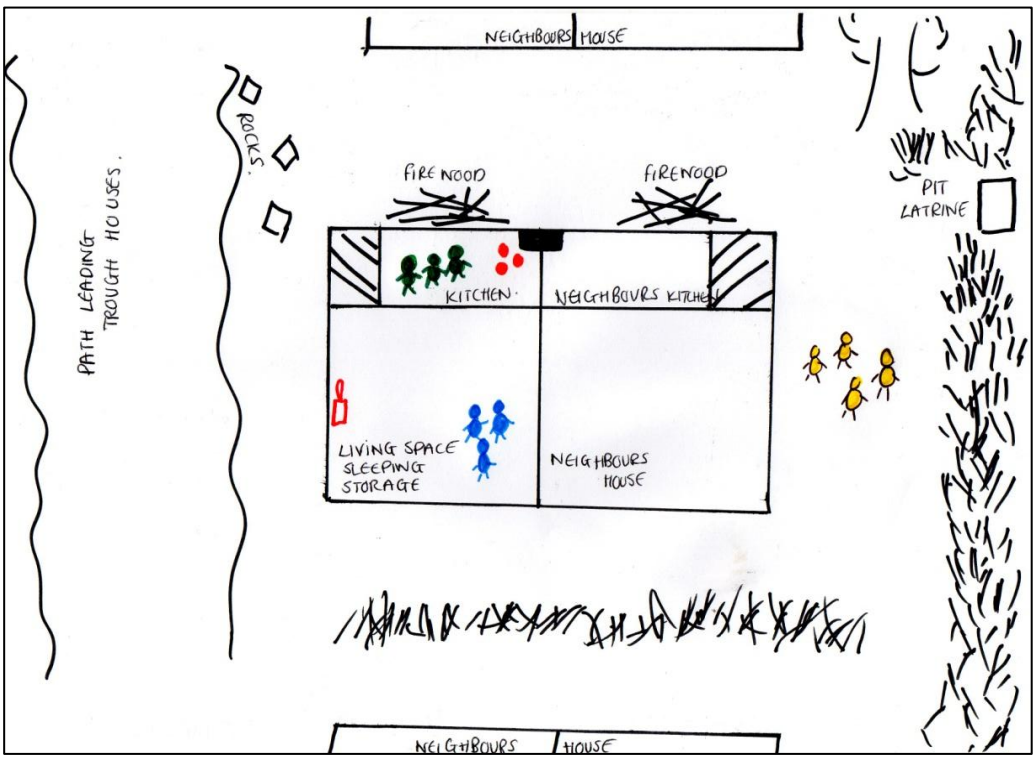


Figure 16: Fieldnote sketch of Comp_PT1 living spaces

5.3.3.1. The house

The houses in Compound are permanent structures. Typically they are made up of one living space with a kitchen attached. There are no shelves or high places to keep objects out of the reach of children, so these are typically scattered on the floor. The floors are smeared with mud or clay

to provide an even surface. However, there were houses where this has worn and therefore created cavities and unequal surfaces.

5.3.3.2. The outside area

The flooring which surrounds the houses is uneven resulting in numerous trip hazards. There is a wide path which runs through the centre of the residential area, although this is not accessible by cars, push bikes pass through. Beyond the pit latrine there is a small river used by households to wash their clothing.

5.3.3.3. The kitchen space

The kitchen space is attached to the house but entered through a separate door from the outside. Most houses are structured this way within the Compound. Each kitchen has a fireplace area with a chimney; however, the marks on the walls created by the soot demonstrated that, despite having a small chimney, excess smoke was passing through the doorway. Most kitchens have a wooden door which can be locked and therefore they are also used to store pieces of firewood, plates and cooking utensils.

5.3.3.4. Location of children

When asked where the children play during each season participants reported, in the wet season the children will be in the sitting room, in the cold season they will mainly be in the kitchen and in the dry season they will play at their friend's house with the neighbour's children.

5.3.4. Mtika

The homes in Mtika village were typically owned by their residents. At the time of data collection participants had lived in their current residence from 3 to 21 years. Figure 17 has been taken from the field notes of Mtika_PT1 to provide a characteristic representation of the homes in this village.

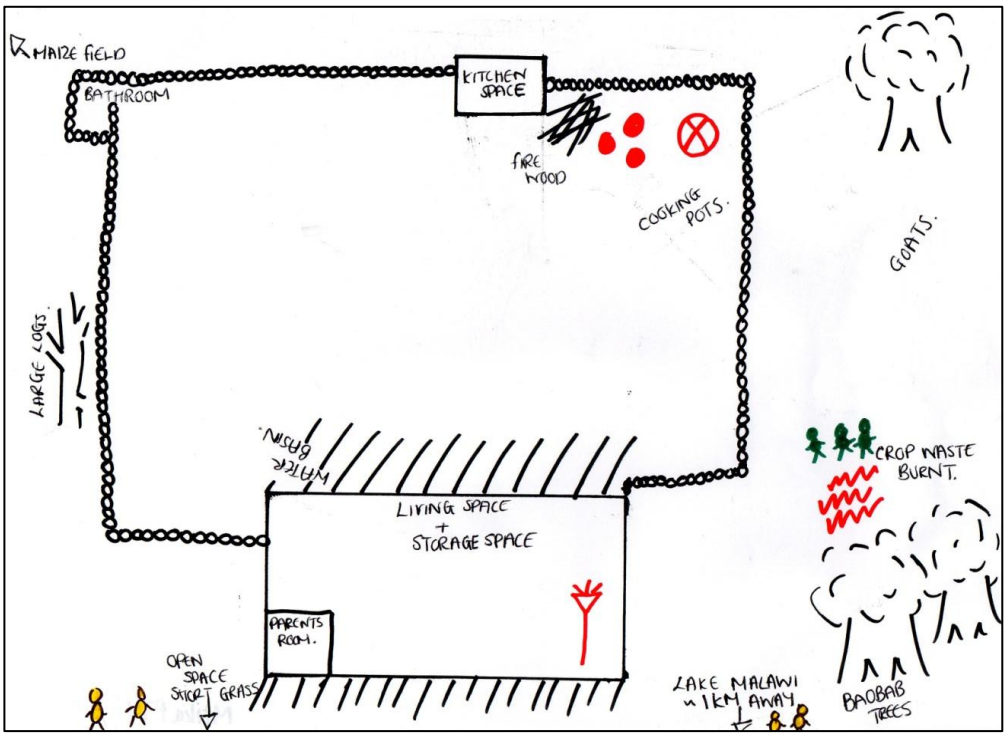


Figure 17: Field note sketch of Mtika_PT1's living spaces

5.3.4.1. The house

Semi-permanent and traditional houses make up Mtika village. The houses are typically made up of one bedroom, sitting area and separate kitchen building. The sitting room area was typically used for the storage of household utensils and water basins. The flooring is smeared with clay or mud; however, between the doorways there are small raised platforms which create trip hazards when moving through and in-between rooms of the house.

5.3.4.2. The outside area

The homes include a small enclosed area surrounded by a perimeter fence made of reeds. The areas within these perimeters are cluttered with cooking pots, water basins, farming equipment, rocks and old maize cobs. Outside of the main household perimeters there are herds of goats moving between the dwellings. There are also large areas in front of the houses where crop waste has been brought together and burnt.

5.3.4.3. The kitchen space

Participants explained, unlike the other villages, the district in which Mtika village is located, Salima, does not experience as much variation in season and as such seems to stay hot all year round. As a result households preferred to cook their food outside.

5.3.4.4. Location of children

Children's play spaces were situated: under the baobab trees when shade or shelter was needed, in the areas of grass land, and by Lake Malawi. With the latter however, participants indicated that they were concerned about their children visiting the lake due to risks of drowning and animal attacks.

5.3.5. Nkhata

Nkhata village is situated approximately 25km from the city of Mzuzu and roughly 4km from a busy trading centre. At the time of data collection participants had been living in their current residence from 3 months to 8 years.

5.3.5.1. The house

Each type of housing structure: permanent, semi-permanent and traditional could be found in the village. To the north of the village houses were sparsely laid out between maize and sugar cane fields, these houses tended to be traditional and semi-permanent structures. In the south of the village, which was closer to the trading centre, the structures were permanent with a select few having an electricity supply. However, despite having an electricity supply not all houses could afford to run this on a regular basis.

The houses in Nkhata tended to include multiple bedrooms, storage and living spaces, with the exception of participants 5, 6 and 8 who had only single living spaces and a storeroom. The more permanent properties had wooden doors to separate each room which meant access to certain rooms could be restricted. However, the smaller dwellings used cloth to separate living and storage spaces. The permanent structures had cement flooring that was smooth and flat whereas the smaller traditional dwellings had uneven mud or clay flooring.

Nkhata_PT2 home, as illustrated in Figure 18, was selected to illustrate characteristics of the village dwellings. The house is situated in the centre of the village along a dirt road to the trading centre. The majority of the house is made of permanent materials but has no electricity supply.

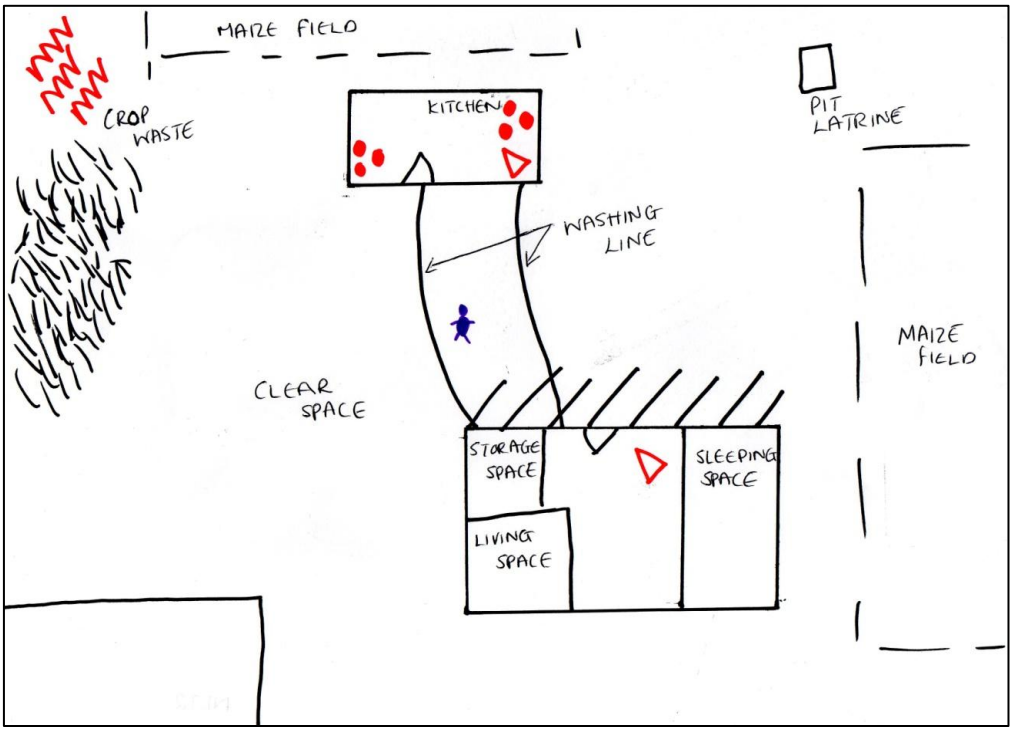


Figure 18: Fieldnote sketch of Nkhata_PT2's living spaces

5.3.5.2. The outside area

The homes typically have a small courtyard space used for sitting, socialising and drying maize. At the time of observation the maize fields had been harvested leaving small sharp stumps between the houses. As illustrated in Figure 18, there are areas where the crop waste is brought together and burnt. Though not present in this illustration, three of the households in Nkhata village used deep rubbish pits for their waste which, on occasion, filled with water or were set alight to burn the rubbish. The village also had a well, pictured in Figure 19, which was covered with a thin wooden sheet.



Figure 19: A typical well present in sample villages

As in most villages the children had access to farming materials which they may decide to pick up and play with as illustrated in Figure 20.

5.3.5.3. The kitchen space

All houses, with the exception of participants 1, 5 and 6, had a separate kitchen building. Participants 5 and 6 did however have a cooking area, partitioned by a wall ~1m in height.

5.3.5.4. Location of children

Participants explained that children could be found in the house using the charcoal mbaula for heating during cold season and close by the verandas in wet season. During the dry season children would choose to play in the spaces between the houses, or visit a local playing ground approximately a 1.5km walk from the centre of the village. However, the route to the playing ground includes passing a dirt road used by bicycles, cars and farming vehicles.



Figure 20: A child playing with farming equipment

5.4. Locations, Fuels and Methods for cooking, heating and lighting

5.4.1. The data

In addition to the demographic data collected, participants were asked to identify the areas, fuels and methods used for cooking, heating and lighting, the responses to which are presented throughout the remainder of this chapter.

As discussed previously in Section 5.2.2, where available, the study data has been presented alongside national statistics. However, comparisons to the national data should be treated with some caution as, while this study allowed participants to provide more than one answer, the DHS and IHS permitted only one response. As such, the national data do not account for households which may employ multiple fuels, and could therefore under-represent the use of fuels supplementary to firewood i.e. charcoal.

5.4.2. Cooking locations

Table 13 illustrates the locations study participants used for cooking, followed by data from the DHS for both Malawi's rural and total population (National Statistical Office, 2017).

Table 13: Household cooking locations

	In the house	Outside	Separate building	Other
A. Nkhata Village	12.9%	35.7%	62.9%	4.3%
Kapeta 2/Chonde Village	13.8%	36.2%	75.9%	1.7%
Mtkia Village	2.0%	60.8%	51.0%	0.0%
Compound	78.7%	36.1%	11.5%	0.0%
Sample Average	**26.8%**	**42.2%**	**50.3%**	**1.5%**
Malawi: Rural Population	**4.8%**	**27.7%**	**67.3%**	**0.2%**
Malawi: Total Population	**8.3%**	**31%**	**60.4%**	**0.2%**

Whilst, it appears that a higher proportion of participants cook in their house than demonstrated by the national data, this variation may be due to the layout of the homes constructed in Compound. Here the kitchens were built attached to the house. With this exception in mind, households tended to cook either in a separate building or in an outside area. During the interviews, households explained that there are a number of factors which influence their choice of cooking location. These are presented alongside illustrative quotes in Table 14.

Table 14: Factors which influence cooking location

Influencing factor	Quote(s)
Comfort	*"When it is hot I would cook outside.."* Int_Compound_PT9 *"Where I feel comfortable wherever is cool and shaded."* Int_Mtika_PT3
Protection from external environment	*"When it is windy there is dust which comes together with that wind and then the dust goes in the food so we use the kitchen."* Int_Nkhata_PT6
Rules and regulations	*"When we are given a house, we are given rules such as don't make fire outside because it would be difficult to control if it gets to the tea plantation so we have the kitchen."* Int_Compound_PT7
Kitchen is required for another purpose	*"The kitchen is now used as a bedroom for somebody else so all the food is cooked outside."* Int_Mtika_PT1 *"I have a kitchen but at the moment because I have some goats I am using it to keep them in there."* Int_Mtika_PT8
Building damage	*"We had a kitchen but it fell during the rainy season."* Survey_Mtika_PT34

These contextual factors indicate that the location of the household stoves is often not permanent. This results in a number of potential areas where children are exposed to cookstove fires.

5.4.3. Fuels used for household cooking

Table 15 presents the fuels used for cooking in each of the sample villages alongside data from the DHS (National Statistical Office, 2017).

Table 15: Fuels used for household cooking

	Charcoal	Electricity	Firewood	Crop waste	Other
A. Nkhata Village	82.9%	5.7%	80.0%	21.4%	1.4%
Kapeta 2/Chonde Village	8.6%	0.0%	100.0%	60.3%	1.7%
Mtkia Village	19.6%	0.0%	96.1%	0.0%	0.0%
Compound	9.8%	0.0%	100.0%	3.3%	1.6%
Sample Average	**30.2%**	**1.4%**	**94.0%**	**21.3%**	**1.2%**
Malawi: Rural Population	**6.9%**	**0.3%**	**91.4%**	**1.2%**	**0.2%**
Malawi: Total Population	**15.7%**	**2.1%**	**80.9%**	**1%**	**0.3%**

The most common fuel used for cooking across both the sample villages and national data is firewood, this is followed by charcoal. Unlike the data that show fuel use for the total population, crop waste was the third most popular fuel amongst the rural and sample population; with electricity third for the total population. This slight discrepancy is likely to be related to the fact that the urban centres, included within the total population results, have a greater access to electricity for cooking.

5.4.4. Methods used for household cooking

Although the types of fuels used by households for their cooking needs can indicate the types of stoves they use, it does not provide a complete picture. For example, firewood is a fuel for both the traditional 3-stone-fire as well as a number of ICS. Therefore, participants in this study were asked to indicate the stoves they used for cooking. At the time of writing,

there were no published national data which specified the types, and proportion, of cookstoves employed by Malawi's wider population.

Table 16: Methods used for household cooking

	3-stone-fire	Charcoal Mbaula	Fixed mud stove	Fixed rocket stove	Chitetezo Mbaula	Electricity	Other
A. Nkhata Village	80.0%	74.3%	0.0%	0.0%	1.4%	1.4%	0.0%
Kapeta/Chonde Village	55.2%	5.2%	3.4%	89.7%	1.7%	0.0%	3.4%
Mtkia Village	82.4%	17.6%	2.0%	0.0%	31.4%	0.0%	0.0%
Compound	59.0%	3.3%	0.0%	0.0%	59.0%	0.0%	1.6%

Table 16 highlights the types of stoves, and their percentage use, across the sample villages. In each area, except for Kapeta and Chonde villages, the majority of households use the 3-stone-fire. However, the data demonstrate that, where there has been a stove intervention, some households have adopted the ICS either completely or alongside their traditional methods.

Table 16 also demonstrates that Nkhata village has a much higher proportion using the charcoal mbaula than in comparison to the other villages. The reasons for this could be attributed to, the location of the village in relation to an urban centre where charcoal is widely available or, a higher economic standing of the participants in this area. However without additional data on household income these factors can only be speculated.

5.1.1.1. Factors which affect the selection of cooking methods

The traditional 3-stone-fire is associated with a significant number of burn injuries and fatalities worldwide (Mock et al., 2008). Yet, the process of moving away from this traditional technology is extremely complex. For example, although householders reported several problems with their traditional technology they continued to adopt this cooking method. These issues included: exposure to flames, long cooking times, smoke, eye irritation and poor pot stability:

"When you are cooking you find that the flames come up here and burn you. If it is in the open space, then children can easily get burned."

Int_Mtika_PT4

"The 3-stone-fire slows the cooking because the wind can blow easily then for the pot to get heat it takes time."

Int_Kapeta_PT3

"…because of smoke! Sometimes the firewood is not dry enough so oh you produce tears!!"

Int_Nkhata_PT3

"You are likely to get burned using the 3-stone-fire if one of the stones moves or falls then either the pot of the water or whatever you are cooking is spilling on your legs."

Int_Chonde_PT2

Consequently, the factors around why participants may employ alternative cooking methods, or continue to use their 3-stone-fires were explored. The themes generated from these discussions are summarised in Table 17, alongside illustrative quotes.

Table 17: Factors which affect the selection of cooking methods

Theme	Quote
Prohibitive costs and infrastructure	*"Other stoves are expensive the 3-stone-fire is the only one that we can manage."* Survey_Compound_PT20 *"If I found another stove I would definitely change to using another stove but now because I have no access and I don't know how to get it."* Int_Comp_PT2 *"...with the heavy rains, my kitchen and stove was destroyed, so now I am using the 3-stone-fire."* Survey_Kapeta_PT15
Fuel saving	*"The chitetezo mbaula uses less fuel [...] you know that you are going to cook even with very little sticks of wood."* Int_Compound_PT3
Wet fuels	*"Sometimes we are forced to use a 3-stone-fire when the wood we have is not as dry, if it not dry then it is very difficult to use in the (fixed rocket) stove, then, when it is rainy season it is difficult for the firewood to be mostly be dry and we use the open fires."* Int_Kapeta_PT3
Convenience: Speed	*"I use the 3-stone-fire in the morning as it cooks fast."* Survey_Nkhata_1 *"When we want to cook fast that is when we go for the chtetezo mbaula because it is faster source of fire to the pot."* Int_Mtika_PT8 *"The (fixed rocket) stoves are quick to cook even the dry beans, they don't take long to cook but if I put them on the 3-stone stove then it will take them longer to cook because the flame is like it flies around while in the stoves it's (the flame) all concentrated on the pot so it really is a good stove for cooking fast!"* Int_Chonde_pt1
Convenience: Easy to use	*"It is easy to cook on the 3-stone fire rather than breaking the smaller pieces of firewood."* Int_Nkhata_PT5

	"The pot is usually stable on the stove (chitetezo mbaula) than on the 3-stone-fire especially when I am cooking nsima the pot would usually tip on the 3-stone-fire but not on that stove." Int_Compound_PT7 *"The (fixed rocket stove) is smoke free so it doesn't affect my eyes when cooking and I can see in the kitchen so it is easier to cook."* Survey_Kapeta_PT20 *"I like using the charcoal mbaula as it keeps the pots clean rather than black, I can say it is easier because there is no need of maybe cleaning the pots with the sand."* Interview_Nkhata_PT4
Convenience: Portability	*"Its (chitetezo mbaula) portability makes it easier for me if it starts raining, even now if I was cooking and it started raining then I would take the stove inside unlike than if it was a 3-stone fire then I would struggle to take it inside."* Int_Compound_PT4 *"It is mobile the charcoal mbaula you can carry it, it is portable because sometimes you may have visitor so instead of leaving your things which you are cooking somewhere you may just carry it and then put it close to you then you may be attending to the visitor while things are working there."* Int_Nkhata_PT3
Tradition and familiarity	*"The 3-stone-fire is like the main stay of the house we can't do away with it! but because fuel saving is best with the chtetezo Mbaula that is why we normally choose to cook with, but we would not stop using the 3-stone-fire all together."* Int_Mtika_PT8 *"The 3-stone fire is the main stay of the house go to any village and you will find a 3-stone-fire."* Int_Mtika_PT8
Celebration and event cooking	*"Where there is a family gathering or a wedding there is really big drums which are being use to cook we need to prepare nsima in really big pots where maybe two people would be cooking at the same time with the same pot and a chitetezo mbaula cannot do*

	that." Int_Compound_PT3
Trying something new	*"I was interested to know how it (chitetezo mbaula) works so I bought it, I wanted to try a new thing."* Int_Mtika_PT1
Copying friends	*"When we saw the demonstration and what it (chitetezo mbaula) does that is when I decided I wanted it."* Int_Mtika_PT8

Importantly, although participants reported that the ICS could shield the fire, safety was not considered to be a primary factor to purchase or use a ICS. Therefore, based on these findings it is apparent, future interventions will need to acknowledge these user behaviours. As, even if an ICS appears to surpass the traditional technology in cooking time, costs and safety, it may not be convenient for the household to transition to using a singular ICS stove as explained in the following section.

5.1.1.2. Fuel stacking

Fuel stacking, or using multiple methods and fuels to cook, was observed amongst each of the sample villages during the scoping and pilot phases of data collection. As such, when the research tools were developed they attempted to explore the rationale for this, so as to understand how, when and why participants choose to employ certain cooking methods. The purpose of understanding this was, if ICS are to be employed to mitigate burn injuries, any protective factors may be limited by the households desire to continue adopting their traditional, and potentially risky, cooking practices.

In addition to the factors presented in Table 17, the rationale for employing multiple stoves was mainly associated with the need to speed up cooking or heat water for other uses:

"When I am in a hurry or sometimes there is need to quickly cook and prepare food or water then I use both types of fires […] we might put the

green maize on one fire and preparing the lunch on another fire so we are using both stoves at one time"

Int_Chonde_PT1

"Sometimes we would have the chtetezo mbaula there cooking the relish and we will have 3- stone-fire there to cook the nsima so the two stoves are working hand in hand when we want to do things fast"

Int_Mtika_PT8

"We make two the charcoal mbaula and the 3-stone-fire so the other is use for warming water and the other one is use for preparing breakfast [...] when the young children who go to school in the morning so they need to be on time at school that is why I do like that"

Int_Nkharta_PT3

The responses indicated that, while participants may take up different cooking technologies, most households will continue to adopt traditional methods. Suggesting that, at present, no single stove can meet every household need.

5.1.1.3. Treatment of the stove following the cooking process

To explore the use of household cookstoves further, and the risks they may present to children, interview participants were asked what they did with their fires once they had finished their cooking tasks. This question was added based on observations, noted during the pilot phase of the study, where fires had been left burning. The responses to which have been illustrated in Table 18.

Table 18 Rationale to leave cooking fires burning

Theme: Rationale for leaving fires burning	Quote
To warm bath water	*"We put water on the fire, while the water is on the fire, while it is heating up we will at least clean the household and do other chores waiting for the water to get warm then we use that water for bathing."* Int_Chonde_PT
To provide heat for the family	*"I would leave them (the children) alone in the kitchen with the stove when I have finished cooking so that they can keep warm in the kitchen."* Int_Compound_PT1
Traditional behaviour	*"I just leave the fire on because that is what I do when I have finished cooking I take the food inside and I leave the fire to go out on its own, I don't put the fire out that is what I have always been doing, there is no set reason, it is just what I do all the time."* Int_Compound_PT2
To make re-ignition easier	*"I would leave the fire like that sometimes I don't have matches so I leave the fire like that some other fire can be saved so that it can be used during lunch."* Int_Nkhata_PT6

Nevertheless, eleven of the participants interviewed indicated that they would extinguish their fires, after cooking, so as to save fuel and prevent the spread of fires:

"Once we have finished cooking we normally take out the firewood and put it out with sand so that we can use it again in the afternoon or evening."

Int_Chonde_PT1

"During the day time it is normal to just put sand on it but in the evening we really need to put the fire out so it doesn't spread."

Int_Mtika_PT5

"If there is blowing wind then I make the fire off yeah? Because you can see the dry grass everywhere I am afraid of the wind which can blow fire to the house."

Int_Nkhata_PT6

The findings here highlight that, although some households may extinguish their fires, cookstoves can continue to present a risk to children both during and after the cooking process.

5.1.2. Methods used for heating

Table 19 presents the methods, reported by survey participants, used to provide heating for their families. At present, there are no national data published on the types of fuels or methods Malawian households use for heating.

Table 19: Methods used for heating

	Three stone fire	A Charcoal Mbaula	A chitetezo mbaula	Other	Open fires	Nothing	Charcoal Pieces
A. Nkhata Village	11.4%	77.1%	0.0%	0.0%	0.0%	12.9%	0.0%
Mtkia Village	58.8%	3.9%	21.6%	5.9%	29.4%	0.0%	0.0%
Compound	36.1%	0.0%	41.0%	26.2%	1.6%	0.0%	3.3%
Sample Average	**35.4%**	**27.0%**	**20.9%**	**10.7%**	**10.4%**	**4.3%**	**1.1%**

It should be noted that the question regarding heating methods was added to the household survey after data collection had been completed in Kapeta and Chonde village. Therefore, there are no survey data recorded regarding their methods of heating. Nevertheless, these aspects were discussed with each of the interview participants in those areas.

As can be seen in Table 19, most households employ some form of cooking technology as a heating method. Therefore, this suggests that cookstoves not only need to fulfil household cooking requirements, but may need to produce adequate heating for the family:

"We would finish cooking and then bring the chitetezo mbaula indoors to warm ourselves during the evening."

Int_Mtika_PT8

Consequently, it is important to note that, in terms of the environment and exposure to heat sources, children will come close to cooking stoves for warmth. For that reason, it might not be appropriate for future prevention strategies to assert that children should be kept away from cooking fires during cold periods without considering alternative heating methods.

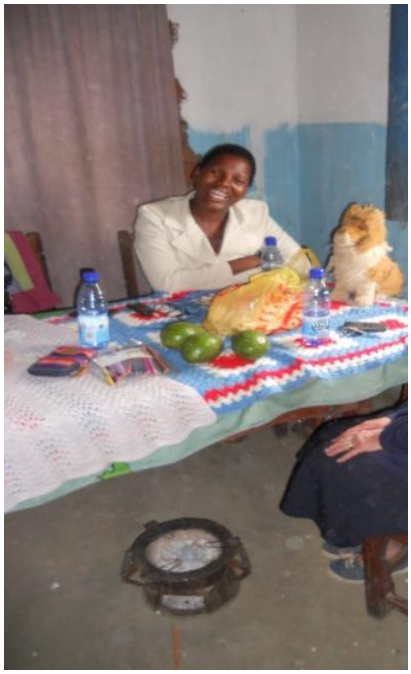


Figure 21: Typical use of the charcoal mbaula to heat the living room

Households also reported that they would use open or rubbish pit fires to provide heating:

"If we want to keep warm outside then normally we go and look for just anything to burn like leaves and burn them outside."

Int_Chonde_PT1

"When it is cold season we would get up early in the morning and put some fire out there to warm ourselves it is the maize stocks the dried grass or you know when you are sweeping all that into a pile of rubbish."

Int_Mtika_PT4

However, some participants expressed concerns that these fires could get out of control, spreading to other areas of land resulting in property loss:

"My rubbish pit, last year when I did that fire it went as far as the toilet and set it on fire! It means I lost that property. For me to purchase those things again I had to pay something so it cost me so now I will wait with the fire till it goes out."

Int_Nkhata_PT4

Furthermore, one participant added, during their interview, that their child had previously suffered burn injuries as a result of these fires:

"My first born he was near the girls secondary school there and there are pits there so the girls usually put their cartons there or maybe everything that they consider that is bad so then watchmen come with fire and then make fire there to keep warm. My child went running wanting to pick something and then he fell in the pit while there was fire and he had a burn somewhere here and we were in the hospital."

Int_Nkhata_PT3

Despite these problems, participants explained that it was common for children to make these open fires alone:

"The children make the open fire for heating themselves, outside the house they would gather crop waste and some match sticks from the house and then make the fire usually they are with their friends."

Int_Mtika_PT1

Lastly, Table 19 also illustrates that charcoal, left over from the cooking fires could also be used for heating the home for example:

"I would just take the remaining charcoal, put this onto a metal sheet then I would usually put it in the centre of this room and we would usually gather as a family and have family time."

Int_Compound_PT4

The findings highlight that, for Malawian households, fires in some form are a necessity to provide heating for the family. As such children are, and will continue to be, exposed to open flames while there is no alternative to these methods of heating.

5.1.3. Fuels and methods used for lighting

Table 20 presents the methods that the survey participants used for lighting their homes, alongside data from the IHS (National Statistical Office, 2012). The question regarding lighting methods was added to the household survey after data collection had been completed in Kapeta and Chonde village. Therefore, there are no survey data regarding their methods of lighting. However, these aspects were discussed with each of the interview participants in those areas.

Table 20: Methods used for lighting

	Battery Dry Cell Torch	Candle	Grass/ Firewood	Solar	Electricity	Kerosene/ Paraffin	Other
A. Nkhata Village	72.9%	14.3%	0.0%	5.7%	15.7%	1.4%	2.9%
Mtkia Village	80.4%	0.0%	27.5%	0.0%	0.0%	0.0%	0.0%
Compound	63.9%	16.4%	0.0%	21.3 %	0.0%	8.2%	3.3%
Sample average	**72.4%**	**10.2%**	**9.2%**	**9.0%**	**5.2%**	**3.2%**	**2.0%**
Malawi: Rural Population	**30.8%**	**2.7%**	**8.9%**	**No data**	**2.9%**	**53.5%**	**1.2%**
Malawi: Total Population	**27.3%**	**4.6%**	**7.6%**	**No data**	**7.6%**	**51.8%**	**1.1%**

Table 20 illustrates that paraffin was reported to be the main source of fuel for lighting Malawian homes in 2012. In contrast, it was more common for the households who took part in this study, to report the use of battery powered torches. This type of lighting method included both conventional battery powered torches as well as crude makeshift torches. The latter torches are made using bamboo or reeds, copper wire, batteries and LED lights.

During the interviews participants expressed that the increased cost and scarcity of paraffin fuel had resulted in them moving away from its use for lighting, replacing it with torches:

"We decided to change because of the expense, it is expensive to maintain a kerosene lamp because you are feeding it with paraffin all the time while with the torch you just buy the batteries and it just lasts you over a month."

Int_Chonde_PT1

"It is so difficult to get paraffin it is getting scarce so I bought a torch and this is what we are using at the moment."

Int_Compound_PT2

It is possible that, the contrast found between the household survey and the national data, may be a result of the rising paraffin costs between 2011, when the IHS was conducted, and 2015 when this study's survey was undertaken.

Nonetheless, households reported that, in addition to cost savings, the torches provided them with a greater and longer lasting light source. As such, participants commented that, even if paraffin should become available again, they would continue using the torches:

"The first reason was paraffin was scarce but even if it came back now the bulb is better I wouldn't go back to using the paraffin lamps, we prefer the bulb."

Int_Chonde_PT2

"It is more sufficient using these torches because the light takes at least a long distance to a long space than the paraffin lamps they only light where the lamp is…"

Int_Kapeta_PT2

After torches, candles were the next most popular lighting source used by participants due to their low cost:

"I am using candles because that is what I can afford at the moment."

Int_Compound_PT8

Upon observation, candles tended not to be placed in candle holders, but held by dropping small pieces of liquid wax onto a flat surface (usually a window ledge or chair) and then placing the bottom of the candle to the liquid wax to hold it in place:

"I would usually take a small chair and put it in the living room and stick the candle to the chair."

Int_Compound_PT7

As a result candles were often observed to be positioned in such a way that they could easily be knocked over. This was corroborated by participant's experiences:

"The children were sleeping in that room so they took a candle and went with it in the room but they forgot to blow it off [...] a cloth just nearby so that cloth touched the fire and then it burned and then other things also touched this fire and then the children were sleeping there so there was fire in the house so..."

Int_Nkhata_PT3

The participant also stated:

"We continue to use the candles because it is the only alternative that we can afford."

Int_Nkhata_PT3

However, where participants could not afford candles, or afford enough candles to light each space required, they may use burning firewood or grass:

"We would pull a few grasses, like a little bunch like that and then go to the fire and light the strand. It will be burning and then we will go in the house just to check "I am going to put out my mat to sleep over there" or move the little things it is just for that time you don't keep it going for a long time."

Int_Mtika_PT4

Table 20 also illustrates that households, particularly in Compound, made use of solar lighting. Here participants explained solar lighting methods had been introduced into their area at a subsidised price. The light produced by the solar light was described to be sufficient enough for their household requirements and reduced the need to replace batteries:

"The solar because the bulb is a little bit bigger than the torch it gives like more light than the torch, and the solar since you just have to charge it on the sun unlike the torch that needs batteries, change of batteries here and there."

Int_Compound_PT6

Finally, Table 20 indicates that a small proportion of households in Nkhata village used electricity for lighting. But, due to the cost of electricity as well as persistent blackouts, households also needed to regularly employ alternative methods for lighting their homes.

This exploration of lighting methods highlights that, in addition to cooking and heating methods, lighting in many cases exposes children to unsteady open flames and hot objects. Moreover, as the cost of paraffin has increased, households have appeared to adopt alternative lighting methods.

5.2. Chapter summary

This chapter has provided a description of the participants and their home environments with a particular focus on the participant's cooking locations and the most common methods employed for cooking, heating and lighting. Where possible the study results have been presented alongside the national data. This chapter has begun to reveal potential burns risks present within the context of rural and peri-urban Malawi. The following chapter considers the socio-cultural and developmental factors associated with burn risks, as described by household participants.

6. Chapter six: The socio-cultural and developmental factors associated with burn injuries

6.1. Introduction

This chapter concentrates on themes generated by the household data, surrounding the socio-cultural and developmental factors associated with burn injuries. Whereas the previous chapter examined the household environment, this chapter focuses on the everyday behaviours which have the potential to expose children to burn injuries. The main categories relating to these aspects were:

- children's learning and development
- children's roles and responsibilities in the household
- play
- childcare and supervision of the cookstove

This chapter will discuss each of these categories, and their associated themes and sub-themes.

6.2. Children's learning and development

6.2.1. Key themes

During both the household surveys and interviews, participants were asked to identify and discuss who, in the household, is most vulnerable to sustaining a burn injury and why. Overwhelmingly participants reported that children under the age of 5 years seemed the most at risk. The factors associated with this assumption could be categorised into two themes relating to their child's learning and development, these are:

- A period of discovery and a lack of risk awareness
- The processes of learning about fire

6.2.1.1. Period of discovery and a lack of risk awareness

Parents described that children, particularly those under the age of five years, had a higher risk of burn injuries because, during this period, they began to crawl, walk and climb:

"The time they discover things at this age some children learn to crawl and they may reach fireplaces."

Survey_Nkhata_PT49

"Mostly these are children who get a burn since they are on the process of learning to walk."

Survey_Mtika_PT18

In addition, parents explained that as children began to explore their environments they unknowingly exposed themselves to burn injuries:

"This is a period of discovery and the child doesn't know to make a difference between good and bad, they may just want to go and see the fire and get burnt."

Survey_Nkhata_PT60

"It's like when you open the gate to let a goat feed he may walk about and be found by a predator, fall in a ditch or walk into a fire without knowing, children are the same."

Survey_Nkhata_PT42

"Children lack knowledge of getting burns from picking up a pot and not realising it is hot."

Survey_Chonde_PT7

Then, as the children began to grow, participants described that their children became increasingly curious and would attempt to imitate their actions:

"Because at this age they are curious to try everything they see their mother cooking so when she is not there she is also curious to try that."

Survey_Compound_PT6

"Sometimes the children may come to see what their mother is doing and in that process children may knock the pot off – or they may go on their own without their mother to practice what they have seen."

Survey_Compound_PT12

6.2.1.2. The processes of learning about fire

Parental reports concerning the process of learning about fire could be divided into two sub-groups:

- learning about fire and
- learning how to cook with fire (discussed in section 6.3)

The theme, learning about fire, emerged as participants discussed the processes in which children were educated about fire from an early age. This learning was described to occur by practical experiences or explanation from guardians. For instance, some participants reported that their children learnt about fire through sustaining minor burn injuries:

"The elder ones will tell the younger ones that this fire is dangerous so they learn from word of mouth and of course by getting burnt a little bit at one point or another so they will know, they might not know how bad it can get, but they will have the feeling that it is something dangerous."

Int_Chonde_PT2

"Usually they have had a burn injury by then. That is when they realise that fire is dangerous or sometimes they would learn without having a burn injury sometimes they would learn from a friend who had a burn, and then they would learn that a fire was dangerous."

Int_Compound_PT4

Although other participants reported that just feeling the heat radiate from the fire was enough for the child to know that there is danger:

"If a child you know normally if he is near fire and he feels the heat he would note that that is a no go area so it is more of a practical experience than just knowledge."

Int_Mtika_PT6

"We teach a child so they can know that this is a bad thing by doing a sound "dohha hehehehe!" so a child learns in this way. I remember my child she liked to enter in the kitchen and she wanted to touch a candle. So one day she had to put a finger close to that light and then she felt that it was hot and then she went "ah" so now if I say "dohhaa!" she doesn't want to be very close so she knows that this is fire."

Int_Nkhata_PT3

Besides sustaining a burn injury, parents and carers reported that they would explain to their children that fire is harmful and advised them to stay away:

"From that age still from one and a half they start noticing that, or if you know that his is going near the fire then you can tell him to get away from it and that teaches the child that this is an area of danger."

Int_Mtika_PT3

"We teach the child for the child to know that this is fire because if you don't teach her then it means for her to know that this is fire she will get a burn. So it means that is the time that she can know that this is fire but before the child gets a burn she has to be taught by a parent."

Int_Nkhata_PT4

Nonetheless, some parents indicated that despite advising children to keep away from fires they would not always follow this instruction:

"Children are always difficult to control you move out of the place they start to play with the fire."

Survey_Mtika_PT31

"Even if I tell them that is fire don't touch it they would still want to explore"

Int_Compound_PT2

In essence, households explained that children developed an awareness of danger through both practical application and explanation.

6.3. Children's roles and responsibilities in the household

6.3.1. Key themes

Participants were asked to describe any roles and responsibilities their children had in the home. These discussions led to further exploration around how and when their children learnt to undertake these tasks. The purpose of understanding the development of children's roles, within the home, was to explore how a child's exposure to burn injuries may change as they grew with age. For example, older children, particularly girls, aged 6-17 years were seen to be vulnerable to burn injuries as they begun to take on responsibility for cooking meals. As such, the two themes which emerged from these discussions were:

- children's roles and responsibilities
- the process of learning to cook with fire

6.3.1.1. Children's roles and responsibilities

Participants described that children from the age of four years old could be responsible for undertaking tasks or chores around the home such as sweeping the compound and cleaning plates. From approximately ten years, as the children started to grow and become stronger, they begun to take on tasks which required increased strength and dexterity such as

firewood and water collection, farming activities and processing maize at the mill. Though parents highlighted several roles and responsibilities the children were involved in around the home, a focus was placed on the age at which children were considered responsible for the care and supervision of younger siblings and the age at which they began to learn to cook independently.

It emerged that children, from the age of five, could be left to supervise their siblings. Depending on the duration that the parent or carer was away from the home, these children could also be expected to prepare meals:

"It is possible a 6-year-old to look after the others who are two or three years, yes it usually happens it is tradition, it is good to teach her some domestic works, like taking care of her sisters and her brothers it is important to teach her domestic works."

Int_Mtika_PT1

"From 5 years old, really you can leave a kid with a 4-year-old or a 3-year-old, she would cook porridge she has been watching mum do it since maybe from 3 years old and then she took over."

Int_Mtika_PT9

"In this house we don't have a grandmother they have all gone so we just rely on the elder children to look after the younger ones if the child is younger then I will take them with me to the field but if they are old and they can be left alone like this one if she is OK then we can leave them with the 11 year old he is old enough to know how to do porridge for the rest the children."

Int_Mtika_PT6

In these circumstances, it is important to understand that young children in this area are expected to undertake tasks which involve using fire, or supervising children near fires. Therefore, any prevention measure needs

to consider that direct parental supervision is not always practiced or possible, at present, in these environments.

6.3.1.2. Learning how to cook with fire

This theme encapsulated the age at which children learned to cook, the learning processes involved, and the type of stoves used by children. As indicated earlier, children from approximately five years of age have started to learn how to cook in some capacity. When probed parents explained why they chose to teach children from this age:

"So, from birth up to 5 or 6 years the children are still young and they don't really know the dangers of fire. But when they reach 7 or 8 years they at least start getting mature that they can understand that they know that this is fire and this is how to handle it, so that is why I wait all that time."

Int_Compound_PT6

"Children learn better if they are taught while she is young so if you teach your child while at the age of 6 years it means that while growing she will know what to do at the right time."

Int_Nkhata_PT3

"By 5 years the mother starts teaching them how to prepare food she will start teaching her children how she does the food preparation so by 8 years they would start maybe making their own."

Int_Compound_PT6

However, the age at which children began to cook was not only determined by their age, but by household need. As participants explained, it was a requirement that children learned to cook from a young age, as carers needed to leave the home for longer periods of time to work or if a key family member became ill:

"The reason is that the older one started cooking at that age because I was sick at one point or another and because the father was busy that is why we decided to teach him how to cook [...] he was six years."

Int_Nkhata_PT5

"I started teaching them that just in case I am not around the house that they should not stay hungry they should be able to prepare your own food so I started teaching them."

Int_Compound_PT7

These examples highlight that, as well as tradition, the time at which children begin cooking is dictated by external factors and pressure on households to ensure that the children can eat when parents or carers are incapacitated, or required to undertake tasks away from the home. These external pressures would need to be considered in any future burns education initiative, as it is unlikely that these pressures will decrease in the near future.

Notwithstanding this, the age at which children were encouraged to learn how to cook varied with their gender, with less emphasis on teaching male children to cook:

"For us to let him do the cooking since he is a boy he will do that only when I (mother) is not around but if I am here then I cook."

Int_Mtika_PT6

"It is not the role of a boy to be cooking so it is just I can say mainly girls are supposed to be cooking boys have got their special roles - just sweeping outside and mopping so I share the responsibilities between the boys and the girls."

Int_Nkhata_PT3

There were two main processes associated with teaching children to cook. Learning appeared to begin with 'pretend' play whereby the children 'played house' and copied their mother's cooking routines. This play was often undertaken with real fire taken from their mother's kitchen and made elsewhere in their compound. Here younger children learnt from the older children how to make and stoke fires to keep them burning:

"When learning how to cook on their own when they are playing they make their own fire and they try to cook nsima. They just take a tin and they make the three stone fire like this and sometimes they will just put in clay pretending that it is nsima flour and when they come of age they use even the real flour they just copy when they see their mum is doing it."

Int_Kapeta_PT3

"They would get fire from mum to start cooking or get bits and pieces to cook to start playing house and, learning how to cook, they are playing and learning at the same time."

Int_Mtika_PT2

The second process of learning how to prepare food was to cook with their parents. This included observing their parents and taking part in smaller aspects of the cooking process, until the parent felt confident enough to allow the child to cook independently. For example:

"...we are always inviting them to say if I am washing plates I will say "come and sit here and wash one plate" as time goes the child picks it up and they start knowing "this is how mummy cooks [...] that way the child grows knowing what is happening"

Int_Mtika_PT2

"Initially they do part of the cooking not all the cooking, so when they were cooking I could ask them to do part of the cooking and then when I am not around they could prepare their own meals so when I come back and tasted what they had prepared I saw that it was OK, the food was cooked and the taste was good. So, I knew at this point that they can cook for the whole family."

Int_Compound_PT7

The observation was made that when children were initially taught to cook they used a traditional 3-stone-fire. Consequently, despite households having an ICS parents reported that, at least initially, their children would use the traditional fire when preparing meals for their family. For instance:

"Most of the time when I was cooking and I could let her do some of the cooking and when I saw that she doing it properly and the food was cooked and the food was tasting good that is when I knew I could leave her to cook by herself so sometimes when I go back the to the village just for the day I leave her here and she does the cooking [..] she uses the 3-stone-fire she has not learnt how to use the stove yet (chitetezo mbaula)."

Int_Compound_PT5

"Sometimes I can even ask for her at least to make the fire to make some porridge, especially when this one is sick so she is able to make the fire – especially the 3-stone- fire is easier for her than this stove (fixed rocket stove)."

Int_Chonde_PT1

6.4. Play

6.4.1. Key themes

Children were exposed to fires and burn injuries when playing. Therefore, parents were asked to describe the types of play their children were involved in and any resultant burn injuries. The data generated from these discussions revealed two sub-themes:

- types of play activities
- children's play locations and environments

6.4.1.1. Types of play activities

The types of play activities that were described by participants could be divided into four different play styles; pretend, exploratory, constructive and physical. Pretend play, as discussed in the previous section, involved children playing the game 'house'. Here children of all ages would pretend to take on roles of 'grown up' members of the family. This type of play typically included the use of a 3-stone-fire to mimic the parents cooking stove. Exploratory play was identified where the children were not formally engaged in a game or objective, but moved around randomly discovering their environments. During this type of play children may touch, move or place objects into fires:

"Children just like to play with fire they may set fire near the house and the fire may also burn the house of which is can cause harm to the people inside the house."

Survey_Nkhata_PT3

"When children are playing they may add more firewood and make the fire big so it touches the grass or the thatched roofing!"

Survey_Chonde_PT12

Constructive play included activities in which children manipulated materials to make something. For example, it was popular for the male

children to use a fire so as to melt and bind pieces of plastic together to make a football:

"They use a fire to bring the papers together, they take a lot of papers and put them in one plastic paper then tie it and then add some papers on top of that and use the fire to make it round into a ball. Sometimes they get burns when they are doing that, like for my first born son, he has been burnt doing that."

Int_Compound_PT2

"Sometimes they burn themselves when they are making the balls when they are joining one plastic to another they take those plastics and put it on the fire and then what they do is they do like this (tapping on the floor) so sometimes they may burn their fingers."

Int_Nkhata_PT4

Lastly, participants described common physical play activities such as playing sport, skipping, play fighting and traditional dancing. None of these activities directly involved the use or direct need for fire. Nonetheless, parents did express concern that should children play fight near the fires they may push each other onto the flames causing burn injuries:

"When they are playing near the fire they can push each other onto the fire."

Survey_Compound_PT40

This theme highlights that, although children are exposed to fires as part of their roles in the household, the use of fires and stoves also have an integral role in their regular play activities. Moreover, while playing with fires clearly presents a certain amount of risk for the child, these games are deeply embedded within the village culture and accepted by parents as routine play activities.

The sub-theme "children's play location and environments" is explored in other parts of the thesis. These include Chapter 5 which provides an outline of the participants' household environment and the locations in which children typically play during the cold, wet and dry seasons, and Chapter 7 which explores parental perceptions of these environments further with regards to the identification of hazardous areas around the home.

6.5. Childcare and supervision of the cookstove

6.5.1. Key themes

Parental supervision was one strategy used to prevent burn injuries by those interviewed:

"In the kitchen I would just make sure that the kids are under my supervision all the time."

Int_Compound_PT1

"I would monitor the child closely and I would make sure that the child is not going into the kitchen around the fire."

Int_Compound_PT7

However, the implementation of this strategy is challenging as participants explained that their household responsibilities such as: cleaning, sweeping, collecting water, collecting firewood, farming activities and/or paid employment impaired their ability to supervise their children. As such, parents described where their children would be based, or cared for, while they were undertaking these tasks. Their explanations led to the development of the theme 'supervision and care of children'. Furthermore, in corroboration with the household observations, the theme 'supervision of cookstove fires' also emerged. Each sub-theme is explored below.

6.5.1.1. Supervision and care of children

Participants explained that when they needed to undertake household tasks or employment their children would be: at school or nursery, with their siblings, extended family or neighbours, carried on their back or left at home alone.

Parents of school or nursery going children explained that they would undertake work while their children were at school. However, this type of supervision only covers weekdays and the period of time where the children are in school. As such, it was common for school-going children to take care of themselves and or undertake their own household chores outside of school time:

"They have their studies first, from there they will do some household chores before going to school, there then after that they prepare themselves, doing their own breakfast, bathing water and then off they go to school. When they are back from school they takes care of the other children and the house, food preparation, fuel wood gathering."

Int_Kapeta_PT3

When children were not attending school or there was no nursery available, participants described that they relied on their extended family, friends, neighbours or older siblings to care for their young children:

"The grandmother is around so I would leave the children with the grandmother looking after them."

Int_Mtika_PT5

"I would leave her at home with her sister. In the village you are never short of people looking after the children you just say "oh I am going to the river". If I take her there to the lake she is naughty and will be drinking the water or splashing around, so to avoid that I leave her behind."

Int_Mtika_PT2

Children under the age of two years were often still breast fed and as such were carried on their mother's back to her location of work or while conducting chores around the home:

"I carry them to the farm, it's not very far, maybe 10 minutes or so, then they are just in the grass nearby, you have a task to do!"

Int_Nkhata_PT6

"I carry the young one while I do piecework. Sometimes the child gets injured there while playing with other friends while I am busy, sometimes the elder children can fight the young child."

Int_Nkhata_PT5

"Say the child is 6 months and you are carrying the child on the back, if you were preparing food in the kitchen would you keep the child on your back."

Int_Mtika_PT6

However, it should be considered that children could then be exposed to additional hazards at the locations where they have been carried to, such as the kitchen or river.

Lastly, parents reported that they would leave their younger children alone asleep in the house if they needed to leave the house early in the morning, returning to check on them during the day. For example:

"If they are still asleep I go and start doing piece works after that I come back here to see if they are awake I don't want to disturb them from sleeping. I care for the children because I come frequently to visit the children so I can see if they are awake or not."

Int_Nkhata_PT6

Nonetheless, leaving children, particularly young children at home was not described as a choice but accepted as part of village life to manage

children and meet household obligations. As one family explained they feared their children may get injured, but described that they had no other choice other than leave their children at home:

"There is nothing I can do but what is that I can just have hope that the child is left safely at home because there is no neighbour yeah so there is nothing I can do. What I do is to pray to God that God should protect our children because if we stay here at home then it will mean that we have no food but we have to go to work!"

Int_Nkhata_PT5

This theme demonstrates that, although parents identify supervision as a key strategy to prevent burn injuries, in reality this is difficult for families to employ.

6.5.1.2. Supervision of cookstove fires

During the observational phase of the data collection it became clear that cookstoves were often left unattended during the meal preparation. To understand the rationale for leaving stoves in this way, participants were asked to describe their cooking process and where they would be in relation to the stove, during periods of cooking. The participant's responses included the need to attend to other household activities, a fear of the cookstove flames and the discomfort caused by the excessive heat produced by their cooking fires. For example:

"It is time consuming because if you waited there it means that you cannot do other activities that is why when you put maybe the breakfast on the fire and then you go and maybe clean the plates yeah? You can be washing clothes while the breakfast is being prepared, sometimes I may be feeding the poultry. If I don't have other activities to do then you can wait but if you have other activities to do then you put the food and it will be boiling while you are doing other things."

Int_Nkhata_PT4

"I clean the house while I am preparing breakfast so I know by this time the breakfast must be ready. Sometimes you know maybe you have a charcoal mbaula and then there might be sparkles of fire so that is why I am fearing. I am afraid of getting burns. I am afraid of the burns because when cooking we cook outside so sometimes there maybe wind of which if you sit just close to the fire like this then you may have burns here."

Int_Nkhata_PT3

Although excess smoke was not reported as a reason to leave the stove unattended, participants reported smoke was a problem with their traditional fires and therefore may also be a cause for participants to move away from their stove while it is alight.

Leaving a stove unattended for periods was also associated with the types of food the household was preparing:

"It also depends on the type of relish we are cooking because if it is like vegetables it is a quick meal but if we are cooking beans or any of those legume family it takes longer it can take 2 hours and a half hours you can't stay with it then."

Int_Mtika_PT4

Consequently, there are periods where children have unsupervised access to both the stove and hot liquids.

This theme highlights that, while leaving the stoves in this way creates a hazard, it is often more convenient and comfortable for those cooking to leave the stove unattended for short periods.

6.6. Chapter summary

This chapter has explored the key socio-cultural and developmental factors, as described by parents, that expose children to burn injuries around the home. It was revealed that, children often undertake household tasks, prepare meals and play with fires from a young age.

Furthermore, it was recognised that the supervision of children can be restricted by the parent's ability to simultaneously manage household demands and childcare. Nevertheless, although the above has demonstrated that children are exposed to fire hazards in relation to their play, responsibilities and development, these processes form conventional aspects of village life. The following chapter will present the participants' perceptions of burn hazards and prevention strategies.

7. Chapter seven: Parental perception of home hazards and burn prevention

7.1. Introduction

This chapter explores the factors relating to the household participants' perceptions of hazards and their prevention around the home. Based on the themes which emerged from the data, the chapter has been divided into two main sections:

- factors which are perceived to contribute to hazards around the home.
- perceptions associated with the prevention of burn injuries in the home.

7.2. Factors which contribute to hazards and injuries in the home

7.2.1. Key themes

During the interviews and household observations participants identified existing hazards and factors which may increase the occurrence of injuries around the home. This resulted in the following themes:

- hazards in and around the home
- children's play locations and environments: safe and unsafe spaces
- seasonal hazards

7.2.1.1. Hazards in and around the home

Interview questions prompted participants to consider and identify all hazards around their home in order to situate burn risks amongst other perceived threats. Following an analysis of the transcripts and observational notes the reported risks were categorised into nine types of hazard:

1) Fires hazards
2) Trip and fall hazards
3) Drowning hazards
4) Sharp objects
5) Toys and games
6) Roads, cars and bicycles
7) Animals
8) Crush hazards
9) Scald hazards

The remainder of this section will explore household hazards using participant's descriptions. Due to the focus of the thesis only those hazards which relate to burn injuries will be discussed in depth.

7.2.1.1.1. Fire hazards

Fire hazards were the most frequently reported by the study sample. This group of hazards included: candles, open fires, bush fires, wild fires, rubbish pit fires, hot water, kerosene lamps, flammable materials and cookstoves. In particular, these risks were reported to be problem when children played with or slept near them:

"We would have an open fire the children will be sitting outside warming themselves on the open fire and being a kid they can accidentally put her dress or whatever she is wearing and it can catch fire and children are not able to immediately able to put it out they will be just running around shouting "oh there is fire there is fire" in the mean time this child is getting burned."

Int_Chonde_PT1

"At night we use candles when the torches have stopped burning. I see that if the candle can touch the nets then the lit candle may cause harm. Sometimes the children may have an idea about making fire inside the house they may take curtains so they can be used as a lighting material so

in that way they can burn a house. My neighbour just somewhere had the same incident and the whole house got burnt…"

Int_Nkhata_PT8

"It has happened to someone where they left the lamp on and then the fire started because a child was trying to turn in his sleep and then the blanket caught fire and then people got injured in the house."

Int_Compound_PT2

Moreover, participants described that these risks may be exacerbated, should these fires become out of control or ignite surrounding materials:

"The 3-stone-fire when wind is blowing can easily blow the fire to a certain place that can cause injuries even to children."

Int_Kapeta_PT2



Figure 22: Bush fire Nkhata village

"Someone may have lighted a bush fire somewhere else but because of sparks it can start a fire because behind my house it is not clean there is still grass and maize stocks around then it may also burn the house."

Int_Mtika_PT6

Of the fire hazards identified, 21 participants reported that their cookstoves were hazardous to children. In particular, participants explained that their 3-stone-fire (n=13) was more hazardous in comparison to their ICS, as the flames are exposed and the cooking pot is not stable:

"When we are using the 3-stone-fire in the kitchen it can sometimes catch maybe a grass or plastic paper that can also ascend into the thatched grass and can cause an accident."

Int_Kapeta_PT3

"The 3-stone-fire in the kitchen is dangerous because children are always in the kitchen with me or alone they can go near the fire and knock the pot or the flames can touch their clothes."

Int_Compound_PT1

In addition, the charcoal mbaula was reported by two participants as a hazard because:

"If you put the mbaula near things then they may also become hot and burnt."

Int_Nkhata_PT2

"Sometimes the children might want to go near the fire and sometimes they may touch the charcoal mbaula and burn themselves."

Int_Nkhata_PT7

Nonetheless, participants explained that their children are commonly exposed these fires due to their frequent use:

"You are always lighting the fire like in the morning you have a fire, you want to cook you have a fire."

Int_Mtika_PT8

"There is fire all the time three times a day but with the water generally we would cover it we would cover the basins."

Int_Mtika_PT7

7.2.1.1.2. Additional hazards relating to burn injuries

Additional hazards reported that might contribute to the occurrence of burn injuries included hot water, certain medical conditions, and trip hazards. For instance, hot water was typically associated with preparing tea:

"You may prepare tea for your children so while it is just removed from the fire sometimes a child may just take a cup and then do like this so the hot water may also cause harm"

Int_Nkhata_PT3

Some medical conditions were also associated with the occurrence of burn injuries. These were reported on three occasions:

"One of the causes is if the kid is feeling sick, sometimes we say you can sit near the fire to keep warm while she is lying there it can happen that she can fall on the fire or something on the fire can fall on her and she can get burnt."

Int_Chonde_PT2

"Sometimes you can have a child that has epilepsy and in the moment of the fit can throw themselves on either fire or water."

Int_Chonde_PT1

Trip and fall hazards, such as areas with uneven flooring and stones, were also associated with burn injuries as they could cause someone to fall whilst carrying hot water or food:

"One of the days he was carrying a pot of hot relish I wanted him to put it into the house, he tripped over these rocks and all the relish was thrown down over him."

Int_Compound_PT8

7.2.1.1.1. Additional hazards relating to the cooking process

Participants also identified existing hazards which would not cause burn injuries, but could cause other injuries as part of the cooking process. These hazards included sharp objects and water storage. For example, it was noted that as children began to take on the responsibility for cooking they were also responsible for chopping firewood and using sharp utensils:

"My daughters the 8 years old and the 12 year old sometimes when they are trying to chop wood for cooking and they get injured by the axe or even the little one sometimes she goes to try and chop wood to copy and hurts herself."

Int_Compound_PT4

7.2.1.2. Children's play locations and environments

Participants described areas which they considered to be safe or unsafe spaces for their children to play, although not all participant responses agreed with each other, as discussed below.

7.2.1.2.1. Safe Spaces

Safe spaces included allocated playgrounds, the house and the courtyard. For example, playground spaces were described by participants to be safe:

"That ground is a good place because it is flat the children can play around there is no risk of the children falling down and breaking a leg because there are no stones or holes it is just plain and safe."

Int_Chonde_PT1

Whereas other participants reported that areas inside the house, such as the living room space, was the safest place for their children:

"Inside the house is the best for a child to play because outside the house there are many things that can harm him for example sometimes he may put a leg on the nail. Sometimes it may happen so inside the house is the best place. The things that can cause harm to the children are like hoes. Sometimes axes they are put outside the house so it means inside the house there is nothing that can harm a child."

Int_Nkhata_PT1

"When they are in the house we see that they are more protected than the kitchen or outside, because in the kitchen there is fire and even outside there is also fire which can cause injuries."

Int_Kapeta_PT4

Areas around the house, particularly the courtyard spaces, were seen as safe areas due to the presence of adults:

"I think my children are safe when they are playing just around here because I am usually outside so I can see what they are doing unlike when they go and play at another house or somewhere else."

Int_Compound_PT4

"At least an adult who will keep an eye on them so it is a safe area, it is not like they are playing away from the house where anything can happen. Nobody is there to monitor but around the home there is an adult around who can keep an eye."

Int_Mtika_PT3

In summary safe areas were determined as either a space or room that could be made free from hazardous objects such as the living room, a designated playground, or an area where it is convenient for adults to provide supervision.

7.2.1.2.2. Unsafe spaces

Generally spaces which were perceived as unsafe by household participants included: rivers, wells, lakes and roads. Nonetheless, in relation to burn injuries, kitchens areas were considered the most hazardous. For example:

"The children can get burn injuries in the kitchen because there is fire – sometimes when I'm cooking even if they are with me when I'm cooking sometimes I would leave the kitchen to get salt from the living room but the kids are playing in the kitchen so they can easily get injured by the fire."

Int_Compound_PT1

Although the kitchen was recognised as an unsafe area due to the continual use of fire for cooking, not all households had a designated kitchen and as such children would equally be exposed to fires outside and around their homes. For example, in contrast to participants who considered their courtyard areas safe, others noted that these could also be hazardous for example:

"Even outside here there can be dangerous places as there is also cooking fires which can cause injuries."

Int_Kapeta_PT4

"There are a lot of rocks; lots of stones around this house that the children can bump into when they are playing it can make it dangerous if they fall on to the fire."

Int_Compound_PT2

Moreover, although some participants reported that their house was a safe place for the children to be, others considered these spaces hazardous for children:

"I think the living room is safe because there is no fire, but then sometimes a house maybe will fall and can also present a risk to the children."

Int_Compound_PT5

"A house can be dangerous if it is not properly built it can fall on you or bricks might fall onto a child when they are sleeping it happens, three times we have re-built this house."

Int_Mtika_PT9

This section has outlined parental perceptions of places that are safe and unsafe for children to play. As a result it provides some context and understanding of the environments in which children sustain burn injuries. Even spaces that were considered safe by some parents were often not free from hazards. With regards to burn injuries, it is clear that with limited safe spaces in which they can be occupied, children may find themselves near open fires or in the kitchen.

7.2.1.3. Seasonal hazards

Participants described that the risk of certain injuries could increase during a particular season. For instance, burns were described to occur during the cold season when children wanted to place themselves near the fire for warmth:

"If it is cold the whole day then the children are most likely to be around hot fires and the parents are not usually there, I might have to go and fetch water and the children are left alone."

Int_Chonde_PT1

"Burn injuries are most likely to happen during the cold season than the hot season. It is very cold and the easiest way to get warm is to sit by the fire."

Int_Compound_PT8

In addition, one participant highlighted that burn injuries may occur in harvest season as fires are made to clear the land:

"Fire accidents the wild fire accidents happen during this season where we are harvesting and more people are using the open fires, then to clear the bushes around the house or you know what we do, we put the stocks together and then we put fire on it."

Int_Mtika_PT5

Certain times of day were also associated with the occurrence of injuries as participants explained that during the early morning the weather is cooler and fires are needed for preparing food, bath water and heating:

"In the morning hours they are feeling cold so they go close to the fire the children want to heat themselves they come near so if there is a hot pot boiling water then it can accidently fall and maybe they can burn themselves."

Int_Kapeta_PT3

"It is like for example burns from hot water would be more likely to happen in the morning because, I would usually prepare tea in the morning and that is when water really can boil and be left for a long time boiling and a child can get injured unlike when I am preparing nsima."

Int_Compound_PT3

However, not all participants agreed that there was a particular season or time of day, that burn injuries were more likely to occur:

"Accidents can happen anytime because any time at any house there is a fire going at one time or another so it doesn't follow any time or season if there is a fire going an accident can happen."

Int_Mtika_PT8

As such, due to the continual use of fire, burn injuries could potentially occur at any point throughout the day or year.

7.3. Perceptions associated with the prevention of burn injuries in the home

7.3.1. Key themes

Four themes emerged from the data relating to parental perceptions and approaches to injury prevention including:

- previous knowledge of injury prevention strategies
- perceptions of injury prevention
- existing methods of preventing and managing risks
- barriers to injury prevention

This section will explore what parents know and currently employ with regards to injury prevention as well as their existing beliefs around the preventability of childhood burn injuries.

7.3.1.1. Previous knowledge of injury prevention strategies

Parents explained that their awareness of injury prevention strategies came from either their family or community health workers. For instance:

"Parents advise new parents, like my parents advised me to make sure that the children are not sitting closer to the fire they also advised that when it has rained that children should not go to the rivers because the rivers are usually flooded."

Int_Compound_PT8

"My mother taught me to be putting my baby at the back when cooking to stop them touching the fire."

Int_Nkhata_PT8

Health professionals were reported to provide information during community visits, hospital clinics and appointments:

"The HSAs come maybe twice a month they have taught use things like the dangers of water and how to keep our water safe from children like the wells. They also tell us about how to protect the children from fire because there are some more burns cases in the hospitals so when they come they will also tell us how to take care of their children so they may not get burnt as well."

Int_Kapeta_PT4

"During my clinics there would be some people who would be talking about that in the hospital. We were told to protect the children from fire to make sure that they do not make fire inside the house, and to make sure that when we are making a charcoal stove; we let all the charcoal burn before you take it into the house because if some of the charcoal is not burnt, then it produces carbon monoxide which would be dangerous to the whole family."

Int_Compound_PT7

Conversely, while some participants were provided with health advice, others stated that this did not include information on injuries:

"When we go for the antenatal clinic they talk about feeding babies and looking after the babies but not about injuries like fire injuries or whatever they are only engaged in inoculations and how to look after you baby and what you should do if your child is sick they don't say "what you should do if your child gets burnt or falls down and breaks a leg" that is not they don't do that."

Int_Mtika_PT4

"The health people who come to [...] the under 5s clinic they talk about how [...] to prevent diseases but they do not talk about injuries or accidents."

Int_Mtika_PT7

These findings highlight that while parents have access to health advice, information provided on injury prevention is sporadic and inconsistent.

7.3.1.2. Perceptions of injury prevention

The concept of injury prevention itself was also explored with participants. As a result, it was found throughout the data collection period, that not all participants considered injuries as something which could be prevented. Participants reported that the occurrence of injuries was, in some cases, external to their control. For instance, some participants cited charms, bad luck and other people for the cause of burn events:

"It is bad luck all the accidents that happen to us is because of bad luck, you can't prevent really, some accidents just happen and you don't know that they will happen so it is difficult to prevent."

Int_Compound_PT4

"There is very little that we can do to avoid accidents because some of the accidents they just happen. There is no way, you can't prevent an injury happening, you can be careful sometimes. But then sometimes even when you are careful then someone else comes along and causes an accident on you and you can't prevent that."

Int_Mtika_PT9

Nonetheless, it is important to note, that the process of discussing the preventability of injuries across languages is challenging. For instance, the translators reported that it was sometimes difficult to differentiate the word injury from the word accident. Therefore, while some

participants may have indicated that accidents on the whole could not be prevented they might indicate that certain injuries could be prevented.

"You can avoid injury with children climbing up the trees you tell them "don't do that if you go up the tree then you can fall down and injure yourself" so you are trying to tell them to avoid the injury but accidents, accidents are an accident there is no way you can tell I'm going to have an accident."

Int_Mtika_PT8

Moreover, other participants explained that injuries, to some extent, could be prevented by employing prevention strategies. These strategies will be explored further in the following section.

7.3.1.3. Existing methods of preventing and managing risks

Participants described a number of methods that they currently employed to prevent injuries and manage risks around the home. These strategies included:

- separating, reducing or removing the hazard from children
- parental supervision of the children
- providing guidance to the children

7.3.1.1.1. Separating, reducing or removing the hazard from children

To separate, reduce or remove hazards from the children parents explained that they made physical adjustments to their home environment including the use of material barriers, extinguishing fires and regularly cleaning the home surroundings:

"When the child has become mobile we may put the food which is hot somewhere there so we usually try to avoid putting it on a place where a child can reach!"

Int_Nkhata_PT5

"I usually close the kitchen because the kitchen has a door so I make sure that the kitchen is closed."

Int_Compound_PT2

"When I am cooking nobody is in the kitchen apart from me or the 13 year old. I have told him that when he is cooking that the other children should not be in the kitchen so the children are usually out here playing. I want to make sure that I prevent the children from getting injured with the fire or hot water."

Int_Compound_PT7

Participants also explained that they could place material barriers between their children and fires by using an ICS:

"Using the fixed stoves they can prevent some injuries because the fire is inside the stove."

Int_Kapeta_PT2

"Using the fixed stoves make it safer because these stoves the fire is inside, even the flames are kept inside."

Int_Kapeta_PT3

In addition to creating a barrier, some participants explained that they attempted to remove hazards by putting fires out after use:

"We have to make sure that when you have finished cooking that you put the fire off and when you are using a candle when you are about to sleep you have to put off the candle as well."

Int_Kapeta_PT3

"Even if I tell the children about the dangers of fire or not to play with the fire children are children they will still play with fire even if I am not around. So I think the best thing to prevent burns from the kitchen is to put off the fire when I have finished cooking."

Int_Compound_PT2

Furthermore, to prevent the spread of fires participants explained that they would clear any combustible waste away from their homes:

"You can prevent injuries by making sure that the area is safe, I am talking about the bush fires, you can clear the surrounding area so that when you do your outside fire there is no chance of that fire getting out of hand."

Int_Mtika_PT3

"After you have cleared bushes or those grasses then you continue to sweep, sweeping away from the house why? because sometimes there maybe fires coming so when the fire can come it may mean that we have a boundary to stop your house burning."

Int_Nkhata_PT8

7.3.1.3.1. Supervising children

Parents explained that to prevent injuries occurring they would carry babies and infants on their back:

"I keep an eye on the child so I can make sure that the child is not putting anything harmful in the mouth or picking anything that can injure the child, when I am maybe going to fetch water or go elsewhere out of the house. I would not leave the child I would carry the child on my back to wherever I am going."

Int_Compound_PT5

"I am preventing the child from being injured because when I am cooking the whole concentration of me is on the food that I am cooking so if the child goes away it means that she may injure herself because the child is still young and to put the child at my back is the best thing to prevent."

Int_Nkhata_PT1

Mothers explained that they would do this up until the child became too active or too heavy to continue carrying:

"It's like when they are four years they are more active so to put him at the back sometimes he will refuse they are more like playing so you better let them down to play."

Int_Kapeta_PT4

"I struggle with the baby now because he is older he wants to come out, he doesn't just want to be confined at the back he wants to get active and do his own things"

Int_Compound_PT3

However, once a child became too difficult to carry or was superseded by a younger sibling they might then be left while the parents continued with their household chores:

"You would carry them to 3 years mostly unless it is a small child, but then you cannot carry at 4 years of age you can't carry him and go working, unless he is ill [...] but to say if we want to carry and fetch water then you wouldn't carry them on the back. No! You see what I am saying you would leave him at home and do whatever you want or need to do."

Int_Mtika_PT1

Therefore, although this method of preventing injuries may be effective for babies and infants this form of protection is time limited.

7.3.1.3.2. Providing guidance to children

Participants explained that they would teach their children about household risks to prevent them from sustaining injuries in the future:

"I have taught my son that when I am away at work and his is with the children that he makes sure that the children are not playing closer to the rubbish pit."

Int_Compound_PT7

"We pass on the information so it is like when we are sitting with the children it doesn't matter which age we would be talking about it even as they are getting older we would still be talking about not going into the deep river or not playing with the fire."

Int_Compound_PT8

"We can play it safe by instructing our children in the correct way, if they are taking their fire to start their own, to play house, you have to have to tell them "if you are not careful you can get burnt" or if a child is just running around crazy you try to stop them and say "whatever you are doing you will end up falling and hurting yourself" so I suppose it is about telling a person or a child stop what you are doing."

Int_Mtika_PT2

"If I see my child holding something which can hurt them I will say "stop doing that" or "leave that" or tell them the dangers of anything they are trying to do."

Int_Mtika_PT7

This section has demonstrated how certain methods of injury prevention are currently employed by participants. However, whilst parents reported such practices, it is not possible to determine if they were effective or consistently carried out. Moreover, during the observational phase of the data collection, it did not appear that there was always space to remove

hazards from the children due to a lack of lockable storage spaces or kitchens for containing the cooking fires. It was also observed that not all households practiced the preventative measures they had reported during the interviews.

7.3.1.4. Barriers to injury prevention

Parents reported that there were barriers to providing consistent injury prevention strategies in the home. These barriers included: a lack of knowledge, a lack of equipment, a lack of control to make alterations to their housing, difficulties controlling their children and an inability to provide continuous supervision.

Participants indicated that parents can lack an awareness of the causes of burn injuries and the methods to prevent them:

"A lack of knowledge, like those who do not even go to school they don't know how they can prevent any other injuries or accidents when they are crossing the roads they even don't know what to do."

Int_Kapeta_PT3

"Ignorance because people don't know how to do it how to prevent, so it is what stops them from preventing because they don't know what to do to prevent so it goes back to the ignorance."

Int_Compound_PT4

However participants also noted that, even if information is given, not all households would take notice:

"Some people just choose not to listen to whoever is providing the information they can attend the training and hear the information but they just don't want to apply it."

Int_Compound_PT7

"They pretend as if they listen when people are telling them something but in reality they don't."

Int_Nkhata_PT7

Nevertheless, in addition to a lack of knowledge about injury prevention, participants also reported that a lack of equipment is a barrier to providing protection against burn injuries:

"Sometimes a lack of equipment to prevent those accidents, a lack of cooking stoves, the method of cooking as I am using the (fixed) cooking stove, and that cooking stove can prevent injuries in the way that the fire is inside so I cannot even harm myself when cooking like using the 3-stone-fire but not everyone has one."

Int_Kapeta_PT1

In addition, participants reported that they lacked the capacity to make changes to their home environment. This was often associated with rented properties or a lack of finances:

"I am not able to change anything because money wise I don't have the means to make changes."

Int_Chonde_PT2

"If it was my home I would change or move some other things but because it is a company house I rent it so I can't."

Int_Compound_PT4

The behaviour of both children and parents was also, in some cases, described as a barrier to maintaining injury prevention strategies. For instance, although parents reported that they taught their children about hazards around the home, they could not be certain that their children would follow this instruction:

"You tell them to stop doing this, you leave them there you go elsewhere they will still continue doing whatever, this is why it is difficult to really prevent accidents because children will always be troublesome."

Int_Chonde_PT2

"You may tell the child not to touch the fire and then the child touches the fire deliberately."

Int_Nkhata_PT1

"I can't think of anything that can stop accidents from happening for us because a child is a child and they are bound to do something that they are not expect to do"

Int_Chonde_PT2

Moreover, although parents indicated that they utilised supervision as a key strategy in preventing injuries they were not always able to implement this strategy:

"Sometimes I get sick and I will be sleeping in the house and it will be difficult for me to look after the child and the child can get injured if she is not closely monitored."

Int_Compound_PT6

"You may teach a person that "you must be close to your children" but then that person is supposed to go to the market and maybe do businesses so they can find money then they may say "no I cannot go with my child to the market I will be busy caring for a baby and then doing this business so the best thing to do is leave this child with another child."

Int_Nkhata_PT2

The quotations above highlight that, although participants reported numerous injury prevention strategies these activities could be difficult to implement and sustain owing to a lack of equipment, the capacity to

make changes the home environment, the unpredictability of children and the parent's ability to provide continual supervision.

7.4. Chapter summary

This chapter has explored the participants' perceptions of home hazards and their prevention. In particular, the chapter has reported on the types of risks parents perceive to cause burn injuries and areas which they considered to be safe or unsafe for their children to play. However, it was observed that, even spaces that were considered safe by some parents were often not free from hazards. The cold season and morning period were also perceived to exacerbate the incidence of burn injuries as water is boiled and fires are made for heating.

The second part of the chapter focused on the perception of injury prevention and existing strategies parents use to reduce injury risks including: separating, reducing or removing the amount of hazard, as well as supervising and teaching their children about burn risks. However, participants indicated that, due to a lack of equipment, knowledge and capacity to supervise their children these efforts may not always be implemented. The following chapter will now explore key characteristics associated with burn events as described by household participants.

8. Chapter eight: Characteristics associated with burn events

8.1. Introduction

This chapter focuses on exploring the factors associated with actual burn injuries which occurred during the 12 months prior to the data collection in each village area. The description of burn incidents, as provided by guardians, could be divided in the three categories:

- pre-event and event
- post-event
- exceptional events

Each of these categories and their associated themes will be explored throughout the chapter. However, before examining them in more detail, the chapter will describe the key characteristics and features of the injured children and the associated burn event.

8.2. Characteristics of burn injuries

8.2.1. Key characteristics of the injured children and the associated burn event

Table 21 highlights the characteristics of the children who encountered burn injuries during the 12 months prior to data collection in each village area. Although the sample obtained was not designed to demonstrate statistically significant factors, it does provide insight into key aspects associated with childhood burn injuries in Malawi. For instance, the sample was determined on the basis of a qualitative research paradigm, rather than quantitatively powered, in order to illuminate characteristics associated with the occurrence of burn injuries, which at present is often lost or not captured by existing hospital records or the wider literature.

Table 21: Key characteristics of the children and associated burn event

Participant Code	Age	Gender	Location	Time of Day	Month	Activity	Cause	Source of heat	Witnessed	Previous child burn injuries in HH
Compound										
COMP_1	8-9	F	KITCHEN	M	MAY	C	Hot Porridge	3SF	-	Y
COMP_2	8-9	M	KITCHEN	MD	DEC	C	Hot Porridge	CM	-	Y
COMP_2	6-7	M	OUTSIDE	MD	JAN	MT	Plastic	3SF	-	Y
COMP_2	4-5	F	OUTSIDE	MD	MARCH	PP	Charcoal	3SF	-	Y
COMP_3	2-3	M	KITCHEN	MD	SEPT	EP	Beans	3SF	-	N
COMP_4	4-5	F	VERANDA	E	MARCH	EP	Hot Porridge	3SF	-	N
COMP_5	0-1	M	OUTSIDE	E	JUNE	EP	Charcoal	3SF	-	N
COMP_8	4-5	M	KITCHEN	M	JULY	H	Unknown	3SF	-	N
COMP_9	14-15	F	KITCHEN	N	MARCH	C	Hot Porridge	3SF	W	N
Kapeta 2 and Chonde										
CHONDE_2	2-3	M	OUTSIDE	M	FEB	EP	Firewood	OF	-	N
KAP_1	4-5	M	KITCHEN	M	MARCH	EP	Firewood	3SF	-	N
KAP_3	2-3	M	KITCHEN	M	NOV	EP	Boiling Water	FRS	W	N
Mtika										
MT_1	10-11	M	SCHOOL	M	OCT	E	Hot Porridge	NA	W	N

MT_2	6-7	F	OUTSIDE	MD	APRIL	PP	Boiling Water	3SF	-	N
MT_4	2-3	F	VARANDA	M	FEB	EP	Boiling Water	3SF	-	Y
MT_5	6-7	F	COURTYARD	M	OCT	C	Hot Porridge	3SF	-	Y
MT_6	6-7	F	KITCHEN	M	JUNE	C	House Fire	3SF	-	N
MT_7	2-3	M	COURTYARD	M	FEB	H	Firewood	3SF	-	N
MT_8	2-3	M	COURTYARD	M	OCT	EP	Hot Porridge	3SF	-	Y
MT_9	0-1	M	OUTSIDE	M	APRIL	H	Open Fire	OF	-	N
Nkhata										
NKT_1	4-5	M	KITCHEN	M	NOV	H	Hot Porridge	3SF	-	Y
NKT_2	2-3	F	HOUSE	E	APRIL	EP	Boiling Water	ChM	-	N
NKT_3	2-3	F	VERANDA	M	FEB	EP	Boiling Water	ChM	-	Y
NKT_4	2-3	M	HOUSE	M	NOV	H	Steam	ChM	W	Y
NKT_5	0-1	F	KITCHEN	MD	AUG	EP	Firewood	3ST	-	Y
NKT_6	2-3	M	KITCHEN	M	JUNE	EP	Boiling Water	3ST	-	Y

Abbreviations: M= Male, F= Female, M = Morning, MD= Mid-day, E=Evening, N=Night, 3SF= 3-stone-fire, CM= Chitetezo mbaula, ChM= Charcoal mbaula, FRS= Fixed Rocket Stove, OF= Open fire, - = Not witnessed, W = Witnessed, EP = unoccupied play, H = heating, C= cooking, PP = Pretend play, MT = Making toys, E= Eating

Colours: Blue= Cold season, Green= Warm and wet season, Red= Hot and dry season

8.2.2. Age and gender of injured children

The majority who suffered burn injuries were 2-3 years old (n=10) followed by, 4-5 years (n=5), 6-7 (n=4), 0-1 years (n=3), 8-9 years (n=2), 10-11 and 14-15 (n=1). Eleven of the burned children were female and fifteen male. The study sample is not sufficient to draw conclusions about the prevalence of burn injuries on the basis of age or gender. However, this information has been added to provide a complete description of the children, who experienced the burn injuries, which are discussed throughout this chapter.

8.2.3. Location burn injuries occurred

The majority of the burn injuries occurred in the kitchen (n-11) or the spaces outside used for cooking such as the veranda (n-3) or courtyard space (n-3). Other burn injuries were sustained in outside areas (n-6) where children were playing or making their own open fires for heating. Two burns occurred inside the home, both caused by charcoal mbaulas which had been moved inside to warm water, cook and provide heating for example:

"...the baby woke up and started walking and fetching for me so as I have already said I put the mbuala sometimes there in the hallway so I had to put water for the husband so when he comes he should take a bath after me. While she was looking for me she did not know that there was an mbaula here so she just moved the mbuala and then the water fell and so she was burnt in that way."

Int_Nkhata_PT2

8.2.4. The time of day and seasons where burn injuries occurred

Mostly burn injuries occurred during periods that food was being, or had been, prepared with the majority occurring in the morning (n=16) followed by mid-day (n=6), evening (n=3) and night (n=1). While each

period is related to food preparation, the morning was also associated with: cooking particular foods for selling, warming water for the family to wash before work and school as well as space heating, for example:

"I would usually only prepare tea in the morning and that is when water really can boil and be left for a long time boiling and a child can get injured…"

Int_Compound_PT3

"I prepare bathwater around half five after preparing the breakfast. I then prepare bath water for the children and the husband. Especially when I am busy I will use all my stoves for cooking so it's like there is porridge on the stove (fixed rocket) and the bath water is on the 3-stone-fire. There is a lot going on at that time."

Int_Kapeta_PT1

"Mostly in the morning it is cold, when we are making fire the children want to heat themselves then when we are making the porridge they may also come near."

Int_Kapeta_PT3

The time of year burn injuries occurred was spread throughout the 12 months prior to data collection, with one to four burn injuries recorded each month, with the exception of January where no burns were reported. However, in relation to season, 16 injuries occurred in the warm and wet season, six in the cold season and four in the warm and dry season. Nonetheless, due to the short duration of the study and the nature of the sample size statistical conclusions cannot be drawn about seasonality and prevalence of burn injuries. However, this information allows future prevention initiatives to recognise the types of burns risks which can occur throughout the year, regardless of season.

8.2.5. Previous burn events experienced by households

Of the households who experienced a burn during the data capturing period, ten reported that either the same or a different, child within the household, had previously sustained a burn injury. One household, Comp_PT2, reported three incidences of burn injuries, one per child, during the 12-month data capturing period. Therefore, for the purpose of data analysis and presentation, each of the burns from this household, has been recorded in Table 21.

8.3. Pre-event and event characteristics

8.3.1. Key themes

During the interviews participants were asked to describe the burn events they identified during the household survey in more detail. To develop a deeper understanding around these events, participants were prompted to provide a history that included: what the child was doing immediately prior to sustaining the burn, the cause of the burn and the location of the child's parents (or carer) when the burn occurred. It was anticipated that these descriptions would add depth to the existing epidemiological literature which, recognises risk factors but lacks information on the more specific cultural circumstances that lead to burn injuries.

8.3.1.1. Activities leading to burn event

The activities children were involved in when they sustained their burn injuries could be categorised into the following groups: exploratory play (n=11), heating themselves (n=5), preparing food (n=5), pretend play (n=2), making toys (n=1) and school dining (n=1).

Exploratory play, as described in Chapter 6, has been used to define episodes where children are not engaged in a formal game, but they are moving around their environment at random discovering their

surroundings. Eleven of the children identified in this study sustained their burn injuries during these periods of exploration. For example:

"I had already done the fire like I normally do and put water on the fire and this girl woke up and then for some reason she went and put her hand in the boiling water then heard her crying and found what had happened."

Int_Mtika_PT4

"The child decided to enter the kitchen and he touched one of the stones and then the pot fell and the hot water burned him."

Int_Nkhata_PT6

Five of the children sustained their burn injuries while heating themselves with fire:

"When the 8 year old woke up in the morning, she took the baby with her to the fire where everybody was warming themselves and somebody stepped on one of the logs then one of these logs moved on to the baby's foot, because he is always all over the place! It landed on his foot and then he had a big burn…"

Int_Mtika_PT9

A further five children sustained their burn injuries while cooking. These cooking related injuries were seen to occur in the slightly older children aged 6-7 (n=2), 8-9 (n =2) and 14-15 (n=1) as they begun to take on more household responsibilities:

"She (aged 8) was preparing porridge back in the village for her sister, she was trying to take the pot from the stove so that she could serve the porridge in the plates and in the process of doing that it poured on her leg."

Int_Comp_PT1

"Charity (aged 6) was making porridge for the baby, I don't really know what happened because I was not there but some of the porridge landed on her face causing a blister."

Int_Mtika_PT5

Two children aged 6- 7 years sustained injuries playing the game "house":

"Everyone had made their own fire and when the fire was going out this little girl was trying make the fire keep going and so she was busy blowing on the fire and then, she stepped on one of the logs which upset the water that was boiling [...] it fell on her arm and she was crying [...] she said "oh my pot has fallen off the fire and it has burnt me."

Int_Mtika_PT2

"She was actually trying to get fire from the kitchen to go and play house to make her own fire outside and she lost balance and fell on the fire and got a burn under her arm."

Int_Compound_PT2

One child was reported to have recently sustained a burn injury in the process of making a plastic ball. In addition, three participants explained that, although their children had not sustained this type of burn during the previous 12 months, their children had experienced these types of burn injuries in the past:

"When he was making a ball the plastic paper got stuck onto the skin so when we removed the plastic paper it formed wound and it took the skin off."

Int_Compound_PT2

(Respondents child) "When the parents are through with cooking that we go and make these balls, I had a burn from it, I was burning a piece of the plastic paper and as it was burning it somehow spit here and stuck to my skin."

Int_Nkhata_PT6

The above descriptions indicate that younger children are seen to sustain burn injuries during periods of exploratory play, whereas slightly older children sustain burns during periods of cooking and pretend play.

8.3.1.2. Heat sources associated with burn events

During the process of obtaining the burn history, participants were prompted to identify the heat source which caused the burn in addition to the stove, if applicable, that the child was near or using. It was found that hot porridge was the most prevalent cause of injury (n=8) followed by: boiling water (n=6), firewood (n=5), charcoal (n=2), beans (n=1), plastic (n=1), open fire (n=1), house fire (n=1) and steam (n=1). As such, it was observed that exposure to hot liquids and fuel components, rather than direct contact with the stove, resulted in the majority of burn injuries. In addition, while households themselves may have adopted an ICS, children continued to make their own or use existing 3-stone-fires for their pretend play, to make toys or heat themselves.

8.3.1.3. Presence of guardians

Of the burn injuries which occurred across the sample households 22 out of the 26 burn injuries recorded were not witnessed by a guardian. This situation reflects that, parental roles and obligations can sometimes result in young children being left without the supervision of an adult:

"I had put pigeon peas on the fire to prepare like relish for lunch, the child started crying saying that he was hungry so, I told him "just wait a little bit the relish is about to cook so we will soon be preparing nsima for lunch" so I left the child here crying and took a bucket and went to fetch water and

then when coming back I saw the child was trying to dip his hand in the pigeon peas, was trying to take the beans to eat because he was hungry."

Int_Comp_PT3

"I had gone to the river to do my laundry so while coming I heard my son crying from a distance so I rushed home and found that he had a paper on his hand and his arm that is when I knew this is what happened."

Int_Compound_PT2

"I had left the children while I had gone to fetch more firewood that morning."

Int_Chonde_PT2

8.4. Post event characteristics

8.4.1. Key themes

During the interviews participants were asked about the events which followed the burn injury, these discussions led to the development of the following themes:

- the initial treatment
- consequences of the injury for the child and family
- changes made following the burn event

8.4.1.1. Initial treatment

Although this research is specifically dealing with primary prevention, it is important to acknowledge the actions taken by families following a burn event, particularly where these actions may have a detrimental impact on the outcome of the child. For example, traditional remedies were commonly described by the study sample with 19 of the burns reported to have been treated with one or a combination of the following; salt, ash, flour, soil, glycerine, leaves and raw egg. Moreover, while these treatments may cause wound infection and impair healing,

these initial forms of management delayed urgent medical treatment as households waited to observe the effect of their remedy:

"I immediately took a raw egg and broke it and applied it within some hours there was a big blister that came out. The following morning the blister had burst. We removed the skin to leave it open and I was washing it with salty water every day for a month. After that I saw that it like kind of had an infection and the wound started growing again and it started affecting the vein maybe the burn plus there was infection so he was failing to walk properly that is when I went to the hospital."

Int_Comp_PT8

"We put an egg the usual remedy is an egg, but we didn't go to hospital that same day we thought it would be OK but the following day it looked a lot worse and the child seemed ill so we took him to the hospital."

Int_Mtika_PT9

Nonetheless, the delay in seeking hospital treatment was also associated with the cost or mistrust of medical services:

"We used you know ashes, on the wound we couldn't afford to go to hospital and we don't have a government clinic around."

Int_Chonde_PT2

"My husband took the child to the African Dr we didn't go to the hospital. If I had taken her to the hospital they would have put a bandage on her and I didn't want that because the bandage would have made the wound worse."

Int_Mtika_PT2

"Even if I could go to the hospital I doubted I could get any particular help for burns."

Int_Compound_PT5

8.4.1.2. Consequences of the injury

The consequences of these burn injuries, as described by guardians, included physical and emotional suffering, educational loss and financial debt. For instance physical and emotional suffering was described as follows:

"It took a month for the wounds to heal but even now she is feeling pain here (axilla) when you maybe want to pick her up to carry her. There is scarring there, so if you just lift her arm like that she feels much pain, she doesn't lift it herself she won't!"

Int_Nkhata_PT3

"It had happened he was this disabled and no longer walking he could not be able to do what his friends are able to do like going to school and playing around."

Int_Mtika_PT1

Moreover the children missed out on education as they were no longer able to attend school:

"But he was in a lot of pain and in that four months he didn't go to school."

Int_ Mtika_PT1

"He was not able to walk properly so he couldn't go to school like this and was home for almost two months."

Int_Compound_PT2

Despite the provision of free treatment at government health facilities the cost of transport as well as taking time away from income generating activities resulted in a degree of financial loss:

"I couldn't sell goods or look after the garden; I needed to be at home to be able to look after the child. It took my time to take care of the wound every morning I had to make sure that I had cleaned the wound and applied the

medicine so I had to use some of the time that I would use doing other things."

Int_Compound_PT2

"We were affected because instead of going to fetch piece works we were caring for the patient."

Int_Nkhata_PT5

This financial debt was increased for families who accessed paid care at a CHAM hospital, private medical facility or herbalist:

"Yes we were worried that the child was sick our work was stopped, our farming work, our business was delayed and even the cost we were paying at the hospital. The money that I had made with my business was affected because I use the business profit, capital money for the payment of the hospital bills."

Int_Kapeta_PT3

"There was a great problem because it means we used everything we had at the hospital. There was a very big problem because the money that we had all of them were used at the hospital."

Int_Nkhata_PT3

"The herbalist he who sold us this capsule to put on the burn I don't know what it was. But when I had not got any money to go back to him and buy these things I opted to go to the clinic"

Int_Mtika_PT7

Although the extent to which each of these consequences influenced participants varied, these reports demonstrated that burn injuries resulted in a degree of physical and emotional suffering, time out of education and financial loss for families who are already living in economically unstable situations.

8.4.1.3. Changes following a burn event

Participants discussed changes which had occurred following the burn event. These changes included making alterations to their environment and their perceptions of these events. The former of these changes included making adjustments to the home or methods they used to care for their children so as to prevent further burn injuries:

"I can't explain it, but it was a wakeup call I think, leaving the children on their own, so now I make sure that I am with the child when I move out of the compound."

Int_Chonde_PT2

"We are making sure that when we were in the kitchen so that the child is remaining with someone so that he might not go by again or anyone is going in the kitchen, I am always making sure that the child is with someone."

Int_Kapeta_PT2

"These days when I have finished cooking I lock the kitchen door so the children don't go into the kitchen."

Int_Compound_PT2

"We still leave the children on their own but we don't leave fire we don't make fire or leave fire on for the children."

Int_Nkhata_PT5

Participants also indicated that, in some cases, their opinion of these events had changed. Whereas before they may not have considered such incidents would occur to them, they become more aware of these injuries and risks:

"My opinion changed because I never ever expected that my child could get burnt and have this injury but I knew this could happen anywhere because

the children are not always in the house and it can be he is playing and it can happen."

Int_Kapeta_PT1

"Even my opinion has changed because now I am thinking, I think that by then I was less thinking than now but now thinking that these accidents can happen anywhere any how if you are not careful enough."

Int_Kapeta_PT3

Nonetheless, not all participants experienced such changes and expressed that there was nothing that they could do or changes they could make that would prevent these incidents occurring again in the future:

"I didn't change anything because as a mother I have to keep going and cook for the children fetch water for the children or heat water for the children to bath."

Int_Mtika_PT4

"You can't tell what will happen next because you never know what can happen in the future."

Int_Compound_PT5

Although some participants reported that they had made changes following the burn events, it is difficult to establish if these changes had been made and sustained. For instance, three participants commented that despite having the intention to change certain behaviours they were not sustainable:

"We will not sustain this change because for me to get another charcoal mbaula and to use separately for heating it requires more charcoal and because charcoal is scarce so we will not manage this."

Int_Nkhata_PT4

"I am thinking that as much as I am locking the door to the kitchen at the moment I think sometimes I might begin to forget."

Int_Compound_PT2

"For the place I don't think I am able to change anything because I don't own the place so it is difficult to make changes to anything."

Int_Compound_PT1

8.5. Exceptional events

8.5.1. Key themes

The last section of the chapter brings together two key themes in relation to the participants' perception and understanding of what a burn injury is, as it is these factors which influenced the participant's disclosure of a burn event. These two themes are:

- what is a burn injury?
- expected burns and unexpected burns

8.5.1.1. What is a burn injury?

It became noticeable during the data collection that, while burn injuries occurred frequently around the home not all were reported to the researcher. The rationale for these nondisclosures appeared to be related to what participants actually considered to be a burn injury "worth" reporting. Therefore, participants were asked to consider what they thought constituted a burn injury and when they would report one.

"I thought since these ones were just minor they were not really something that anyone would consider a burn really. To me the one I went to the hospital with is what I consider a real burn."

Int_Compound_PT2

"If there is a really big wound I would say something, if it is something very small I wouldn't tell anyone even the neighbour, but if it is a big wound that is visible then I would tell."

Int_Compound_PT7

"It is only when it has formed a blister which after bursting it would form a bigger wound, but if it is just being burnt from hot porridge while cooking it is not really a burn injury."

Int_Compound_PT8

8.5.1.2. Expected burns and un-expected burns

The notion that not all burn injuries were worth reporting was also associated with the premise that, some burns are to be expected in this environment. For example burns were often expected as part of the cooking process:

"As long as you are in the kitchen and you are cooking you can get a burn or water can spill on you a little bit."

Int_Mtika_PT2

"It is normal to have these burns when you are cooking."

Int_Chonde_PT1

"Sometimes you can have an actual burning piece of wood on your foot that can happen it's normal."

Int_Chonde_PT2

"When you are cooking nsima properly you do things expecting that yeah I can get burnt."

Int_Compound_PT5

In contrast, burns which involved factors such as seizures, falling, pot tipping and out of control fires were considered not to be expected:

"The burns which are not expected are when the boiling water falls on somebody or a piece of wood accidentally burns somebody we don't expect those to happen you don't expect the pot to suddenly tip."

Int_Mtika_PT5

"Somebody who is suffering from epilepsy it happens suddenly and you don't expect someone would get burnt badly or you can trip and fall on the fire it can happen but it is not expected."

Int_Chonde_PT2

"Those with epilepsy can fit while in the kitchen yet you might not expect that they can fit they get burnt it is not expected to happen."

Int_Kapeta_PT4

"Those where you really get burned or when you step on a log which is hot or the water is tilted or poured on your leg or your arm the bigger burns you don't expect those to happen."

Int_Mtika_PT4

From these discussions, it became apparent that participants, to some degree, expected to receive small burns during the cooking process and although they might cause some level of discomfort they seemed part of life.

As such, the record of burn injuries across the study communities may be an underestimation of the true occurrences, as many households may not have considered reporting certain burn injuries.

8.6. Chapter summary

This chapter has described the characteristics associated with the burn events reported by participants which occurred in the 12-months prior to data collection. Although, it is not possible to determine the statistical significance of these characteristics, the in-depth information provided

by participants begins to provide a cultural and contextual picture of childhood burn events that is not yet considered in medical records or the prior literature. The second part of this chapter explored any changes parents made and the consequences for the child and family following a burn injury. This was followed by an exploration of the participants' perceptions around the definition of burn injuries. The next chapter will examine the households' perceptions of safety in relation to their cookstoves.

9. Chapter nine: Safety assessment of household cookstoves

9.1. Introduction

The nature of ground level cooking observed in Malawi, where food is prepared in areas where children have easy access to the stove, the pot, and the lit fuel, means that they are vulnerable to burn injuries. While it has been suggested that the use of ICS interventions may reduce the occurrence of burn injuries, evidence following the implementation of an ICS remains deficient (Mock et al., 2011). Therefore, this research has attempted to understand existing safety considerations relating to household stove use.

The rationale for conducting focus groups for this part of the study was to capitalise on the interaction between participants as they discussed their experiences. For instance, it was anticipated that any different perspectives of the stoves, may stimulate ideas and further exploration.

The existing BSSP, used by the GACC, was used to develop the focus group guide so as to engage participants in a discussion about the safety of their cookstoves. However, before examining the participants' responses the chapter will provide a brief description of the focus groups.

9.2. Focus group characteristics

9.2.1. Focus group participants

Table 22 indicates the number of participants who took part in the focus groups and the types of stoves which they use at home. The number of participants who took part in the focus groups exceeded the total number of interview participants, for instance in the case of Chonde, Kapeta and Nkhata the wife of the village chief also requested to take part.

All those who took part in the focus groups were women. For the households where males took part in the interview phase, a female member of their household took part in the focus group as they were considered to have more experience using the stoves.

Table 22: Focus group characteristics

Village	Number of participants in group	Stoves used at home	Stove(s) assessed
Chonde and Kapeta	Group A =4 Group B = 4	Fixed rocket stove , charcoal mbaula, chitetezo mbaula, 3 stone fire	Fixed rocket stove
Compound	9	Chitetezo mbaula, charcoal mbaula, 3 stone fire	Chitetezo mbaula
Mtika	9	Chitetezo mbaula, charcoal mbaula, 3 stone fire	Chitetezo mbaula
Nkhata	9	Charcoal mbaula, 3 stone fire	Charcoal mbaula, 3 stone fire

9.3. The stove safety assessment

9.3.1. Key themes

The existing BSSP protocol, used by the GACC, is made up of ten independent tests, listed below, which are designed to identify hazards that could cause burns and scalds, lacerations and abrasions and house fires (Global Alliance for Clean Cookstoves., 2015a, Johnson, 2005):

1) Sharp edges and points
2) Cookstove Tipping
3) Containment of fuel
4) Obstructions near the cooking surface
5) Surface temperature
6) Heat transfer to the environment

7) Handle temperature
8) Chimney Shielding
9) Flames surrounding the cookpot
10) Flames exiting fuel chamber, canister or pipes

It was decided to utilise the protocol as a focus group guide so as to: understand the tests from a user perspective, uncover real life experiences of household cookststoves, identify aspects of cookstoves that users may consider a problem, as well as how these factors may influence cooking a meal.

The chimney shielding test was not added to the focus group guide as none of the stoves used in the sample villages had a chimney design.

Unlike the data presented in the previous chapters this portion of the data was analysed by using both an open and priori coding system. For instance, participants' responses were categorised based their association with each of the BSSP testing procedures. Once this was completed, an open coding system was used to reveal sub-themes, associated with or, which had not been accounted for by the BSSP measures.

9.3.1.1. Sharp edges and points

During the focus groups, participants were asked to report any sharp edges or points on their stoves that they had noticed during use. When sharp edges were identified participants were then asked to discuss if and how this might impact on their cooking.

The findings indicated that sharp edges were most commonly associated with the 3-stone-fire and the charcoal mbaula. In contrast, sharp edges were not recognised by those using the ICS. For example, those using the chitetezo mbaula explained:

"No it doesn't have any sharp edges I don't see anywhere where you will be able to tear you cloth it is a good stove."

Mtika_Group

"The metal stoves, yeah it is possible to get the sharp edges to cut your clothes or cut your skin, because it has a lot of sharp edges the metal stove it happens if it cuts on your clothes sometimes it can tip and the stove would fall or the pot would fall and everything would fall on the floor that is why we are preferring this one it is smooth compared to the metal."

Compound_Group

In addition, participants using the fixed rocket stove explained they found the surface of the stove was generally smooth:

"The stove itself, there is no problem, it is smooth enough as far as it is sitting there it doesn't give us any problems. The only way we can get our cloths burnt is probably when there is too much fire and the flames are coming out from all the sides it happens sometimes but you just have to be careful."

Chonde_Group

However, they also explained that that fuel guide, circled in Figure 23, can develop sharp edges:

"Yes there are some corners and some sharp edges around the stove around this part, the fuel guide this is like sharp corners."

Kapeta_Group



Figure 23: Fixed rocket stove

In spite of this, participants reported that the fuel guide did not impact on their cooking process as the edges were not exposed during use:

"This guide there is no problem because the firewood is on top of it and it's not in the open. We are not touching it when we are cooking."

Kapeta_Group

This test reiterated that traditional cooking methods are a source of sharp edges which lead to lacerations and burn injuries.

9.3.1.2. Cookstove tipping

Participants were asked to identify if they had ever experienced their cookstove tipping. Consequently, they explained that their 3-stone-fire could tip regularly resulting in scald burns. For example:

Respondent: "These 3 stones sometimes they fall - so when they fall the things that you are cooking on top may also fall and in that way they may also cause burns to you.."

Interviewer: "How many people have experienced the stones tipping?"

Respondent: "Almost everyone! It is common! Everyone has got an experience! Sometimes even the stone itself may burn you because if it is not in the right place you might think "let me put this in the right position to make it stable" and then it may burn you or when a child or any person steps on the firewood that might cause the bricks to move…"

Nkhata_Group

Alternatively, the portable ICS assessed by the focus groups was only reported to tip if it was placed on un-even ground:

"It (chitetezo mbaula) is a stable stove nobody has experienced that tipping, if it leans on the side it means that they are not placing it on even ground so typically you would put it on a level place."

Mtika_Group

Participant responses to this aspect highlighted the difficulties households experience with their 3-stone-fires. Their responses here have

also indicated that the stability of an ICS can be influenced by the ground in which it is placed.

9.3.1.3. Containment of fuel

Participants were asked to demonstrate, without lighting, how they would typically load their cookstoves (as illustrated in Figure 24). The length of wood protruding from the stove was then measured by the researcher. The measurements for each group were as follows:

- Kapeta and Chonde group ~50cm
- Mtika group ~75 cm
- Compound group ~1m



Figure 24: Demonstrating the chitetezo mbuala (Mtika Group)

The length of firewood left protruding from the stove was attributed to different factors across each area. For example, Kapeta group explained that they loaded the wood to such a length so as not to disturb the cook:

"We leave it up to this place when it is much longer it can also disturb you when you are cooking so at least we make it not to be as much longer but up to this place is ok."

Kapeta_Group

Whereas Mtika group explained that they loaded their wood based on their perception that it would be safe for the users and children passing by the stove:

"We don't want to trip over so this is a safe size it is a good size for the children. Around the other side the children can walk around or sit around but this side we will tell them to avoid upsetting this firewood."

Mtika_Group

Alternatively, the Compound group explained that having longer pieces of wood made the cooking process easier when heating foods with a long cooking time:

".... it is just that if we are cooking for example beans that have to stay on the fire for a long time, we would not be bothering to go outside to bring in more wood we would just be using the same long log of wood ...."

Compound_Group

However, the groups also indicated that, there were a number of issues associated with the firewood left protruding from the stoves, such as tripping and spillages. For instance, although the Compound group preferred to use longer pieces of wood, they also acknowledged that this could cause injuries:

"Sometimes if you are not careful you can accidentally trip over the long sticks of wood."

Compound_Group

This analysis has highlighted that the length of firewood used in an ICS can vary based on a number of factors. In addition, it has recognised that the existing BSSP does not currently take into account the risks that protruding fuel may have on the safety of the stove and its impact on its users.

9.3.1.4. Obstructions near the cooking surface

Members of the focus groups were asked to explain if their stove had any obstructions near the cooking surface that might cause the pot to overturn or the contents to spill, and if so what impact this had on their cooking.



Figure 25: Demonstrating removing a pot with pot skirt from a fixed stove

Participants explained that the method of removing hot pots from their stoves was a "familiar process" as they had learnt to manage, regardless of stove type, to avoid sustaining burn injuries. For example:

"You are not holding on to it properly just pick and put it there, even a child will do it because they are used to it. So I can do it on and off and no big deal I won't even show any blisters there."

Mtika_Group

"When we can't remove the pot using our hands because it is very hot then we need to have something to support - a separate cloth or even sticks."

Kapeta_Group

However, participants using the fixed rocket stove did report they had difficulties when attempting to remove their pot from the stove's pot skirt (illustrated in Figure 25):

"It is difficult to remove it from the pot because the skirt is hot, we can't touch the skirt, so to remove the skirt we just we have to wait for it to cool so then there is a problem getting food out of the pot."

Kapeta_Group

"The pot and the skirt will stick together so it's difficult, its good, but it is difficult to cook the food, so we have to use our skills as ladies."

Chonde_Group

Nevertheless, while the pot skirt made part of the cooking process more challenging, participants reported that they liked using the skirt as it could speed up their cooking time. This aspect is discussed further in Section 9.3.1.7.

Therefore, none of the stoves assessed were reported to have obstructions that might overturn cookpots when removed from the stove. However, participants did identify parts of the stoves which may "stick" to the cookpot making the process of manoeuvring the pot and removing their food more challenging.

9.3.1.5. Surface temperatures

Initially participants were asked to report if, and when, they ever needed to touch the outside of their cookstove when cooking. They were then asked to provide their perception of the stoves surface temperature when in typical use.

Based on these discussions participants indicated that the surface of their stoves did not need to be touched during meal preparation. With the exception of the 3-stone-fire:

"You touch the stones because when you are cooking the stones they move, so it means they stop their job of supporting the spot so what happens is you may squeeze the other one inside and then you may squeeze the other one inside and then that one inside so you touch several areas and - ah they are very hot because even the colour of the stones changes to red!"

Nkhata_Group

The surface temperature of the chitetezo mbaula was reported to vary depending on the meal being prepared:

"If you are cooking some vegetables that doesn't take a long and it doesn't get that hot. But, if you are cooking something like beans if you are using this stove for a long time, it gets very very hot sometimes it gets red inside…"

Compound_Group

Furthermore, foods which take longer periods to cook would be left warming on the stove while the users attended to other chores. Therefore, unsupervised children are at risk of making contact with the stoves surface, potentially resulting in a burn injury.

Those using the fixed rocket stove reported that the main body of the stove, made from clay and brick, did not get hot:

"The outside of the stove is not hot, only the opening where we put the firewood gets hot."

Kapeta_Group

However, although the main body of the stove did not seem to become hot, some operational parts, which are made of metal, did. This is discussed further in Section 9.3.1.7.

Overall participants reported that, although they did not need to make contact with the body of the stove during use, the surface of their stoves could become very hot if used for a long time. This indicated that the BSSP, which states that the stove's surface temperature should be measure at approximately 20 minutes after ignition (Global Alliance for Clean Cookstoves., 2015a), does not take into account longer cooking times. Therefore, the protocol may not accurately record the maximum temperature the stove reaches when used by households.

9.3.1.6. Heat transfer to the environment

Focus group participants were asked to identify if the environment around their stove gets hot, and if so, to what extent does this impact on

their cooking. However, although the original test was designed to recognise the potential for the stoves to ignite surrounding materials, participants instead emphasised that excess heat could make cooking uncomfortable and create difficulties. Nevertheless, those using the chitetezo mbaula described that the heat emitted from their stove was bearable:

"It is a good heat it doesn't make us feel uncomfortable so we are able to finish whatever we have been cooking."

Mtika_Group

In addition, because the chitetezo mbaula is portable, participants explained if the heat in one place became too much, they could easily move their stove:

"When it gets really hot we take the stove outside so when the wind is blowing it is at the same time cooling the air around."

Compound_Group

Equally those using the fixed rocket stove described that the area around the stove may get warm but not too hot:

"It is only warm, the heat from the stove it's like radiation, yes warm not hot. Maybe during the hot season it is uncomfortable but if it is cold season it is good because it keeps us warm as it keeps the heat."

Chonde_Group

The discussions around this question highlighted that, while property damage may be a concern, participants indicated that excess heat transferred from the cookstove can make cooking difficult and uncomfortable. However, as seen in Chapter 5, these same cookstoves may also need to provide space heating and as such a certain level of heat transfer may be desired.

9.3.1.7. Handle temperature

Participants were asked to identify any operational parts that they may need to touch or handle when cooking, how easy these were to handle and any problems that may impact their cooking. These discussions highlighted that the areas of the stoves which needed to be touched when the stove was in operation included: the handles of the chitetezo mbaula and charcoal mbaula, and the pot skirt on the fixed rocket stove.

Nevertheless, the participants explained that the handles are not necessarily used to facilitate the cooking process but are used when they need to move the stove to another area. For example:

"When we are cooking we would not touch the handles at any point unless we are cooking outside and it starts raining that is when we would grab a piece of cloth or maybe leaves to use, to carry the stove (chitetezo mbaula) inside."

Compound_Group

"At the time of cooking those handles are useless your concentration is on the pot not the (charcoal) mbaula unless, sometimes you may need to move it inside the house so that you can warm yourself."

Nkhata_Group

Consequently, the users need to be able to comfortably touch the handles. As such, to move the stove, without getting burns, the groups explained that they would protect their hands using cloths or leaves, as also exemplified in the preceding Compound_Group quote.

As the fixed rocket stove is static it does not require handles. However, the stove does include a pot skirt that is designed to encircle, direct and maintain the heat towards the pot which participants explained could become very hot:

"The skirt it gets too much hot that we are unable to cook well, by all means we might get burnt while cooking. That we are unable to cook well without getting burnt."

Kapeta_Group

"We can't just cook without holding it there is a problem with the skirt because it is too hot and we can usually burn ourselves if we don't support it, or when sometimes it happens when we are trying. Because it is at the same level of the pot the skirt so we can't touch the skirt as it is very hot so sometimes we try to hold the pot inside so it because it can become sometimes difficult and we get burnt."

Kapeta_Group

Despite this difficulty however, some choose to accept this risk as they found the skirt allowed them to cook their food faster:

"These stoves are quick to cook even the dry beans because all the heat is concentrated on the pot so it really is a good stove for cooking fast!"

Chonde_Group

"They heat at the cook pot faster and this speeds the cooking so we use less fuel."

Kapeta_Group

As such it was recognised that while small burns could be sustained from the pot skirt it was more desirable for users to cook fast with less fuel.

9.3.1.8. Flames surrounding the cookpot

Participants identified that flames surrounding the pot were both necessary and a challenge. For example, it was explained that flames were, in some instances, required to cook their food properly:

"We don't find any problem it is something that we have gotten used to because if the flame is like that then it will give sufficient energy to cook properly."

Compound_Group

Notwithstanding, the presence of excess flames could also cause problems:

"I don't like it when the flames are very high the food will get burnt you need an average type of fire."

Chonde_Group

"We can get our clothes burnt when there is too much fire and the flames are coming out from all the sides."

Chonde_Group

"Sometimes if there is too much fire it may break a pot, it may cause a hole or make your pots dirty!"

Nkhata_Group

Although excess flames were most commonly associated with the 3-stone-fire, the volume of flames which surrounded the pot was also determined by the amount or type of wood inserted by the user:

"It also depends on the firewood that we are using there are some that produces a lot of flames and some not."

Kapeta_Group

Nonetheless, some participants using the ICS explained that once the firewood was burning they would remove any excess wood:

"If we want to start cooking, then we have to take off some of the firewood to make it manageable otherwise we will get burnt."

Chonde_Group

"As we are cooking we need it to be lower because once it has started boiling then you don't need the a big fire so that is when you can take some of the fire away."

Mtika_Group

As such, despite the difficulties associated with excess flames, it was found that the amount of flames that surrounded the cookpot was determined by the user and their perception of the flames required for cooking rather than the stove itself.

9.3.1.9. Flames exiting the fuel chamber

Participants were asked to identify if flames ever exited their stove's fuel chambers and if so, what impact this had on preparing their meals.

The 3-stone-fire, which does not enclose the fire at all, was associated with flames which were the most unpredictable:

"Sometimes you may burn your chitenge as you may you may be in this position so the winds would be coming with flames and then you may burn your chitenge!"

Nkhata_Group

Whereas the ICS assessed by the focus groups were perceived to keep the flames enclosed and focused towards the cookpot:

"The fire doesn't come out of the opening here (fuel chamber), it will only concentrate on going up just around the skirting."

Chonde_Group

"The flames don't come out this way they only come out on the top."

Mtika_Group

However, some participants using the ICS indicated that when firewood needed to be re-loaded some flames were found near or exiting the fuel chamber. For example, the chitetezo mbaula and the fixed rocket stove

are re-fuelled by pushing small pieces of wood into the fuel chamber. As the wood burns it needs to be pushed into the stove so as to keep the flame inside the stove. However, participants found that, as they were not always with their stoves, the wood would burn and the flames began to come outside the stove:

"If we are cooking something on the stove, we have left it there and we have to go and fetch some water first when we are coming back we would find that the flame is outside and not inside because we have not pushed the wood into the stove on time."

Compound_Group

However, sometimes participants experienced difficulties feeding the firewood into the stove due to a build-up of ash:

"When the fuel is burning it forms charcoal inside so you have to kind of push the firewood inside and sometimes you find that there is a lot of charcoal inside such that if you push, the wood it will not go further so you find that the flame is coming out side so what we do, we remove some of the charcoal inside so that we can load the wood."

Compound_Group

Although it was not reported by participants, it is possible that removing hot ash part way through the cooking process could be both problematic and dangerous.

9.4. Stability of the pot on the stove

Although the existing BSSP does not account for the stability of the pot on a stove, it became apparent during the pilot phase that unstable pots may contribute to burns. As such, participants were asked to consider the stability of their pots on the cookstoves that they use regularly. From these discussions it emerged that the causes of pot instability could be related to the placement of fuel and the design of pot rests.

For example, participants explained if pieces of firewood are knocked when using the 3-stone fire it could disturb the pot. In addition, those using the charcoal mbaula noted that, if the charcoal was loaded incorrectly the pot would not sit level:

"If there is more charcoal then the pot cannot be stable."

Nkhata_Group

Moreover, participants highlighted that if the charcoal did not burn evenly the pot could become unbalanced:

"We put a lot of charcoal so what happens is you may put a pot on it but as that charcoal looses it strength little by little the pot may fall."

Nkhata_Group

Participants also mentioned that wear and tear of the metal pot rests on the charcoal mbaula could result in an unstable cooking surface.



Figure 26: The fixed rocket stove pot rests

Issues associated with pot stability and the ICS were related to the design of their pot rests. In particular, the pot rests found on the fixed rocket stove (illustrated in Figure 26) were seen to cause difficulties. For instance, participants found that when preparing nsima, the pot rests would move or fall inside the combustion chamber causing the pot to become unstable:

"If you are using the pot rests then the pot is never steady [...] if you have to use it for cooking nsima, then definitely it will slide."

Chonde_Group

"We don't know what to do because of the way the stove is made the pot will dance because it is a smooth surface and the pot rests are not fixed."

Chonde_Group

In order to manage these difficulties the participants explained that they would need to hold the pot tightly. However, the fixed rocket stove is also designed with a metal pot skirt which makes the pot difficult to handle:

"Those things that support the pot may go inside [...] so we need something to support the pot so sometimes we take a separate cloth to hold the pot and the skirt together or even a fire wood that is not being used for cooking."

Kapeta_Group

Whereas, other participants indicated they would replace the pot rests with pieces of firewood (as illustrated in Figure 27) to provide a temporary solution. However, using firewood in this way also created problems:



Figure 27: Fixed rocket stove using wood as alternative pot rests

"The fire catches those and they start burning. So it disturbs our cooking because we have to remove the pot from there also sometimes it can be different [...] if you find different sizes of firewood the pot can be up and down and it disturbs your cooking."

Kapeta_Group

Participants using the chitetezo mbaula did not report any problems with pot stability:

"They are steady the pot rests they are OK they are smooth and do not upset the pot."

Mtika_Group

Whilst the pot rests on the chitetezo mbaula were considered stable, the stability of the pot would also continue to be reliant on the user placing the stove on even ground, unlike the stoves which are fixed.

9.5. Participant's perception of a safe stove

Lastly, participants were asked which of the stoves they had available, they considered the safest. Here participants reported that their ICS were safer than their traditional cooking methods as they contained the majority of the flames inside the stove:

"The body of the stove (chitetezo mbaula) shelters the flame."

Compound_Group

"This type of stove fire (chitetezo mbaula) holds the fire properly so you can't get burnt with this stove because the fire is protected."

Mtika_Group

"These three stone stoves have no barriers so if a child falls on it he or she will definitely get burnt but the stove (fixed rocket stove) you can only get burnt from a bit of it not the whole place."

Chonde_Group

"The method of cooking as I am using the cooking stove and the cooking stove can prevent injuries in the way that the fire is inside so I cannot even harm myself when cooking like using the 3-stone-fire."

Kapeta_Group

"The 3 stone fire is what used to cause a lot of burns when you are cooking because the fire is all around your cloth or your skirt can catch fire or you

are putting your leg nearby and you can get burnt, but the fire from the chitetezo mbaula is controlled it is in one spot so even if it is going even if there is a lot of fire then still it is in one place the chances of it getting to your clothes or your legs are not they are remote."

Mtika_Group

"I prefer using the cookstoves (fixed stoves) because it is easier, even the children can use without injuring themselves the fire is inside usually and it is very difficult even for a child to go and touch even the fire because when it is inside it is only the pot that is getting hot."

Kapeta_Group

However, while participants explained that they considered the ICS to provide some level of protection against burn injuries (as reported in Chapter 7, Section 7.3.1.3), this factor was not considered key in the choice of adopting certain cooking methods. Moreover, where cooking speed could be increased, participants would accept a certain level of risk.

9.6. Chapter summary

This chapter has explored the participant's perceptions of their stoves in relation to the current BSSP guidance used by the GACC (Global Alliance for Clean Cookstoves., 2015a). In particular, the participants experiences have highlighted areas which are not accounted for in the testing procedure, such as pot stability and the risks associated with fuel protruding from the stove. In addition, the groups identified that their cooking times do not necessarily match the one that is currently considered in relation to the surface temperature test.

While the participants who assessed the ICS considered these stoves to be safer as they enclosed the open flames, it has been previously understood that safety is only one factor in the decision to use a stove. As such, people may continue to use their traditional stoves, which are

inherently unsafe so as to meet household requirements and their cooking preferences. The following chapter will now consider the perspective of key stakeholders who are manufacturing and promoting ICS interventions in Malawi.

10. Chapter ten: ICS interventions in Malawi and perceptions of key stakeholders

10.1. Introduction

Key stakeholders were interviewed as part of the study to identify existing approaches and safety standards utilised by ICS initiatives in Malawi. The themes which emerged from these interviews could be categorised into the following three areas:

- the approach, development and distribution of ICS
- methods to maintain quality
- factors which affect the achievement of stove programmes

Before exploring these categories in more detail, the chapter provides an overview of the participant's characteristics

10.2. Participant and organisation characteristics

10.2.1. Participant Characteristics

Six key stakeholders took part in semi-structured interviews. They were purposively selected to provide information on the safety, quality and distribution of ICS in Malawi. They all had involvement or an association with the villages, which had taken part in the household portion of the study where ICS had been promoted. Nonetheless, it must be recognised that there are other organisations in Malawi also involved in the production and distribution of ICS.

The participants came from three different organisations and had varying roles in the stove sector as illustrated in Table 23. Table 23 provides a brief summary of the organisations that the participants belonged to, and the household stoves that they produced or promoted in relation to the study. However, the technology promoted by these organisations continues to change and develop outside the period of this study.

Table 23: Characteristics of the key stakeholders interviewed and their organisation

Participant code	Position	Description of organisation	Stoves produced / promoted
KI1	Director	A consultancy company that supports and runs fuel efficient projects in Malawi.	Chitetezo mbaula
KI2	Technical Advisor		
KI3	Project Manager	NGO promoting fuel efficient technologies in an attempt to mitigate climate change.	
KI4	Operations and logistics officer	NGO that facilitates and promotes community based agricultural projects with emphasis on building resilience to climate change.	Fixed rocket stove
KI5	Senior Technical Advisor		
KI6	Production group supervisor	Local producer of the chitetezo mbaula	Chitetezo mbaula

10.3. The approach, development and distribution of ICS

10.3.1. Key themes

To provide some context, participants were asked to discuss their approach to developing and promoting ICS in Malawi. This resulted in the following themes:

- rationale for promoting a particular stove design
- promotion and training
- monitoring and evaluation

10.3.1.1. Rationale for promoting a particular stove design

Participants were asked to discuss the motivation to promote particular stove designs. Primarily, their explanations included the need for an

accessible and affordable technology developed through input from local cooks:

"We would have looked mainly at what is available locally what is appropriate, what is affordable, what is accessible and we have played around with various types of stoves. Most of our work is around the chitetazo mbaula but that's not because we identified that, it's just because it has emerged as the most appropriate, accessible and affordable stove etc. that we have worked with so far."

KI1

"The stove can be made locally, using locally available materials. The stove is sold at an affordable price and a lot of household can manage to purchase their own stove. The stove is easy to use and it uses firewood which is the most common fuel used for cooking in many households."

KI2

"We eventually ended up with this one based on the fact that it was easy to scale because it was easy to build and the thermal efficiencies fit within the category they were looking for. Also people accepted this aesthetic [...] they want a lower stove, [...] so it was built like that and accepted by the local cooks and tested for a couple of weeks and it fit all the criterion and was put into place."

KI5

However, participants acknowledged that there were certain limitations associated with their stoves. These included being limited to certain pot sizes and issues with handling wet wood:

"In some cases, households do not completely abandon the old three stone fires [...] In some cases three stove fire is used when cooking is being done on bigger pots which cannot be accommodated on the chitetezo mbaula."

KI2

"A lot of improved cookstoves have a hard time dealing with wet, very wet wood also, yeah the chtetezo mbaula and also the fixed rocket stove so if someone has just picked something then they use an open fire usually."

KI5

Therefore, participants accepted there were circumstances where households would not make a complete transition to the ICS promoted.

10.3.1.2. Promotion and training

ICS are donated to households free of charge, purchased or assembled by householders themselves following the distribution of construction materials and guidance. The key stakeholders interviewed as part of this study had experience in each of these distribution methods.

Activities undertaken to advertise the ICS included promotional and training events such as: placing stoves in guardian shelters, the use of mass media, celebrity endorsements, free chitenge with a stove purchases, community 'cook off' events and peer-to-peer information sharing

In some cases, participants described that the information provided during these activities included advice on the safe use of cookstoves and kitchen management. For example:

"Our educational materials include how you have to hold the pot skirt when you are cooking. If it has shifted we actually advise them to have a cloth, actually a wet cloth, that they should use to maybe to put it back if it is a bit loose when they are cooking."

KI4

"We try to tell them to keep the kids away while they are cooking but there is only so much that we can do, unless they have a minder for the child."

KI3

"We do encourage in our in our health and safety things, we encourage people to keep children away from the cooking place, or the stove. As a safety precaution, how much that has been heeded or not is hard to know…"

KI1

However, the impact this training may have had on burn injuries has not yet been evaluated.

10.3.1.3. Monitoring and evaluation

During the interviews participants expressed that they faced several difficulties in obtaining accurate information about stove use. For instance, participants acknowledged that the distribution of a stove to a household may not mean the technology has been adopted. As such, one participant reported that their donor organisation would only acknowledge that half of the ICS distributed were in use:

"Because they (donor organisation) have worked with so many others and they have seen what happens in the field yes you bring a nice efficient stove but more than 50% of the time the original stove will still be used…"

KI3

Whereas, another participant indicated that there is a need for a more thorough evaluation of how cookstoves are employed in 'real life' by their end users, so as to better understand household behaviours and needs.

10.4. Maintaining the quality of ICS

10.4.1. Key themes

It had been observed during the scoping study that ICS distributed in Malawi's bordering countries could be sold with varying degrees of quality. This meant that design features, that should provide a degree of protection, might not be present or consistent across the same type of stove. For instance, where an ICS was designed to have a smooth and

level base to ensure stove stability and prevent tipping, in reality, this was not always the case. Therefore, participants were asked to consider their existing approaches and perceptions of maintaining quality control and safety features. From these discussions the following themes emerged:

- standardisation
- measurement tools
- quality checks
- the qualities that make an ICS 'safe'

10.4.1.1. Standardisation

Participants explained to maintain stove quality, and any associated safety features, standardisation was important:

"One of the motivations for standardisation is you can estimate the firewood savings, the emissions reductions, the safety benefits and so on, you have to have a standardised product to be able to do that, and that is kind of our main motivation for standardisation…"

KI1

"The position of stove handles has a bearing on the safety of the stove as the stove can tip when carrying if the handles are not correctly placed. The stove is supposed to be finished properly to remove all sharp edges."

KI2

These standards and specifications are provided to production groups and manufacturers, using posters and user manuals to encourage them to create consistent stoves:

"We also have user manuals we have one for using a paddle mould and one for using a fuel efficient kiln in English and Chichewa […] we do a bunch of stuff around standardisation and quality …"

KI1

"Our stoves are made with a certain size of brick so that standardises most things because the geometry is just layers of bricks with certain openings based on the height of the bricks."

KI5

It was understood that for ICS made by local artisans and householders, the development of easy to follow standards and guides is integral to maintain the quality of the stoves produced. However, further evaluation is needed to measure the extent to which these instructions maintained stove quality and consistency.

10.4.1.2. Measurement tools

Participants' explained that, in addition to standards, measurement tools have been created to assist stove manufacturers in producing uniform stoves. In relation to safety such tools are important. For example, a paddle mould provided to production groups who make the portable chitetezo mbaula helps them create a level base for the stove, to ensure that the finished product does not lean or tip:

"We also have this paddle mould [...] it's a massive help for improving standardisation because each one comes out much more standardised. The bases are much more even and level than in comparison to previous moulds we were using"

KI1

The same production groups are also provided with bamboo rulers and stencils. These tools assist producers in maintaining safety features as they aim to ensure that the finished stove has even handles and a stable surface on which to place a cookpot:

"....this bamboo it is a ruler all the measurements from the chitetezo mbaula come from there. Then this (holding stencils) is the door if you want to cut the door or this is used to show where the pot rests should be placed this means when the stoves are fired they will be finished well."

KI6

Moreover, the consistency of the clay was also reported to influence the quality, strength and longevity of the final product. As such producers are advised on the importance of using the right clay:

"The dimensions are for a wet stove, and therefore the fired product would differ in thickness depending on the shrinkage rate of the clay being used. That is why it is important to ensure that the area has a suitable clay source before formulating a production group."

KI2

"The mixture of the mortar will determine the lifespan of the stove the mortar is important and a critical point to check for quality control. Because in different regions they have different qualities of clay and sand"

KI4

These measurement tools, if employed correctly by producers, should assist in manufacturing an ICS of a certain specification and quality. This in turn should ensure that the stoves are uniform and meet the same safety standards as set by the initial stove design. Nonetheless, the effectiveness of these tools could be influenced by the producer's willingness to use and maintain these tools.

10.4.1.3. Quality checks

Quality checks were conducted by the key stakeholder's organisations to ensure that the standards and quality of their stoves were met before use and or wider distribution. For example, those promoting the fixed rocket stove explained that their community volunteers would conduct, and

report back, on a 5-point check for each fixed stove built by the households, these checks included:

"We visually check it for the size of the brick so the height and the size of the combustion chamber and the spacing of the grates, and then if the complete set of parts is there."

KI5

In contrast, those involved in the selling and distribution of the chitetezo mbaula would perform quality checks at the point of purchase from the local manufacturers or production groups. Consequently, only stoves which met all design and quality standards would be selected by the organisation to ensure that the stoves which were then sold on or donated met the required specifications:

"We have a team that goes with quality control tools and actually checks [...]. We have got our donors who actually go to the shops and check and they will complain and say "no we went to this shop and we saw the stoves and they didn't look good". So we have to remember that we have a name that we are trying to up hold and a image as well. So (the donor organisation) wants to be associated with the highest quality [...] make sure that they the measurements are the same so if they are on the shelf whether you pick the top one or the bottom one it should be the same thing."

KI3

The same participant also highlighted how the National Cookstove Steering Committee (NCSC) assisted with these quality checks:

"The National Cookstove Taskforce (now named the NCSC) has really helped us quite a lot because now we have a body that can go around and monitor the stoves how they are being produced and making sure that the quality is of good standard."

KI3

These quality checks should ensure that the end products are consistent with the initial design and maintain important safety features such as: flat bases, level surfaces, equal handles and thickness of the stove walls. Nonetheless, without further investigation, it is not obvious as to what extent these processes guarantee the quality or safety, of the final products. However, in contrast to what was observed in Malawi's bordering countries, these processes demonstrate a potential starting point for organisations to maintain quality, and the associated safety features, where stoves are manufactured by local artisans and households.

10.4.1.4. Qualities that makes an ICS 'safe'

The Malawi NCSC defines ICS on the bases of being "CLEANER" (Mbaula, 2017b)

Convenient,

Low in emissions,

Efficient on fuel use

Affordable

Not harmful

Easy to use

Robust

Consequently, participants were asked to consider what specific qualities they perceived made their ICS "not harmful". The features reported

included: shielding the flame, maintaining a cool surface temperature and stability. For example:

"The fire that comes there is not like the one that comes from the 3-stone-fire because, if you put a lot of firewood it will produce a lot of fire while the chitetezo mbaula it controls the what? The fire yeah because the amount of firewood that is being used there is smaller so it is safer."

KI6

"You can get burnt assuming that your mother has allowed you to play around the cooking area which is more the norm because you are bored and maybe you are the only child at home maybe your other siblings are away so you play around the fire and you get burnt. The chtetezo mbaula stops the you know the process of you getting burnt I won't say that it would save you 100% I can foresee somebody getting burnt if they have left the stove cooking and then a child is playing, it can tip over if you have not put it straight, so the child can get burnt and you can get scalded if you are boiling hot water [...] but I would say that there should be less accidents compared to the 3-stone-fire it is just the design itself it is closed so it keeps the flames away from the child."

KI3

"The outside is cool I think you remember the last time in (the village) people were able to say "I think I can leave my kids playing around in the kitchen if I am using this stove" because the outside does not get hot."

KI4

Whilst leaving children with a lit stove may not be a desirable outcome, since it is the norm for children to cook from a young age, it is possible that the children would have been left with a 3-stone-fire to cook in the same way.

Stability was also an essential safety feature to ensure that the stove does not fall over when in use. To prevent stoves tipping participants explained that, the stoves were either made to be heavy or fixed in place:

"You know the chitetezo mbaula it is made to be such a heavy instrument that the weight of itself makes sure that it is not moveable when cooking"

KI6

"I mean a fixed stove is really cool because again it is probably one of the safest, it is not moving so it is not going to tip over or anything"

KI3

"It is often a problem with portable stoves that people just put them somewhere and light them and then they are hot, and then they are at an angle and then pot is just precariously balanced throughout the cooking process. You know, most people will adjust it but I have seen it many times and even here."

KI5

Lastly, a participant explained that by engineering these qualities into a stove design it could provide a certain level of passive protection. For example:

"I mean engineering can eliminate certain types of accidents whereas education, you can know not to walk on the thin ice, but someone still will. But if you put a bridge over the river then people can walk over."

KI5

However, it could be suggested that the ability of such features to provide protection is dependent on the user employing the stove as intended, as well as their wider kitchen environment. Hence, it is important when evaluating ICS and their potential safety features, to involve end-users and 'real-life' cooking scenarios.

10.5. Factors which affect the achievement of stove programmes in Malawi

10.5.1. Key themes

Participants were asked to discuss the factors which enabled and or prevented the achievement of ICS programmes in Malawi. For this study, the investigation of these factors was important as, it may be that the factors associated with the uptake of ICS technology, are similar to factors which may enable or restrict the diffusion of future injury prevention strategies and interventions in these areas.

10.5.1.1. Enabling factors

Enabling factors involved: good marketing, buy in from both government and village chiefs and the increasing cost and scarcity of firewood. For example, participants explained that encouraging households to talk to each other was integral in establishing stove uptake. For example:

"The good thing about Malawi is the word of mouth is the biggest advertising tool compared to any other form of advertising so if someone says "this stove is awesome it is saving me." Or, they will see their neighbour cooking and they are saving an amount of money being used for firewood or she is walking less they will say "I want to be like her" so it becomes a trickle affect."

KI3

In addition, buy in from the village chiefs was an important factor in establishing ICS programmes in individual village areas:

"At a village level when a chief speaks and gives out his instructions then people try to comply [...] that is one way that you can promote stoves to households that are not welcoming you with open arms with the new technology [...]. A chief who sees the bigger picture about their forest behind their village try to, you know, who understands everything then that can help."

KI4

Government buy-in was described to be crucial, on a broader scale, to support and coordinate the efforts of the ICS programmes and stove organisations:

"I would say maybe government giving us the 2 million cookstove target that actually showed that there was a buy in from the government itself. I mean setting up The National Cookstove Taskforce (now named the NCSC), that has really helped us quite a lot because now we have a body that can go around and monitor the stoves, how they are being produced, and making sure that the quality is of good standard."

KI3

Lastly participants explained that, areas in which firewood had become scarce or expensive to purchase, people were more receptive to the ICS interventions. For example:

"Stove projects have been more successful in areas where people walk longer distances to collect firewood, or where it is very expensive to purchase wood. It has really been difficult to reach the targeted households in places where firewood is not an issue."

KI3

Although the incorporation of these factors appeared key to disseminating ICS across Malawi, participants also recognised several contrasting factors which had been seen to restrict the advancement or complete transition to ICS by households.

10.5.1.2. Restrictive factors

Restrictive factors included a number of issues relating to production, purchase, installation and transition. For example, maintaining production groups was reported to be a challenge in areas where members may stop making stoves during harvest periods:

"..Malawi is highly dependent on maize so when the first rains comes then everything stops [...] as most of the producers are women and women are usually told by their husbands "you have to stop and come to the field."

KI3

"Rainy season is period when people work in their field to cultivate their food so stove production can be neglected."

KI2

Participants also reported that there may be restrictions associated with the purchase and installation of an ICS. For example, households may not want, or have the money, to spend on purchasing a stove:

"The main thing here that stops someone from buying a stove is money - you know financial restrictions if you don't have the money then you can't. Unless [...] it is so cheap and everybody can afford it (chitetezo mbaula)."

KI6

Nonetheless, participants also explained that it could be difficult to pass on messages about the benefits of ICS in areas where literacy was low:

"It is hard! In the urban centres it is not that hard because you are dealing with people who are more educated than people in the rural areas. The biggest challenge I guess from the rural areas is trying to convince them that, one the 3-stone-fire isn't better for them two, that they will save money and save time."

KI3

Moreover, participants explained that a lack of exposure and previous bad experiences with ICS could restrict sales of their stoves:

"Now I see you guess that if there were no factors then everyone would have a stove, so there is a bunch of barriers. Why do 9 out of 10 households in Malawi use 3 stone fires… because mainly I would say because they haven't got a choice they haven't been exposed to other options. Some people have, some people haven't and then there have been some bad improved cookstoves […]. I mean that you know it's one of the dangers of stove interventions that that is if you can't guarantee the standard or yeah, there's risks…"

KI1

Furthermore, installing stoves which require a shelter or kitchen could also be a challenge. As households may not want to make changes to their existing kitchen design:

"They just build a big structure no windows or anything just a door so you have to go and make windows for them but they will say "no we don't want windows" and you have to say "no you need windows because you need to breathe properly". There is resistance for example they are used to a 3 stone fire if there is windows that means there will be air coming in when there is air it means it doesn't cook as fast so it is something that is out of habit…"

KI3

Installation was also an issue when households had multiple uses for their kitchen space:

"People who have animals and they don't want actually to build just a cooking kitchen […] they still want to use their old system and so when you […] put a stove in their kitchen it is normally destroyed by the animals…"

KI4

Even in households which had purchased or installed an ICS, the complete transition from a traditional stove to ICS was a challenge. For example, participants explained that households may continue to use their traditional cookstoves alongside their ICS:

"In some cases, households do not completely abandon the old three stone fire, so they use both the old and new stoves sometimes because they want to cook faster or probably because of the rush in the morning where they would want to heat bath water and prepare breakfast at the same time. In some cases, the 3 stone fire is used when cooking is being done on bigger pots which cannot be accommodated on the chitetezo mbaula."

KI2

Consequently, as explained by participants, there continues to be a number of difficulties associated with the distribution and transition to ICS in Malawian households.

10.6. Chapter summary

This chapter has explored the themes which emerged from the interviews with key stakeholders relating to the development and distribution of ICS, methods to maintain quality and factors which influence the achievement of stove programmes. The chapter has highlighted that safety advice may be provided as part of ICS distribution activities. However, the consistency and impact of this training has not yet been assessed. Moreover, participants recognised that by engineering safety features into the stove design, it might provide passive protection against burn injuries. Yet, further investigation is needed to identify if such safety features directly influence the occurrence of burn injuries. Lastly, although participants identified several factors which may enable ICS uptake, they also acknowledged a number of barriers which may restrict households making a complete transition to an ICS. The following

chapter will discuss the main study findings in relation to the research objectives and the context of wider literature.

11. Chapter eleven: Discussion of study findings

11.1. Introduction

The overall aim of this study was to explore the factors associated with paediatric burn injuries in rural and peri-urban Malawi. To achieve this, data were obtained from households, health professionals and key stakeholders (e.g. stove manufacturers, distributors, project managers and technical advisers) using survey, interview and observational research methods. Chapters from 4 to 10 presented the findings of these data based on the type of participant and the themes generated from the qualitative analysis. This chapter will synthesise these themes in relation to the research aim, objectives and the context of wider literature.

Section 11.2 provides a summary of the main study findings. This is followed by Section 11.3 which situates these findings alongside wider literature and theory. The chapter ends with a discussion of the study's rigour, strengths and limitations.

11.2. Summary of principal findings

The research methods employed revealed rich data which can contribute to the current understanding of childhood burn injuries in rural and peri-urban Malawi. Through observations and interviews with parents it was revealed that there is a lack of space, within the villages, for children that are free from hazardous objects and terrain. In addition, participants explained that the occurrence of burn injuries could be attributed to rapid changes in their children's developmental capabilities, play and household responsibilities.

The study has also presented a number of barriers which parents reported restricted them from providing consistent injury prevention strategies. These included: a lack of knowledge about injury prevention, a lack of safety equipment, a lack of control to make alterations to their

housing, difficulties controlling their children and an inability to provide adequate supervision.

The interviews with health professionals revealed that, due to a lack of time and resources, they are unable to consistently provide information to parents and caregivers about preventing burn injuries in the home.

Notably, the interviews with key stakeholders, working with existing ICS initiatives in Malawi revealed that, although kitchen safety is currently discussed as part of the organisations' promotional activities, there is a lack of data measuring the effectiveness of this teaching.

Principally, this study has demonstrated that the factors associated with burn injuries and their prevention, both actual and perceptual, are multifaceted and intertwined by the complex nature of the household environment and those who live within it.

11.1. Interpretation of the study findings in the context of previous research

The following section explores both the study findings and previous research in relation to the study's objectives.

11.1.1. Insights into the factors which expose children to burn injuries in the Malawian context

The first study objective was to identify factors that expose children to burn injuries in Malawi. To gather information on this objective, data were obtained from: household questionnaires, interviews, observations and interviews with health professionals. Based on the data and previous research, the types of risk factors associated with burn injuries in Malawi, can be categorised as follows:

- Household environment and infrastructure
- Cooking, heating and lighting: appliances and methods

- Children: developmental characteristics, responsibilities and play
- Season and time of day
- Presence of underlying health conditions
- Parental supervision and household history of burn injuries

11.1.1.1. Household environment and infrastructure

The interviews with the household participants in this study revealed that burn injuries were often associated with the kitchen spaces. This was due to the presence of cooking stoves, hot water, food and firewood. However, it is also common for households to cook outside due to: kitchen damage, the need to use their building for an alternative purpose and finding it more comfortable to cook in an open space. Therefore, participants indicated that their veranda and courtyard spaces could be equally hazardous.

Moreover, in addition to the location of their cooking fires, parents explained that the fires used to clear the land and burn rubbish could result in the occurrence of burn injuries, particularly if, their children were playing near to the fires or, the fires ignited surrounding crops or buildings.

It was observed that, the majority of households had only one living space which was used for a multitude of activities, such as: sleeping, socialising, eating and storage. These single living spaces may be sub-divided using temporary materials such as reeds and cloths. However, while separating the spaces may provide an order to the ways in which the family members can use their buildings in relation to burn injuries and fire risks, such temporary materials may ignite if caught by flames. Additionally, the materials used to construct the exterior household structures were also highly combustible and included: unfired mud bricks, grass thatching and wooden beams. These observations also demonstrated that, due to the lack of internal walls, doors and shelving

hazardous equipment such as matches and liquid fuels were stored within easy reach and access to children.

The problems associated with the easy ignition of these building materials and burn injuries in children were also identified by health professions during their interviews. For example, they reported that from their experience, house fires have been the result of leaving candles unattended or alight while sleeping. They also noted that these fires can cause significant harm and spread quickly if a candle ignited a mosquito net.

These findings are aligned to other research conducted in this region. For example, as presented in Chapter 2, poor architectural design, structural materials and overcrowding across this region have been associated with childhood injuries (Albertyn et al., 2006, Barss et al., 1998, Justin-Temu et al., 2008, Kiser et al., 2012, Komolafe et al., 2003, Roman et al., 2012). Furthermore, other studies have demonstrated that inadequate housing, which does not contain shelving or storage spaces, means that children in these locations have easier access to hazardous materials (Albertyn et al., 2006, Roman et al., 2012).

Hazards that can result in bush and house fires have also been reported in the literature. For example, previous studies have highlighted that bushfires, used to clear and prepare farmland may spread resulting in severe burn injuries (Albertyn et al., 2006). In addition, house fires have also been associated with unstable candles igniting surrounding materials. For instance, a retrospective analysis of burns patients admitted to a referral hospital in Uganda, identified that between 2008 and 2011 45 patients were admitted with severe burn injuries caused by the ignition of mosquito nets (Kalanzi et al., 2014). Recognisably, the majority of these patients (33%) were aged between 0-1 year (Kalanzi et al., 2014).

Prior literature has also demonstrated that children, in LMICs, sustain burn injuries in and around their home due to the presence of open fires, hot liquids and objects (Chalya et al., 2011, Justin-Temu et al., 2008, Ringo and Chilonga, 2014, Roman et al., 2012). To better understand the factors relating to these burn hazards in Malawi, this study sought to understand the rationale associated with employing certain household cooking, heating and lighting methods. These factors are considered in more depth in the following Section (11.3.1.1).

This study has shown in corroboration with existing research from Malawi, and its neighbouring countries, that there are limited spaces available for children to spend their time which are free from hazardous objects and terrain (Justin-Temu et al., 2008, Outwater et al., 2013). However, due to the limited resources available at village level, the existing processes in which families design and build their housing, as well as their methods to manage rubbish and farmland, it may be difficult to make changes without wider financial development, housing and farming regulation (Atiyeh et al., 2009, Parbhoo et al., 2010, Peck et al., 2008b).

Nonetheless, in the short term, it may be possible that smaller adjustments to household environments could be instigated, such as implementing alternative methods to destroy rubbish and using alternative light sources which do not produce flames. In addition, designated storage and kitchen areas could be developed to keep hazardous objects and cooking fires out of the reach of children. Moreover, the methods employed to keep children warm during colder periods requires further consideration.

Lastly, whilst it is important that households should continue to provide protection for their children against malaria, it may be that further education is required, alongside the distribution of bed nets, to ensure

that flames are kept at a safe distance and extinguished overnight (Kalanzi et al., 2014).

11.3.1.1. Cooking, heating and lighting: appliances and methods

The 3-stone-fire was the most prevalent cooking method utilised by households in the sample. However, where ICS had been promoted some households had begun to adopt them into their cooking routine. Nonetheless, despite having an ICS, many of these participants indicated that they continued to employ their 3-stone-fire, particularly if there was also a need to cook several ingredients at once, heat bath water or cook quickly. As a result, despite the implementation of ICS interventions, many households had not yet made a full transition to these methods. Therefore, while future ICS initiatives or burns prevention programmes should consider the inherent safety of a new cookstove, such safety may not be directly transferred to the environment where it is being promoted as households continue to maintain their traditional cooking methods.

The use of multiple cooking stoves, or fuel stacking, is not new to the literature and has previously been linked to factors such as: maintaining energy security, household preference familiarity and traditional baking (Alem et al., 2016, Cheng and Urpelainen, 2014). As a result, these features should be considered with any future attempts to integrate ICS into households.

It was observed that cookstoves not only pose a threat to children during the cooking process but for a period following their use. For example, during the observational phase of the data collection it became apparent that cookstoves were often left unattended both during and following the meal preparation. The rationale for such behaviour, as described by parents during their interviews, was associated with the need to attend to

other household chores and a feeling of discomfort when close to the excessive heat or smoke.

It was also common, following the cooking process, that cookstoves would be left burning to provide heat for warming bath water or family. However, even once the cookstoves had served their purposes some families reported a preference for leaving their fires burning so as they would be easier to re-light later. As a result, children were also left exposed to the hot embers remaining from the fire. Nonetheless, the practice of leaving stoves unattended both during and following their use appeared to be a conventional behaviour across each sample village.

Although existing research associates ground level cooking with burn injuries (Chalya et al., 2011, Justin-Temu et al., 2008, Ringo and Chilonga, 2014, Roman et al., 2012), it has not considered the behaviours associated with supervising or extinguishing them during and after use. Yet, these factors may prove essential in teaching parents how to manage the risks associated with ground level cooking, such as using sand to smother any excess flames and hot firewood. These practices could be encouraged to save fuel, prevent the spread of flames and reduce the chance of children crawling onto hot embers or fire.

There is currently a lack of national data which indicates the type of heating methods utilised by Malawian households, therefore it is not possible to make comparisons between the study sample and the national population. Nonetheless, the testimonies provided by households in this study indicated the types of the heat sources that may present as hazards around the home. For example, cookstoves were the most common method employed amongst households to provide heating for their families, followed by open fires. Consequently, advising parents to keep their children away from these fires may not be practical during colder periods as they rely on these methods to keep warm.

Moreover, stove designers also need to consider that the cooking fire is an integral method utilised by households to provide space heating. Therefore, while it may be desirable to ensure the surface temperature of the stove remains low, it should also provide some degree of space heating.

National data from Malawi indicates that the majority of households use paraffin or kerosene lamps to light their homes (National Statistical Office, 2012). However, in contrast to the national data, the majority of households in this study used dry cell torches as a light source. These differences may be attributable to the rising costs of paraffin since 2011 and the depreciation of the Malawian kwacha making paraffin an inaccessible fuel for rural populations (Malawi Energy Regulatory Authority, 2016). Such a change may be considered as a positive in relation to burns prevention, as the dry cell torches do not create flames when producing light. Therefore the risk of them igniting their surrounding materials is much lower than that of paraffin. While such financial processes might not be possible to implement on other burns risks present in the home, it provides an indication of a successful means to encourage households to adopt a new technology.

However, this method of lighting was not consistent across households. For example, the batteries may run out and therefore, until the household can purchase another one, families may need to use alternative flammable lighting. In addition, not all households reported that they could afford to purchase a torch. Therefore, they also needed to employ alternative lighting methods. Thus, it was still common for households to use candles or grass to provide light which are inherently unsafe if not placed in a stable position, left unattended or put near to combustible materials. As a result, in addition to non-flammable lighting methods, parents could be advised or supported to ensure that candles are placed in a stable container away from combustible materials.

11.1.1.2. Children: developmental characteristics, responsibilities and play

The health professionals explained that ground level cooking stoves begin to present a serious risk to children as they become mobile and can crawl towards, grab or disturb the cooking fire. Likewise, parents indicated that, without the understanding that fires or hot water can cause them harm, their infants are exposed to burn injuries as they crawl about trying to discover their environments. These experiences support previous research which attributed rapid changes in developmental capabilities to the higher prevalence of burn injuries in children aged 0-5 (Ablewhite et al., 2015b, Peden et al., 2008, Rushforth, 2006, Sethi, 2008, The Royal Society for the Prevention of Accidents., 2017). Therefore, it is recommended that information about developmental stages and risks of injury should be targeted towards families.

Play is one of many fundamental processes whereby children come to learn and understand their environment (Gray and Macblain, 2015). For example, Bandura's 'Social Learning Theory' describes how children engage in behaviours or play, based on their observation and imitation of others (Bandura, 1977b). These copying behaviours and pretend play were highlighted by both parents and health professions as potential factors associated with burn injuries. For instance, children, particularly young girls, liked to play the game 'house'. During this game, children make their own fires to cook small amounts of food. However, it was reported that, during such games children might burn themselves or lose control of the fire. Despite this, parents explained that this game was an essential process in which young girls learned how to manage and cook with fires. Thus, regardless of risk, this game was understood to be an important part of their children's development.

The distinction between the occurrence of burn injuries between boys and girls could not be made by this study due to the nature of the investigation and the sample size. However, it was highlighted by parents

that, unlike males, female children would begin the process of learning how to cook and prepare meals from the age of six. It was found that as female children grew into adolescence, their roles in undertaking food preparation and similar household tasks increased. This move towards taking on more domestic responsibilities supports existing data which indicates that, in LMIC, adolescent females are more likely to sustain a burn injury than their male counterparts as they become closer to the cooking fires (Ahuja and Bhattacharya, 2004, Albertyn et al., 2006, Forjuoh, 2006)

11.1.1.3. Season and time of day

The health professionals interviewed indicated that they noticed an increase in burns admissions during the cold dry seasons, as children spend more time around fires warming themselves. They also noted that, unlike in the hot season, parents are more likely to warm the bath water to higher temperatures so as to keep their children warm while bathing, thus potentially increasing the risks of scald injuries. These findings are consistent with existing literature which also indicates that burn injuries tend to peak during the colder months (Peden et al., 2008, Samuel et al., 2011).

Parents considered that certain times of the day were also associated with the occurrence of burn injuries. For example, they explained that early in the morning, when the weather is cooler, open fires might be made, in addition to the lighting of fires for preparing breakfast and bath water. This is similar to the prior literature found from Malawi, Tanzania and Mozambique which reported peaks in burn injuries around the times at which food is being prepared and served (Chalya et al., 2011, Karan et al., 2015, Samuel et al., 2011).

As such, the findings of this study demonstrate attention should be paid to managing the temperature of bath water and heating during the colder months. But also, as many burns risks remain prevalent

throughout the year these messages need to consider how to manage broader risk factors and the increase of burn injuries at meal times.

11.1.1.4. Presence of underlying health conditions

Health professionals indicated that epilepsy was a common feature amongst burns patients and may often contribute to the repetition of burn injuries for one person. In addition to the seizure activity itself, health professionals also linked burn injuries with a lack of compliance concerning the use of anticonvulsant medication. For instance, they explained that, once the seizures appeared to cease, parents would discontinue administering anticonvulsants to their children and the seizures would re-appear.

These observations are consistent with prior literature which indicates that people who suffer with uncontrolled seizures may fall onto fires or hot substances resulting in severe and devastating burn injuries (Albertyn et al., 2006, Barss et al., 1998, Boschini et al., 2014, Edwards et al., 2011, Forjuoh, 2006, Karan et al., 2015, Komolafe et al., 2003, Mushi et al., 2011, Nthumba, 2016, Outwater et al., 2013, Peden et al., 2008, Ringo and Chilonga, 2014, Rybarczyk et al., 2017, Virich and Lavy, 2006). Moreover, prior research indicates that epilepsy continues to be a poorly controlled condition in LMIC owing to a lack of understanding about the causes of seizures and use of medications (Barss et al., 1998, Kalayi and Muhammad, 1996, Virich and Lavy, 2006).

In the future, health professionals indicated that when parents present to a health facility with a child following a seizure, further advice could be provided concerning both treatment compliance, follow up and injury prevention. In addition, Boschini et al. (2014), who identified an association with seizure disorders and burn injuries in Malawi, advocates for the implementation of a national seizure treatment and prevention campaign. However, such suggestions may be prohibited by the lack of resources and time to deliver this information.

11.1.1.5. Parental supervision and household history of burn injuries

The characteristics and understanding of parental supervision, and a household history of burn injuries, have been highlighted throughout the analysis of this study's findings and in wider publications as key factors associated with the occurrence of childhood burn injuries (Ablewhite et al., 2015b, Albertyn et al., 2006, Chalya et al., 2011, Forjuoh, 2006, Justin-Temu et al., 2008, Karan et al., 2015, Munro et al., 2006, Peck et al., 2008b, Ringo and Chilonga, 2014, Rybarczyk et al., 2017, Saluja et al., 2004). For instance, the majority of burn injuries reported by participants during their interviews had not been witnessed by a parent. Moreover, almost half of the households who had experienced a burn of a child during the twelve months prior to data collection had a history of previous childhood burn injuries. Key features associated with these factors have been attributed to a parent's preoccupation with demanding household tasks and their inability, or perception, to make changes to their environment to prevent burn injuries occurring. Consequently, while it should be acknowledged that these elements have been associated with the occurrence of burn injuries, in order to examine these aspects further they are better considered in relation to parental and health professionals' perceptions around their ability to instigate prevention strategies.

11.1.2. Insights into parental perceptions of paediatric burn injuries and their prevention

The second study objective was to explore parental perceptions associated with burn injury risks and their prevention to understand the current methods, if any, utilised by households to protect their children from burn injuries. It also sought to identify any potential barriers which may impact the development of future burns prevention strategies.

11.1.2.1. Hazards which are perceived to contribute to the occurrence of burn injuries around the home

Before examining the parents' perceived ability to control or modify burns risks around the home, it was important to establish what factors they might relate to such injuries. The significance of this has been recognised by Van Niekerk et al. (2007), Gaines and Schwebel (2009) and Munro et al. (2006) who assert that in order to develop culturally relevant prevention programmes that are consistent with the parental interpretation of injury risks, caregivers' understandings of hazards should be sought. Yet, there has been minimal attention given to these experiences within a LMIC setting (Van Niekerk et al., 2007).

Parents identified that burn injuries were attributable to: fires, hot water, medical conditions and trip hazards. Particular fire hazards included: candles, open fires, bush fires, wild fires, rubbish pit fires, kerosene lamps and cookstoves. These risks were described to be most likely to cause an injury if: they were placed near to flammable materials such as dry grass and maize husks or their children were playing with them, near them or slept next to them.

Unsafe spaces and environments were also reported by parents. However, there was disagreement over which spaces were safe, or unsafe, amongst participants. While some explained that their houses, and the space around it, were safe as these locations provided a convenient area for parents to supervise their child. Other parents noted that they were concerned that their homes were not structurally sound and children had greater access to hazardous objects in these areas. As such, it became clear that there is very little space in which children could play or occupy themselves that was considered safe. This situation is in stark contrast to HICs which have created and enforced legislation to ensure that children's play areas, equipment and toys meet exacting safety

requirements to reduce the occurrence of injuries in children (The Royal Society for the Prevention of Accidents, 2017).

Nevertheless, while parents could recognise hazards and unsafe spaces, these appeared, based on the observations of this study, to be accepted in some cases . Thus, further understanding of parents' perceptions about their ability, and readiness, to make changes to their behaviour and environment is needed. In addition, legislative action could be used to promote the allocation and design of safe play areas for children in Malawi.

11.1.2.2. The interpretation of burn events: Parental perceptions and control

The process of examining caregivers' perceptions about their ability to prevent and manage burn injuries is complex since, as indicated by the theory presented in Chapter 2, an individual's perception of their circumstances is dictated by their broader social, physical and environmental norms and pressures (Sleet et al., 2006). For instance, the Integrated Social Cognition Model (ISCM) indicates that there are a number of variables which must be felt by the individual in order to initiate an intention to change their behaviour (Sleet et al., 2006).

In relation to the Malawian setting these individual intentions may be hampered by a fatalistic attitude towards the occurrence of burn injuries. For example, some participants indicated that burn injuries were the result of bad luck or other people being careless. Consequently, caregivers may perceive that such injuries are beyond their control and therefore do not believe that they have the capability, or self-efficacy, to be able to act in a way that would prevent burn injuries occurring. However, not all participants expressed this state of mind and considered that in some instances they may have the control to change aspects of their behaviour or environment to prevent burn injuries.

Nonetheless, even if a person begins to exhibit an intention to change their behaviour the ISCM also indicates that environmental constraints, or barriers, may restrict the individual from carrying out preventative behaviours (Rice et al., 1994). As such, while certain individuals may have a plan to prevent burn injuries they can be hampered by an environment which is inherently unsafe and difficult to manage without increased financial support, infrastructure and the development of the country as a whole.

These factors might also be considered in relation to the reoccurrence of burn injuries within one household (Forjuoh, 2006, Karan et al., 2015, Rybarczyk et al., 2017). For example, ten participants reported during their interviews that either the same or a different child within their household had previously sustained a burn injury, with one household reporting three incidences of burns within one 12 month period. Although there is limited information concerning the reasons behind these patterns of events, the concept of 'learned helplessness' as described in Chapter 2 (Section 2.4.7) might be a possible explanation. For instance, this concept asserts that, when individuals are exposed to events that they perceive they have no control over, this interferes with their incentive to respond or make changes (Seligman, 1975). Therefore, as a number of parents perceived burn events to be associated with external influences, or explained that their ability to make changes to their environment was restricted by finances, it is possible that some parents might fall into this state of 'learned helplessness'. For example, this study found that, while some households explained that the occurrence of a burn injury made them think about making changes around their home, they indicated that, these changes could be difficult to make or sustain. Consequently, for many, their environments, and behaviours, remained unchanged.

Furthermore, due to the methods and processes employed by households to prepare meals, heat and light their home, burn injuries were to some

extent accepted. This notion was particularly common when households described burn injuries which occurred while they were cooking. For example, during the initial surveys some participants reported that no burn had occurred in their household during the last 12 months. However, after further discussion they highlighted that they sustained burn injuries on a regular basis when cooking, but these injuries were not considered 'real' burns. As a result of this finding, additional prompts were added to the interview guides in order to explore what households perceived to be a 'real' burn injury. The responses to such questions re-emphasised for a burn injury to be reported, it must have been: considered large, the result of a house fire, caused by epilepsy or falling, resulted in hospitalisation or medical treatment, caused significant scaring or pain and or required a period of rehabilitation. Thus, it became clear that burns were only reported by households which had resulted in significant consequences for the individual. This also demonstrates that burn injuries, related to cooking, are potentially downplayed and underreported by those living in rural and peri-urban areas of Malawi.

Based on the notion that parental perceptions of burn injuries are related both to their cultural interpretation of these events as well as their physical and domestic environments, the importance of adopting an ecological model for interpreting, understanding and developing burn prevention initiatives was acknowledged. As previously presented in Chapter 2, Section 2.9, ecological models like the Haddon Matrix and the Injury Iceberg consider the individual amongst the much wider physical, environmental and social background (Hanson et al., 2005, Hosking et al., 2011). In addition, the Injury Iceberg also illustrates that latent failures within the physical environment, infrastructure, design, community involvement, interpersonal relationships and societal constructs can influence an individual's behaviour. Therefore, as seen in both the findings of this study, and prior literature, there is a need to consider

how such latent failures can be addressed, rather than individual behaviours alone, so as to result in a more sustainable process to reduce burn injuries (Hanson et al., 2005). Moreover, solutions will need to be fluid and flexible to adapt to changes in the community's environments, capacity and resources (Hanson et al., 2005). As such, while it is apparent that the individual perceptions of injury events are important determinants in the occurrence of injury risk and intentions to change behaviours, they are only one small part of an interlinking system. Consequently, there is a need for multiple interventions at a number of levels including engineering, education and enforcement measures.

The following section explores some of the strategies identified by parents to prevent burn injuries in their homes and the barriers they face in implementing them.

11.1.2.3. Parental perceptions of the barriers towards engaging in burns prevention

This section considers, more practically, what influences a parent's ability to engage in burns prevention strategies. In addition, where the above section highlighted the influence of the broader environmental and domestic environments, this section will focus more specifically on the issues parents described they faced preventing burn injuries and discuss this in relation to the prior literature.

Existing strategies employed by parents to prevent burn injuries were highlighted during the interview process. These strategies included: separating, reducing or removing the hazards from their children, supervising and providing guidance. However, participants also expressed a number of key issues that restricted them from protecting their children from burn injuries, including: poverty, housing restrictions, a lack of knowledge around burns prevention and an inability to provide continuous supervision.

11.1.2.3.1. Poverty

In this study participants explained that their lack of finances meant they were unable to make changes or repairs to their home to reduce hazards. For example, where kitchens had been destroyed by the rains families had to revert back to their traditional cooking methods, especially if they had been using a fixed stove installed within their kitchen, as well as find alternative places to cook.

In addition, participants acknowledged that they were unable to purchase equipment that they considered to be safer than their current items. For instance, some participants explained that ICS had the potential to reduce burn injuries as the fire was contained within the stove, yet they reported not everyone had access or the means to purchase a stove. These sentiments were also echoed in relation to household lighting methods. For example, participants reported that a lack of finances meant that households were unable to replace their candles or grass lighting with those which do not generate flames such as torches.

The issues associated with poverty and lack of financial security, as explained in Chapter 2, have also been linked to the occurrence of burn injuries globally, with those who live in LMICs or low income areas of HICs being most at risk (Edwards et al., 2006, Mock et al., 2011, Mock et al., 2008, Peden et al., 2008).

11.1.2.3.2. Housing restrictions

Housing restrictions meant that families were unable to make changes to their home that they foresaw might reduce burn injury risks. For instance, participants who were renting their property noted that they were not able to make alterations to their house as it did not belong to them. Nonetheless, certain restrictions enforced in these areas were also seen to reduce fire hazards. In particular, households living in the Compound were not permitted to make fires outside so as to prevent the

spread of fire which may damage crops. This inadvertently meant that households were restricted to cooking in a kitchen area attached to the property. Although not all households were seen to comply with this rule, many explained that they feared the consequences of losing their property should they get caught making fires in outside areas. This aspect is important to consider, as while housing enforcement across rural areas is lacking and difficult to implement, the successful application of these regulations across the Compound demonstrates that, in some cases, legislation can be applied in areas of Malawi to reduce fire risks.

11.3.2.3.1. A lack of knowledge to provide injury prevention

In their interviews some parents explained that they were provided with information about home hazards by health professionals at antenatal and postnatal clinics, although this was sporadic and inconsistent. As a result, the majority of participants explained that their understanding and management of home hazards came from their parents, extended family or as a result of sustaining an injury.

A lack of parental knowledge on the recognition and management of burn risks around the home is also consistent with the findings of other studies conducted in the region. For example, research conducted in Zambia that surveyed 559 children (aged 9 to 18 years) and 39 adults found that both groups lacked fundamental knowledge around burns prevention (Heard et al., 2013). For instance, 42 per cent of their adult sample reported that they did not know that hot water or food could cause burns (Heard et al., 2013). Furthermore, a study conducted in South Africa which provided a questionnaire based on two pictures illustrating hazards in a low income home setting to 268 parents, demonstrated that people living in environments optimal for burn injuries know relatively little about burn prevention strategies (Cox et al., 2016).

Thus this study, in corroboration with existing research indicated that there is an urgent need for education about burns risks which takes into account the cultural context (Cox et al., 2016, Heard et al., 2013). Yet as many are living within a limited space, managing parental supervision amongst other household tasks and have a limited ability to afford basic equipment, education alone only responds to one aspect of the burns problem.

11.1.2.3.3. Inability to provide continuous supervision

As a means to provide supervision, parents explained they employed a number of strategies including: the use of formal establishments like school or nursery, leaving children with other village members, leaving children with older siblings or carrying children on their backs. The type of method used by parents typically depended on the child's age as well as their perceived ability to care for themselves. This parental process, of selecting supervision practices based on a child's character, perceived ability to listen and understand instruction is also present in the literature which considers parental practices in HICs (Ablewhite et al., 2015a). Nonetheless, the parents in this study also recognised that, sometimes, regardless of the child's character or abilities, they had no choice but to leave their children at home or with other siblings.

At present, there is a lack of information from LMICs which has examined the use of children as an alternative to adult supervision. Nevertheless, research conducted in the UK has demonstrated that, in areas of deprivation, older siblings were perceived to provide an adequate form of supervision for their younger counterparts (Ablewhite et al., 2015a).

However, research carried out in Canada whereby children aged between 5 and 13 years (who had younger sibling aged between 2 and 4 years) and their mothers were asked to respond to a video of a toddler playing by stopping the tape whenever they thought they would verbally respond to

an action either positively or negatively (Morrongiello et al., 2010). The results demonstrated that the younger children were allowed to engage in more risky behaviours when supervised by siblings, rather than their mothers (Morrongiello et al., 2010). Nonetheless, the Morrongiello et al. (2010) sample consisted of predominantly middle class Caucasian families and as such these results may not account for children who live in a more cohesive environments where historically it is accepted that children will provide supervision for their younger siblings (Mull et al., 2001). As a result, further understanding around the protection that older children can provide in this context is needed.

Participants in this study also explained that, in order to supervise babies and young infants, they would carry their children on their back when undertaking tasks such as collecting water, firewood, laundry and harvesting. However, they also noted that, once at the place of collection or their fields, the children would be removed from their back and placed nearby while they conducted their tasks. However, while this meant that small children were in close proximity to their mothers they were not necessarily being supervised. This behaviour is also reflected in a review of the conceptual and methodological issues related to supervision and child injury risks (Saluja et al., 2004). For example, Saluja et al. (2004) asserts that "supervision increases as attention, proximity and continuity increase" (Saluja et al., 2004 p18). Consequently, in order to provide adequate supervision each of these three elements is required. Therefore, in the context of this study, despite a parent being present, their proximity alone is not synonymous with the ability to provide adequate supervision.

During their interviews, household participants expressed that their ability to provide supervision for their children was hampered by: conflicting household demands, responsibilities and illnesses. These findings are similar to what has been reported previously for this region whereby, in addition to caring for their young children, women are also

responsible for many domestic and farming tasks which may mean their attention cannot always be on the child (Karan et al., 2015, Ringo and Chilonga, 2014). Moreover, parents in this study also explained that they had experienced periods where they had been bedridden and therefore unable to supervise or care for their child as they would wish. This is re-emphasised by existing literature which indicates that the HIV/AIDS pandemic and the prevalence of malaria and TB in this region has resulted in a high number of parent deaths therefore increasing the number of child-headed households (Hope, 2005).

The ability to provide adequate and consistent supervision of young children is difficult for parents globally, with those living in more disadvantaged areas facing greater challenges (Ablewhite et al., 2015a, Ablewhite et al., 2015b, Munro et al., 2006, Saluja et al., 2004). However, despite being such an integral part of injury prevention parental perceptions of supervision has been under investigated in LMICs (Van Niekerk et al., 2007). This is a problem, particularly as the concept of 'adequate parental supervision' is subjective and situated within an individual's social context (Saluja et al., 2004). Therefore, in order to develop future awareness programmes, it is important to examine parents' existing understanding of supervision.

11.1.3. Insights into health professionals' perceptions of paediatric burn injuries and their prevention

This section aims to report on the third study objective which was to explore the health professionals' perceptions of paediatric burn injuries and their prevention. The factors which health professionals attributed to the occurrence of burn injuries are the same as those which were presented in Section 11.1.1.1 and therefore will not be repeated here. During their interviews, the health professionals were able to offer an insight into the existing methods employed to provide advice about

home injuries, the difficulties they face with this, and make culturally relevant recommendations for future burns prevention strategies.

11.1.3.1. Existing methods to provide health advice

The methods reported by health professionals to impart health advice included one-to-one, group discussions and posters. One-to-one advice was often ad hoc and took place when a practitioner observed that a parent needed health information, such as on admission or discharge following a burn injury. Typically, these sessions might include information on managing and caring for the child and their wound, followed by advice about preventing the reoccurrence of burn injuries. However, the provision of this added information was subjective, and depended on the practitioner who was admitting or discharging the patient at that time.

More formalised group sessions were conducted when there was a number of paediatric burns patients present on the ward. These group sessions were described by the health professionals to include information about caring for a burnt child and their wounds, such as the need for a high protein diet and good hygiene practices.

Across one burns unit, posters were strategically placed along the walls. The posters, created by a local artist, presented culturally relevant messages about keeping children safe around fires and hot liquids using the vernacular language.

11.1.3.2. Health Professionals: Barriers to providing burns prevention information to parents

The health professionals interviewed in this study explained that they faced a number of barriers in providing burns prevention information to parents. The most commonly reported barriers included a parent's level of education, attitude, knowledge and their financial capabilities.

For instance, during their interviews, the health professionals suggested that parents who had received little, or no formal education, struggled to understand the rationale between the health advice being provided and their own traditional practices. A lack of parental education has also been cited amongst the literature as a key barrier for health professionals providing injury prevention advice (Watson et al., 2007). For example, a UK based study sought to capture the views of health professionals on the barriers and enabling factors to injury prevention in deprived areas of a city in the UK. To achieve this they surveyed 51 health visitors and 7 nursery nurses, and like this study their findings identified that health professionals viewed that it was harder for parents to understand health messages if they were less well educated (Watson et al., 2007). Conversely, where it was recognised that parents had a higher level of education they were viewed by health professionals to be more able to understand health messages and less likely to leave children at home alone (Ablewhite et al., 2015a, Watson et al., 2007).

In this study, health professionals also perceived that parents living in the rural areas, who had not accessed much formal education, lacked an awareness of how burn injuries might occur. For instance, they described that parents do not anticipate that that certain hazards could result in a burn injury and therefore parents continue to cook and behave as they have always done. Furthermore, this lack of awareness was also attributable to the child's own capabilities whereby parents had not recognised that their child could now reach objects and hazards which they had not done previously.

It was reported by one health professional that, sensitisation campaigns and education about home injuries are rare, if non-existent in Malawi, in comparison to that of other illnesses and health problems such as malaria. As a result, the participant explained that although parents had come to fear some illnesses, they did not know that they should fear burn injuries. This lack of fear or anticipation of burn injuries could be echoed

by the perception of unintentional injuries across LMICs on the whole. For example, in Cairo, a survey of 99 health care professionals working in a primary care setting reported that almost half of their participants did not consider injuries a priority (Elboray et al., 2015). This attitude was associated with a lack of recognition of injuries as a health problem (Elboray et al., 2015).

This lack of recognition can also be seen at a governmental level. For example, unlike HICs who have developed more established injury surveillance systems and an awareness of the burns problem, there is limited information available to levy attention towards injury prevention in LMICs (Atiyeh et al., 2009). Moreover, such information is required to overcome the traditional rhetoric that burn injuries are random, accidental events which cannot be avoided (Atiyeh et al., 2009). As a result, while those who are in a position to influence the development of health legislation are not aware of the burns problem, it is understandable that rural households are also unaware that these injuries are something to be concerned about in comparison to other health issues.

Two health professionals in this study reported that parental negligence was associated with the occurrence of burn injuries. Although, it should be understood that parental neglect in this case was not used to express that parents intentionally neglected or harmed their children, but rather that they were careless in providing close supervision of their children, hot water and fire. Nonetheless, as reported both in this study, and the literature, mothers may have little choice but to leave children and hot objects unattended as they concentrate on other household responsibilities (Albertyn et al., 2006, Karan et al., 2015, Munro et al., 2006, Peck et al., 2008b, Ringo and Chilonga, 2014, Van Niekerk et al., 2007). Such pressures have the potential to act as a barrier to parents following health advice, as without additional support mothers will

continue to face a conflict between supervising their children and necessary household tasks.

However, the practitioners explained that they were aware that while Malawi continues to experience a high level of poverty, injuries will continue to be difficult to prevent as parents may lack the capacity to make changes to their home environments. The difficulties households face, in improving their home environment, due to financial limitations has also been expressed in the literature both for LMICs and HICs (Edwards et al., 2006, Mock et al., 2011, Mock et al., 2008, Peden et al., 2008, Watson et al., 2007).

In addition to the barriers associated with parental understanding and capabilities, the health professionals interviewed stated that heavy workloads and a lack of resources meant that they faced difficulties in providing health information. For instance, participants stated that the wards were often overcrowded with children and their attention needed to be focused towards those who were most unwell. The prioritisation of other health needs, where health services are over stretched, is also emphasised amongst the wider literature as a barrier to delivering injury prevention (Woods, 2006).

When probed, the majority of health professionals noted that they had never received specific training on injury prevention. As such, one participant explained that they often relied on their own understanding and experiences when providing this advice. This approach, of using one's own opinions to impart preventative information, has also been reported by a UK based study (Tomlinson and Sainsbury, 2004). Their study analysed 215 questionnaires completed by a sample of health professionals (Tomlinson and Sainsbury, 2004). Throughout the questionnaire participants were asked to provide a minimum age that they considered a child could safely engage in a range of activities. Their responses were then compared to evidence presented in the existing

literature (Tomlinson and Sainsbury, 2004). The results demonstrated a large variation between the health professionals' responses and the existing evidence (Tomlinson and Sainsbury, 2004).

Nevertheless, a lack of training received by health professionals during their training, around injury prevention, features in literature from both LMICs and HICs (Elboray et al., 2015, Kendrick et al., 1995, Lévêque et al., 1995, Watson et al., 2007, Woods, 2006). Therefore, while practitioners may rely on their own opinions and perspectives, there is a need to develop evidenced based guidance, appropriate to the context which can be provided by health professionals to parents (Tomlinson and Sainsbury, 2004).

Currently, as the information provided to parents in Malawi is typically un-coordinated and unmonitored it is difficult to identify if the information, which is provided to parents about injury prevention, is interpreted correctly or has had an impact on the occurrence of burn injuries. This lack of evaluation is also evident in the literature covering wider LMICs areas. Furthermore, where such evaluation has occurred it often reflects particular projects and interventions (Jetten et al., 2011, Munro et al., 2006), rather than what is provided by the existing government health facilities.

11.1.3.3. Health professionals' suggestions for future burns prevention strategies

Despite the number of barriers expressed by health professionals they also reported methods which may assist in providing injury prevention information to rural and peri-urban households in Malawi. The strategies identified were focused on raising awareness and information delivery.

The most common recommendation identified by the health professionals during their interviews was to develop civic education campaigns. This suggestion included recruiting teams of people, or using community health workers (CHW), to visit villages and provide

information around preventing burn injuries as well as appropriate first aid skills. For instance, it was reported that Health Surveillance Assistants (HSAs) who are employed by the government to act as intermediates between the community and health sector (Kok et al., 2016), could provide education about injury prevention to their associated communities during their clinics and community visits. However, no formal interviews were conducted with HSAs therefore it is difficult to establish, from their opinion, the feasibility of implementing this advice.

In addition, while some studies have indicated the benefits of training and employing HSAs and CHW in relation to preventing malaria, HIV testing and reduction in diarrheal diseases across Malawi and neighbouring countries (Bemelmans et al., 2010, Brenner et al., 2011), they too also face a number of problems. For instance, Kok et al. (2016) conducted 44 interviews and 16 focus groups with HSAs, community members and managers across Malawi's Mchinji and Salima districts. Their findings demonstrated that due to a mistrust between different groups in the health system, irregular supervision and inconsistent training opportunities, HSAs had become to feel demotivated. Kok and Muula (2013) also conducted a qualitative study to explore motivation and job satisfaction of HSAs in Malawi's Mwanza district. Here they reported, in addition to the above that heavy workloads, involvement in activities outside of their job description, poor telecommunication, roads and transport made their job more challenging. Therefore, the addition of injury prevention to the HSAs workload may also require additional support, training and resources above what the participants in this study may have considered.

Participants also recommended using the media, particularly newspapers and radio messages, to inform households of the dangers and correct treatment of burn injuries. However, the practitioners also recognised that the people who are most in need of these health messages are least

likely have access to a radio or literate enough to read a newspaper. Moreover, for LMICs these campaigns can be somewhat limited. For instance, in addition to being costly, these messages can be prohibited by the purposed recipients language and access to mass media (Parbhoo et al., 2010). Furthermore, despite such messages, without additional support there may be little parents can do to modify their environment to reduce injury risks (Mock et al., 2011, Rice et al., 1994).

Lastly, practitioners considered factors which might limit the sustainability of these strategies. They explained that these educational approaches might only provide a short-term impact and therefore regular community visits and advertisements would be needed to remind households of the problem. They also noted that education alone might not be enough to ensure parents make adequate modifications to their home. For instance, they explained that financial limitations and lack of materials may mean that households are unable to build appropriate kitchen spaces.

The limitations of taking one approach to injury prevention, such as the delivery of educational messages alone, are also recognised by the wider international community, as highlighted in Chapter two, Section 2.6. Consequently, while educational campaigns may have some success, the addition of legislation and engineering which combine both active and passive measures need to be considered (Jetten et al., 2011, Peden et al., 2008).

11.1.3.4. ICS initiatives and householders' perception of safety

The WHO has indicated that ICS have the potential to mitigate the occurrence and severity of childhood burn injuries (Mock et al., 2011, Peden et al., 2008). However, there continues to be minimal evaluation of ICS in relation to the applicability of the international biomass stove safety protocol or the context in which childhood burn injuries occur

(Gallagher et al., 2016). As a result, the study's fourth and fifth objectives were developed to: examine the households' perceptions of safety in relation to their cooking methods and identify existing quality control and safety standards utilised by ICS initiatives in Malawi. In order to achieve these objectives focus groups were held with householders to discuss their cooking methods using the current biomass stove safety protocol (BSSP) (Global Alliance for Clean Cookstoves., 2015a) as a guide. Additionally, interviews were conducted with key stakeholders currently working for organisations developing, manufacturing or distributing ICS in Malawi.

11.1.3.5. Quality control strategies utilised by ICS initiatives

It is important that design features, especially those which may provide a level of protection are consistent across each stove manufactured. Therefore the key stakeholders were encouraged to discuss, how they managed to maintain the quality of their stoves produced by local artisans and households. In response, the majority of participants reported the need to create a product standard, measurement tools, quality checks and training. Interestingly these strategies appear to emulate that of the three E's, introduced in Chapter 2: engineering (product standards), enforcement (quality checking) and education (training) (Mock et al., 2011, Peden et al., 2008). However, without further exploration, this research is unable to determine the extent to which these processes resulted in an improvement of stove quality, or if the associated safety features resulted directly in a reduction of burn injuries. Nonetheless, these processes provide a potential starting point from which organisations can attempt to maintain a consistent quality of ICS when manufactured by households and local producer groups especially in countries where there are difficulties in enforcing national standards (Atiyeh et al., 2009).

To ensure that ICS are used as intended the key stakeholders explained the importance of training stove users through demonstrations, pictorial manuals and posters. Though, the information provided appeared to focus primarily on firewood management and kitchen ventilation, this information could inadvertently encourage behaviours which might also reduce the risk of burn injuries. For example, key stakeholders explained that to reduce children's exposure to household air pollution (HAP) users were advised to keep their children away from their cookstoves. Thus, even though burns prevention might not be the key message intended by the demonstrations, some precautionary messages are being delivered. Nonetheless, participants explained it is hard to quantify how effective this training has been or if the stoves have reduced burn injuries.

It has been recognised that, while injury prevention might not be the key message associated with ICS at present, a portion of the existing training provided by these organisations might inadvertently assist in protecting children from burn injuries. In the future it would be recommended that user training and materials contain specific information about burns prevention. Moreover, further research is also required to measure the impact of the demonstrations and manuals provided by organisations to establish if the information has been interpreted correctly, retained and implemented by users.

11.1.3.6. The applicability of the BSSP in relation to householder experiences

Many of the cookstove features, considered by the BSSP, are to some extent in the control of the user (Gallagher et al., 2016). Therefore, to better understand the BSSP, in relation to real cooking practices, focus groups were undertaken with households who had been exposed to, or were using, the ICS stoves promoted by the key stakeholders' organisations.

The responses generated from the household focus groups demonstrated that, while the BSSP can act as a useful guide to draw attention to and measure key safety features of biomass stoves, there are areas not yet considered by the protocol. The aspects included measuring the stability of a cookpot on the stove and the risks associated with firewood that may protrude from the fuel apertures.

Furthermore, it was noted that the evaluation may not represent the true picture of real time stove use. For instance, at present the BSSP indicates that the surface temperature of the stove should be measured at "approximately 20 minutes" (Global Alliance for Clean Cookstoves., 2015a p5) so as to generate a score on the basis that the stoves may, or may not, present a contact burns risk. However, participants explained that the surface temperature of their ICS varied depending on the length of time it is being used. More especially, participants indicated that, once or twice a week, their cooking times would exceed 20 minutes, particularly when cooking legumes and as such their stoves became increasingly hot indicating that the BSSP may not accurately represent the maximum surface temperature of the stove when used to prepare food that has a longer cooking time.

Moreover, although the BSSP measures for flames surrounding the cookpot or exiting the fuel chamber (Global Alliance for Clean Cookstoves., 2015a), it was identified that the amount of flames which surround the cookpot during use is ultimately determined by the user. For instance, even if an ICS was designed to reduce the flames around the cooking pot some users felt that a certain amount of flame is required to cook properly. Therefore, they loaded and stoked the fuel accordingly. This was not the only case where participants appeared to accept a certain level of risk. For example, although participants noted that the pot skirts associated with the fixed ICS design might cause contact burn injuries, as the skirt becomes hot during the cooking process, they liked

this feature as it enabled them to speed up their cooking time and reduce the amount of wood required.

Therefore, whilst household participants, who assessed the ICS, perceived these stoves overall to provide better protection from burn injuries, the safety of a stove itself was not considered a primary decision to use a stove. For instance, despite reporting a number of risks when using their traditional stoves many participants continued to use them as a convenient means to fulfil household requirements. As such, the 3-stone-fire appears to remain a necessity for many households. The reluctance, or preference, to make a complete transition to an ICS is also featured amongst the wider literature which highlights that, despite the introduction of an 'improved' stove, many households will continue to use traditional, or multiple, stoves rather than make a complete move towards an alternative technology (Adkins et al., 2010, Alem et al., 2016, Bielecki and Wingenbach, 2014, Cheng and Urpelainen, 2014, Concern-Universal, 2012, Kumar and Kumar, 2013, Urmee and Gyamfi, 2014).

This study has demonstrated that the BSSP is a useful tool to measure the safety of an ICS, however, while it is possible to have a 'safe' ICS the degree to which certain features can provide a form of passive protection is based on how households choose to use the stove. Consequently there is a need to identify the information that is provided to households on the use of their stove in more detail and where applicable begin to measure the impact of these resources, in addition to the stove itself. Moreover, as many households continue to fuel stack, the presence of a 'safe' stove itself is arguably not enough to create a safer environment on the whole. Therefore, further exploration is needed to identify a means to improve the overall design of cooking spaces, in addition to the stove itself.

11.1.3.7. Factors which affect householders' use and adoption of ICS

The process of behaviour change and the uptake of new technologies is complex and intertwined across broader social, organisational, physical and intrapersonal facets as indicated by the Injury Iceberg created by Hanson et al. (2005). Moreover the diffusion or rejection of a new innovation, such as an ICS, is also influenced by its compatibility with socio-cultural values, the relative advantage compared to the existing solution and its simplicity and an observability of successful results (Nutbeam, 2006a, Rogers, 2003). While ICS themselves might not have been created as a means to reduce burn injuries, the users' rationale for their adoption or rejection of these stoves, could provide an insight into the cultural factors which may hinder, or enable, the promotion of technological or behavioural injury prevention strategies in this area. As a result, both key stakeholders and household participants were encouraged to discuss issues around the adoption of ICS.

Key stakeholders identified that: good marketing, peer education, support from village chiefs and government ministries enabled organisations to initiate ICS adoption across Malawi. In concurrence with existing theory, this approach should accelerate the initial acceptance of ICS. For instance, targeting those who are seen as role models, such as village chiefs and local celebrities to become 'early adopters' should help spread the message, encourage and pressure others to adopt the intervention (Jagger and Jumbe, 2016, Rogers, 2003). Notwithstanding, this adoption also requires that the stove design and set up is culturally appropriate and meets all the needs and requirements of the end users, which as illustrated during this study may be extremely difficult to establish.

In addition to adopting the ICS, participants recognised that financial restrictions may also prevent households from purchasing a stove or building a suitable kitchen in which to install new equipment. It is

therefore also likely that financial restrictions could prohibit households in making changes to their homes which might create a safer household environment. Therefore, as development continues to shift from subsidy-driven to market-based dissemination models there is a need to ensure that any ICS, household alterations, or injury prevention initiatives are equally appropriate, affordable and inexpensive to maintain (Bailis et al., 2009, Sesan, 2012).

Consequently, this study has demonstrated in corroboration with existing research, the introduction and promotion of ICS does not necessarily equate to a change in cooking technology or the complete transition to a new stove (Bielecki and Wingenbach, 2014, Urmee and Gyamfi, 2014). Moreover, as the factors associated with burn injuries cannot be isolated from the broader contexts of poverty and lack of resources, further investigation is needed to uncover the key factors which might motivate sustainable behaviour change, without the need for the overall development of a country.

11.1.4. Factors associated with the causes of childhood burn injuries in rural and peri-urban Malawi using the Haddon Matrix

To conceptualise the study findings the Haddon Matrix, introduced in Chapter 2, has been used to highlight risk factors and possible preventative actions or initiatives associated with burn injuries as reported by participants. The Matrix is presented in Table 24.

Table 24: Risk and preventative factors associated with the causes of childhood burn injuries in rural and peri-urban Malawi using the Haddon Matrix

	Host (Person)		Agent (Equipment)		Physical Environment		Socio-cultural Environment	
	Risk Factors	Preventative measures	Risk Factors	Preventative measures	Risk Factors	Preventative measures	Risk Factors	Preventative measures
Pre-event	Lack of awareness of the causes and prevention of burn injuries Injury prevention not currently a priority Perception that burn events are outside of an individual's control Existing information about the prevention of unintentional	Teach users the safety features of ICS designs and the correct use Incorporate injury prevention within school education messages Advise users to extinguish their stoves after use Incorporate injury prevention into existing health promotion strategies	Candles, open fires, bush fires, wild fires, rubbish pit fires, hot water, kerosene lamps and cookstoves Combustible materials accessible to children	Make available cooking technology which produces heat without the need for (open) flames e.g. ICS Employ alternative lighting sources that are battery or solar powered Provide instruction about the placement of cookstoves Advise that children	Lack of living and storage space for flammable objects and materials Lack of play spaces for children free from hazards No separation between cooking area and other areas Many households lack the financial capacity to make changes to their	Provide education about the burns risks around the home Keep lit flames away from combustible materials Store flammable objects away from children Cook in designated cooking areas, keeping flames in	Gross poverty Open fires and household stoves are a point of social gathering and heating Some hazards and spaces are naturally accepted as part of the village environment It is common place to burn rubbish	Gather support of key 'change agents' in the delivery of injury prevention messages Make burns safety an important community issue Identify other methods to destroy rubbish which encloses flames e.g. incinerators Promote alternative agricultural

	injuries is sporadic and inconsistent	Use hospital visits as an opportunity to impart health advice e.g. posters		are kept away from fires during meal preparations and stove use	environment	one known area Use legislative action to restrict the lighting of fires to certain areas	Bushfires are used to clear the land before harvest Injury prevention not currently a priority	techniques which do not require burning the fields
Event	Stoves and fires are left unattended Children from the age of 6 years can be responsible for household cooking Infants cognitive and physical developmental phases can leave them prone to exploring, crawling and walking into fires during 'a	Incorporate fire safety into existing school programmes from early years Teach techniques to smother flames if someone is on fire i.e. stop, drop and roll Develop the use of play pens, or designated areas, free from fires for small children to play while parents attend to	Lack of water supply Hot porridge, boiling water, charcoal, beans, plastic paper and steam Burn injuries caused by the cooking process are, to some degree, expected Where	ICS have the potential to shield the flame and provide a stable base to cook on Teach parents how to put out fires safely and the importance of not leaving fires unattended Encourage households to store materials such as	Children are at increased exposure to injuries during meal preparation, cold weather and seasons The kitchen spaces are required for other purposes Housing structures are made of flammable materials	Improve access to materials which can be used to put out and stop the spread of fires Investigate ways to separate cooking spaces from other areas where children can be present Teach community leaders and groups methods to	Children's play activities typically include being near or creating fires Female children playing the game 'house' is an integral part of learning how to cook Male children hunting mice and using fires to create toys	Involve the wider community in developing a means to supervise small children and keep them away from fires, particularly during meal preparation Teach and supervise children when learning how to cook Teach parents about abilities in relation to child development.

	period of discovery' Seizure disorders, epilepsy and lack of compliance with anticonvulsant medication Cause of injuries perceived to be the result of factors outside of an individual's control	household chores Develop processes to improve parents belief, or self efficacy, that they are able to make small changes to prevent a burn injury occurring Teach parents about child development stages and link to child safety measures	households have access to more than one stove they might 'fuel stack' increasing the number of heat sources used.	sand and water close by when using fires	Uneven ground around the fire may cause someone to trip into the fires Burn injuries seen to occur in the kitchen, veranda and courtyards	prevent, and put out, large fires safely to prevent damage to buildings or crops Encourage households to maintain an even flooring, free from trip hazards, especially in and around the areas where fire is made and hot substances are carried	The ability to provide adequate supervision is impeded by household chores and responsibilities Parents are not always available to prepare food and therefore it is a necessity for children to cook and use fires	
Post-Event	Lack of first aid knowledge The use of traditional remedies to treat burns injuries such as: salt, ash, soil,	Teach about effective first aid Encourage others to share their experiences of burn injuries so as to highlight the risks	Flammable housing structures Households continue to adopt traditional cooking methods	Ensure that the protocol used to measure the safety of new devices, such as ICS, represents real life use Promote injury	Changes to the household structure are difficult to make and maintain Low levels of appropriate first	Keep dry grass and crop waste away from cooking and open fires Assist households in finding alternative places	Lack of emergency response Difficulties accessing health care facilities	Use community demonstrations to indicate the appropriate first aid following a burn injury Promote the

	flour, glycerine, leaves and raw egg is common Delayed presentation to hospital Lack of consistent information provided to parents about preventing reoccurring injuries Consequences: physical and emotional suffering, loss of education and financial debt	Teach children and parents methods to prevent future burn injuries at treatment facilities Encourage those with epilepsy the importance of complying with medication regimes as well as strategies to follow up patients with epilepsy	alone or alongside ICS	prevention activities through, peer education, local and national government buy in and support of village elders Dispose of faulty stoves, improve accessibility and affordability of replacements	aid, medical services and post burn rehabilitation services Open fires continue to be required for space heating during cold periods	to store their livestock Ensure that fires created for heating are supervised and under control	Despite injury the exposure to burn injuries were seen to be conventional part of village life The ability to heed IP advice has been associated with their level of education, awareness of burn hazards and cultural beliefs Existing health services do not have the time or resources to provide adequate injury prevention.	understanding that some burn injuries require urgent medical attention and should be taken immediately to a medical facility Integrate injury prevention messages into anti-natal and post-natal classes using culturally appropriate visual cues Develop burns services including both acute care and rehabilitation

11.1.4.1. The third dimension

To evaluate potential strategies, developed through the application of the Haddon Matrix a 'third dimension' should be considered (Runyan, 1998). This dimension proposes a set of value criteria which need to be thought-out in relation to potential prevention strategies to ensure that, prior to initiating an intervention or teaching the recommendations are culturally appropriate and sustainable (Peck et al., 2008b, Runyan, 1998).

For example, to successfully integrate an injury prevention strategy, community members must perceive that there is a problem and accept the proposed solution (Freire and Runyan, 2006). However, at present, as demonstrated by the findings presented here, not all households necessarily recognise burn injuries as a problem. Furthermore, household behaviours, such as fuel stacking and the continued used of traditional cooking methods has demonstrated that, ICS alone may not be an acceptable solution to the burns problem. Consequently, any future strategy and intervention needs to explore the perceptions and preferences of the affected community members, to ensure that the socio-cultural context is both recognised and taken into consideration (Runyan, 1998).

Interpreting the feasibility of such interventions is also crucial. For instance, while strategies or interventions can be developed, they might not be realistic in each given setting. In relation to this work, the feasibility of carrying out proposed burns prevention strategies might be hampered by the household's ability to modify their environment or purchase alternative technologies. Moreover, feasibility should also be considered in relation to the individual's ability to carry out the countermeasure (Runyan, 1998). For example, while it might be recommended that parents supervise their children around fires, prevent them cooking from an early age, or keep them away from fires during meal preparation, due to household commitments and demands it is

unlikely that households will be able to adopt or sustain these behaviours without additional support.

Consequentially, the Haddon Matrix presented here provides a starting point from which to understand the contextual factors associated with paediatric burn injuries which had primarily, until now, been restricted to quantitative and hospital based methodologies. However, further research is required to examine the effectiveness and cultural acceptability of these potential prevention strategies.

The remainder of this chapter will now consider the study's rigour, strengths and limitations in order to evaluate the trustworthiness of the research findings.

11.2. The strengths and limitations of the study

11.2.1. Study strengths and trustworthiness

Through the use of qualitative research methods this study has begun to reveal aspects of burn injuries and village life, which have not yet been considered in the published literature. In particular, the methods employed facilitated rich descriptions of the household environments, behaviours and relationships with their cooking, heating and lighting technologies. Moreover, by approaching a range of participants including households, health professionals and key stakeholders this study has provided a range of different perspectives of the burns problem and potential strategies to reduce their occurrence.

In order to add strength to the study findings, this research has applied specific evaluative criteria associated with the qualitative paradigm. These are: credibility, transferability, dependability and confirmability (Lincoln and Guba, 1985). These criteria aim to express that the interpretation of the participants perceptions and realities have been expressed without bias (Maykut and Morehouse, 1994, Speziale et al., 2011).

11.2.1.1. Credibility

To demonstrate that this research has produced an accurate representation of the participants' perceptions the study employed a number of strategies as advocated by qualitative scholars, including: prolonged engagement, peer briefing, iterative questioning, negative case analysis, responder validation and the use of established research methods (Lincoln and Guba, 1985, Shenton, 2004).

To add to the researcher's prior experiences in Malawi, an initial scoping study was conducted. This allowed the researcher to spend time engaging with households and members of the stove sector to develop a familiarity and understanding of the local context and social setting, before data collection took place (Shenton, 2004). As such, this initial visit ensured that the research design and tools could be developed in such a way that they were appropriate in both addressing the research aim and culturally sensitive.

Peer briefing and scrutiny of the research methods and progress was undertaken at four different stages. Firstly between the researcher and the supervisory team, secondly as part of the ethical review process, thirdly in the course of presenting updates to peer groups at academic meetings and fourthly, through presenting at the annual CLEANER Cooking Conference in Malawi. Each of these stages exposed the project to different academic and field perspectives to challenge the researcher and lead to fresh insights (Shenton, 2004).

Iterative questioning was used to assist the researcher in uncovering un-truthful responses. For example, the interviewer rephrased questions or recalled matters previously raised by the participant which had not appeared consistent (Shenton, 2004). This ensured that the researcher could grasp the truth of what was being reported as well as check that the participant had correctly interpreted the questions being asked and confirm the translation. These lines of questioning were also used when

the researcher's observations did not match what had been described by participants.

This research endeavoured to account for all cases and viewpoints expressed by participants (Bazeley, 2013). Therefore, to ensure that individual viewpoints were explored the analysis process acknowledged both common and less common participant responses (Bazeley, 2013). As such, the emergent themes revealed the contrasting ways in which participants explained what they experienced, their environment and burn events.

It was not possible to revisit the village households to corroborate the researcher's interpretations of their data. However, it was possible to discuss the preliminary findings at two annual CLEANER Cooking Conferences in Malawi. The attendees at these events included government and non-government organisation representatives some of whom were interviewed as key stakeholders. As a result, these events provided the researcher with an appropriate platform to discuss their interpretations and gain feedback from those who are familiar with and working in the field.

Unlike quantitative research tools which can be externally validated, qualitative tools need to be purposively developed (Kallio et al., 2016). To ensure that the interview and observational guides were created appropriately the researcher developed an understanding of the area through a review of the literature and preliminary fieldwork. From this, initial research tools were created and piloted in two villages to ensure that the questions were intellectually appropriate and they were eliciting participant experiences. Revisions to research tools were then made accordingly.

11.2.1.2. Transferability

Thick descriptions were used to provide a rich account of: the culture, environment and participants, the rationale and processes used to recruit

participants, the research methods and process to analyse the data so as the reader can make a judgement on the extent to which the findings and conclusions can be generalised to other milieu (Braun and Clarke, 2013, Holloway and Wheeler, 2002, Kallio et al., 2016, Lincoln and Guba, 1985).

11.2.1.3. Dependability

Determining a study's dependability can be problematic. For instance, the concept asserts that, if the study was repeated in the same area, with the same participants, the same findings would be obtained (Bryman, 2012, Lincoln and Guba, 1985). However, it could be argued that, as an individual's perceptions of events is based upon their understanding of reality which is considered by some philosophers to be both time and context specific (Crotty, 2009, Shenton, 2004), further study in the same area may potentially yield different results. Nonetheless, this study has attempted to address these issues by providing a detailed description of the research practices, as well as examples of the processes used to code the data and generate themes (Appendices 5 and 6) (Shenton, 2004).

11.2.1.4. Confirmability

Triangulation of methods, which involves the comparison of two or more data sources to produce a well-developed understanding of the phenomenon, was used to strengthen the credibility and confirmability of this study (Lincoln and Guba, 1985, Mays and Pope, 2006, Parahoo, 2006). However, there is much contention around the use of triangulation as a means to test for validity as, in some cases, it presupposes "that any weakness in one method will be compensated by the strengths of another" (Mays and Pope, 2006 p87).

Nonetheless, in this study triangulation proved useful in providing a rich and comprehensive account of the participant's reality (Parahoo, 2006). For example, by utilising a variety of methods the researcher was able to produce data on a number of different facets and perspectives and where there were differences, it raised more areas to be explored.

Lastly, as the researcher's personal characteristics and prior experiences shape the course of a study (Mays and Pope, 2006, Shenton, 2004), to strengthen the confirmability and credibility of the results, a reflective account of their character and experiences was provided in Section 3.11 at the end of Chapter 3.

11.2.2. Potential limitations of the study

11.2.2.1. Bias in the selection of participants

The processes employed to identify sample villages, households and health workers may have led to an element of bias in the results. For example, the recruitment of villages and ultimately the household participants was reliant on gatekeepers identifying potential communities. However, the selection of villages in this way was purposeful so as to explore householder behaviours alongside different cooking methods. Moreover, developing alliances with NGOs and gatekeepers, who are working in these areas and have gained the trust of elders and community chiefs, meant that the researcher had access to families and communities who might usually be harder to reach and engage with. Therefore, this approach provided an acceptable method to successfully develop a household sample in the time available (Bonevski et al., 2014).

Practically, village selection was also based on the researcher being able to physically access and find suitable accommodation near the sample sites. While this may have restricted the selection of villages, finding accommodation near to the communities allowed the researcher to develop a deeper understanding of the local area through engaging in ad hoc conversations and observations with people around the sample villages.

Nevertheless, in order to situate the study sample amongst the wider population Chapter 5 presented key household attributes alongside the

national data, where available, so as to allow the reader to compare the study sample to Malawi's rural and total population.

Health professionals were purposively selected based on their experiences in caring for children in hospital emergency departments, children's wards and burns units. However, due to the time available for hospital data collection the potential for an individual to be approached to take part in this study was based on their shift patterns, availability and willingness to take part. As a result, the voices of those who were unavailable or uninterested are not included in the findings.

It should be noted that, only a selection of government ran health facilities were approached to take part in this study and therefore might not provide a total and comprehensive picture of methods used to promote health advice for all areas and types of institution. However, the sample does include health facilities based in each region of Malawi and therefore it is anticipated that the study sample could provide an insight into the types of methods and problems faced by government institutions across each area.

11.2.2.2. Researcher bias

As researchers are human beings, it is not entirely possible, nor ideal, to completely remove their prior knowledge or experiences from their interpretation of the data (Braun and Clarke, 2013, Brinkmann and Kvale, 2015, Holloway and Wheeler, 2002).

Therefore, this research employed a number of strategies to ensure that the findings represent a true interpretation of the participant experiences, not those of the researcher. These strategies included: the rigorous development of the research and data analysis tools, seeking critique from supervisors, academic peers and research groups as well as reflecting on the researchers own character and attributes.

Furthermore, to reduce bias during the development and refinement of the key themes, detailed participant quotes were presented to the supervisory team to assess whether the data obtained appropriately supported the final interpretations or not.

11.2.2.3. Social desirability bias

As with natural human conversations, a power asymmetry can sometimes exist between the researcher and participant during the interview process (Brinkmann and Kvale, 2015). More especially, when research or programme development is conducted between outside organisations and community members from lower-socio-economic groups this power imbalance may restrict the participants full and honest contribution in the interview or, produce what the interviewees consider to be socially desirable responses (Atiyeh et al., 2009, Jetten et al., 2011). As such, the impact of these potential imbalances should be reflected on in relation to the production of interview data (Brinkmann and Kvale, 2015).

To mitigate bias in the data collected, the researcher employed a number of strategies. For example, the use of observation, in addition to interview data, allowed the researcher to take note of the environment and household dynamics. Where conflicts appeared between the interviewee's responses and the observational data clarification was sought. However, such conflicts were not common, possibly due to the fact that interviews were conducted in the participant's home, allowing them to use their own observations as a point of reference to respond to interview questions. In addition, certain interview questions were repeated so as to cross check participants responses following different routes of questioning.

It was initially anticipated that, as many of the gatekeepers who introduced the researcher to the villages were affiliated with ICS interventions, participants would speak more favourably about their

technology or be seen to be using their ICS more frequently than the traditional stoves. Yet, this was not found, for instance households were seen to be using a combination of both traditional and ICS technologies during the researcher's time in the communities. Additionally, during the interviews and focus group sessions participants shared their likes and dislikes for each type of technology whether improved or traditional. These open discussions provided reassurance that the participants felt able criticize and speak freely, although, the extent to which participants felt this way will continue to remain unknown.

Lastly, social desirability bias may have occurred during interviews with the key stakeholders representing ICS interventions as they may have wished to represent their work in a positive light, particularly with regards to safety. Nonetheless, throughout the interviews it was noted that the key stakeholders spoke about both their interventions' strengths and limitations. Such openness may also have been assisted by the informant's involvement in the monitoring and evaluation of their ICS interventions typically required by their own funding bodies.

11.2.2.4. Timing and duration of data collection

The timing and duration of data collection was funding and time dependent. Consequently, the relatively short two to three week period spent in each community may have influenced the depth of data collected, as it may not have given enough time for the community to adjust to an outsider carrying out research in their area. For instance, as indicated by the Hawthorn studies, individuals may initially alter their behaviour as a result of being part of a study (Green and Thorogood, 2014). Hence, naturalistic and ethnographic researchers emphasise that investigators need to spend time within their study setting so as to minimise the impact of their presence on the behaviour of those being studied (Green and Thorogood, 2014). In spite of this, it may have been unlikely that the researcher could have achieved this during this time, if at all. However, the communities selected for data collection had

previously experienced outsiders entering their community to conduct surveys and promote interventions and, as a result, may have become, to some extent, used to the intermittent presence of outsiders.

11.2.2.5. Translation of interview data

The process of translation may potentially limit the interpretation of participants' responses. For example, as the researcher did not speak the vernacular languages translators were required. During data collection, the researcher would explain to the translator the question they wished to ask, the translator would then offer this question to the participant and repeat their response back, in English, to the researcher. However, during this process, there was the potential that the translator may paraphrase participant responses. Furthermore, as not all English words are directly translatable into Chichewa or Tumbuka and vice versa, potentially relevant information and nuances may have become lost or misinterpreted.

To mitigate the potential for misinterpretations the translators were briefed prior to assisting with the data collection process. These briefs included highlighting the importance of translating the participant words and experiences, no matter how trivial, as explicitly as possible. It was also highlighted that the translators should not ask leading questions or suggest responses.

Lastly, as the translation was carried out at the time of the observations, interviews and focus groups, it allowed the researcher and participant to seek clarification where necessary to avoid confusion.

11.2.2.6. The use of audio recording equipment

The use of audio recording has the potential to influence participants' accounts as they become nervous or concerned about the use of the equipment which in turn may inhibit participant interaction (Rapley,

2004). Therefore, the interview recording equipment used was small and discrete so as not appear intrusive (Seidman, 1998).

During the data collection process with households the flow of conversation did not appear inhibited by the use of recording or photography equipment. However, in contrast, two health professionals did initially vocalise some apprehensiveness about recording the interview. These issues were particularly associated with concerns about maintaining their anonymity. Such concerns were discussed with these participants. For instance, it was re-emphasised that their contribution would remain anonymous and where applicable they, or any patients they mentioned, would be given pseudonyms or codes. As a result, both participants consented to the use of tape recording. Although the cause for such concerns can only be speculated, it may be that health professionals are more apprehensive about discussing cases to an outsider due to their professional code of conduct and their commitment to maintaining patient confidentiality. Nonetheless, following a few 'ice breaker' questions participants appeared to feel more at ease with the interview situation. No instance was found where participants wished to make comments off the record.

11.3. Chapter summary

This chapter has discussed the principal findings in relation to the research aim, objectives and the wider literature. These findings were then brought together and conceptualised using the Haddon Matrix. The latter part of the chapter has considered the study's rigour, strengths and potential limitations to allow the reader to evaluate the trustworthiness of the study findings. The following chapter will conclude the thesis by presenting the study's contribution to knowledge, implications for future practice and recommendations for future research.

12. Chapter Twelve: Recommendations and conclusions

12.1. Introduction

This final chapter concludes the thesis by presenting the overall contribution to knowledge followed by practical implications for future policy, practice and research. The transferability of these implications and study findings are then discussed. The chapter ends with a concluding summary of the thesis.

12.2. Study overview and contribution to knowledge

This is the first qualitative study in Malawi to provide detailed data on the factors associated with burn injuries based on an investigation of parental perceptions and the household context. In addition, an exploration of the perception of health professionals and those working on interventions which have the potential to reduce the occurrence or severity of childhood burn injuries has been undertaken.

Through the use of interviews and observations this study has systematically collected a wealth of information concerning burns risks and the barriers families face in preventing these injuries. Most importantly, this information has been generated and presented using the participants' own words and experiences, which until now, had not previously been reported. This use of observation assisted the researcher in creating a rich description of the context and household areas. This resulted in additional questioning and exploration. Furthermore, these descriptions can support the transferability of these findings to other similar areas and contexts.

This thesis has addressed the existing gaps in the evidence base by exploring areas which have not yet been considered in the Malawian

setting. Whereas the existing epidemiological literature has been able to recognise potential risks and protective factors associated with childhood burn injuries, this often lacks the depth of information required to understand parental perceptions of burn injuries or the contextual information required to tailor injury prevention initiatives. As such, this study design could be used to initiate further qualitative enquiries around the factors associated with unintentional injuries in other areas of LMICs.

The study has revealed that many of the factors which lead to burn injuries reported in the prior literature are also identifiable by parents and health professionals in Malawi. However, parents often lack the capacity or self-efficacy to perform measures to reduce these risks. In addition, as also reported by studies from HICs, this study has identified that parents are often restricted in providing adequate prevention of burn injuries based on their financial capacity and competing household demands.

In addition to the hazards associated with burn injuries and the developmental capacity of children, this study has highlighted that children in Malawi are exposed to fires during the process of playing games and learning how to cook, more so than their economically stable counter parts. The children's involvement with fires from a young age was also associated with the need to care for their siblings when parents were working or unwell.

The health professionals who took part in this study recognised that they lacked the time, resources and capacity to provide advice to parents on injury prevention. Despite their recommendations that CHW might be able to take on this task, it was made clear by existing literature from Malawi that often they too were hampered by large workloads and challenging infrastructure.

Through the collection of community based data this study has also demonstrated that, in addition to ground level cooking stoves, there are a multitude of other fire related hazards around the home including: candles, open fires, bush fires, wild fires, rubbish pit fires, hot water, kerosene lamps and flammable infrastructures. Therefore, future burns prevention strategies will need to consider both the cookstove and the environment in which it is situated, in order to develop effective injury prevention initiatives.

Ultimately this study, unlike the proceeding literature, has attempted to uncover the wider socio-cultural, environmental and perceptual factors associated with burn injuries in the Malawian setting. In doing this, the study has indicated that, the factors associated with burn injuries are multifaceted and intertwined by the complex nature of poverty, the household environment and the people who reside in it. Thus, it is crucial that all factors are considered in the development of injury prevention strategies if they are to be both accepted and effective.

The following section will now consider the study findings in relation to their practical application, recommendations and future research.

12.3. Practical implications for policy, practice and future research

12.3.1. Creating an awareness of the problem

The initial emphasis of the public health approach is to first identify the extent of the problem and who is most affected by it (Mercy et al., 1993). However, due to the lack of rigorous and comparable epidemiological data sources on the burns problem for this part of Africa, it is difficult to levy support and attention towards the burns problem (Burd and Yuen, 2005). Moreover, as much of the data lacks the detail required to develop appropriate public health strategies, this study proposes that there is a need for more thorough and comprehensive surveillance tools from

which to record burns patients attending health care facilities. Such tools may then act as a guide to inform public health officials to direct resources, treatment and prevention initiatives. Once developed, these tools could also be used to assess the effectiveness of future burns prevention strategies.

In addition, community based and qualitative research studies are required to examine the risk factors in the context in which they occur. Despite the recognition of injury patterns, research is needed to put into context the issues that parents and health professionals face in the prevention of unintentional injuries. For instance, the creation of a standardised observation tool could be used to inform the development of targeted training, support for parents and health professionals to reduce injuries in the home. These tools may prove useful in being pro-active, rather than re-active, to injuries caused by hazards in the home.

12.3.2. Conceptualising the problem

To better understand the burns problem in Malawi, taking into consideration the multi-causal interpretation of injury events, the Haddon Matrix was applied. This conceptualisation of the study's findings has created a means to visualise the risks associated with the: human, agent, environmental and socio-cultural factors. Where the findings generated the identification of preventative strategies, these were also added to the Matrix.

The study recommends that the next phase of this conceptualisation should be to consider, alongside the community members' and health professionals' value criteria and cultural preferences, which potential preventative strategies could be employed and sustained by rural and peri-urban households. The process of exploring these measures should be conducted in such a way that the ideas and concerns of community members are acknowledged at an early stage and throughout the evaluation of a burns prevention programme.

12.3.3. Developing a comprehensive strategy

An important implication noted in both the review of the literature and the empirical data is tackling any risk in isolation is unlikely to have a lasting impact on the occurrence of burn injuries. Therefore, to establish methods which have the potential to deliver health benefits there is a need to consider an ecological approach, whereby the individual is considered as a small part of the much wider physical, environmental and social context. This was applied throughout this study by employing the Injury Iceberg Model as a foundation on which to develop the study's methodology and research tools.

This process indicates that the management of burn injuries falls on the responsibility of many, not just those providing health and curative services. This is also emphasised by the existing public health approach to develop injury prevention strategies and behaviour change using the three Es: education, engineering and enforcement. Throughout the study process it became apparent that there are a number of potential recommendations which could be applied to each of these facets as described below.

12.3.3.1. Education

In HICs health education has been successfully disseminated through a number of mediums including: community education, awareness campaigns, mass media, home-based safety interventions and school programmes (Atiyeh et al., 2009, Gielen and Sleet, 2006, Kendrick et al., 2007, Parbhoo et al., 2010, Rybarczyk et al., 2016). In this context, it has been recommended that educational programmes and campaigns should be targeted towards families, village leaders, health professionals and policy makers to highlight that:

- Burn injuries are an important public health issue
- Many burn injuries are preventable

- Those with, or caring for people with epilepsy, should be supported to administer anticonvulsant medication appropriately (Albertyn et al., 2006, Karan et al., 2015, Outwater et al., 2013)
- First aid for burns, particularly the application of cool water to a burn should be promoted as a secondary intervention strategy (Albertyn et al., 2006, Justin-Temu et al., 2008)
- Campaigns should be targeted during the cold season and times when the use of fires increases i.e. in the morning and evening (Kiser et al., 2012, Samuel et al., 2011)
- Advice on safe cooking practices should be provided, especially on supervising the fire when in use and extinguishing once the cooking task is completed
- Children should be taught about potential risks in and around the home from primary school
- Advice on injury prevention should be illustrated, by poster or demonstration, at points when mothers attend for health services including: pre-natal, anti-natal and under five clinics
- Distributors and retailers of mosquito nets must provide advice not to leave open flames near to the net

12.3.3.2. Engineering

It has been understood that engineering interventions developed by public, private and non-government organisations have the potential to mitigate burn injuries. As a result these technologies should incorporate and consider the following:

- To disseminate ICS which enclose flames within the stove and maintain a cool surface temperature
- To develop existing BSSP guidance to fit with the 'real life' use of the cookstoves
- To incorporate a test for the stability of a pot on the cookstove, in addition to the stability of the stove itself

- Information should be provided to the customer at the time they purchase or receive an ICS to ensure that they are aware of the correct operating procedures in addition to maintaining the safety of the user and those who may be present around the stove
- Using alternative methods, other than open fires, to dispose of waste such as incineration and composting should be considered. Where waste needs to be set on fire in this way, an adult should be present and be equipped with sand, or water, to prevent the spread of flames
- Alternative light sources powered by dry cell batteries or solar should be promoted and made affordable for households to purchase and maintain to reduce the need for kerosene and candle light
- Designated areas should be created where children can play which are free from hazardous objects and terrain

12.3.3.3. Enforcement

Legislative action can be used as a valuable tool to increase the uptake of preventative measures (Peden et al, 2008). However, while it has been noted that often there are difficulties in enforcing such legislation in LMIC, this study has demonstrated that regulations on fire lighting for households that live on corporate land has been implemented with some success. Furthermore, the inadvertent rise in paraffin costs has motivated families to purchase torches, rather than kerosene lamps, suggesting that the cost of fuels can encourage households to adopt alternative, safer, methods. In addition, the following enforcement strategies are recommended based on this study and prior literature:

- Poverty assistance and resource provision programmes (Karan et al., 2015)
- Legislation on standard housing infrastructure, home safety and appropriate fire extinguishing equipment (Nthumba, 2016)

- Legislation on the types of stoves and lamps permitted for sale (Forjuoh, 2006, Nthumba, 2016)
- Legislation should be considered to prevent the careless lighting of bush fires in preparation for the planting season (Albertyn et al., 2006, Edwards et al., 2011)
- Develop and implement child-injury prevention policies (Hyder et al., 2009)
- Impose regulations to ensure that the manufacture, sale and distribution of children's clothing is made from flame retardant fabrics (Atiyeh et al., 2009, Parbhoo et al., 2010)

Notwithstanding these recommendations, it has been considered that in addition to the three Es presented here, community members and health professionals need to be, and feel, empowered to develop the self-efficacy and resources to instigate these actions into their normative behaviours and practice, particularly within deprived contexts. As a result the second practical implication and recommendation considers that of capacity building.

12.3.4. Capacity building and empowerment

To develop injury prevention strategies for rural and peri-urban communities in Malawi, this study has highlighted that parents require additional social and financial support. For instance 'latent' failures, which are metaphorically described by Hanson et al. (2005) in the Injury Iceberg Model as those which lie beneath the waterline, demonstrate that burns risks cannot be isolated from the broader contexts of poverty and lack of resources. Therefore, despite crucial educational input, parents may continue to lack the ability, or readiness, to make changes to their behaviour or environment as needed. As a result, prevention strategies may struggle to empower parents or find success where they continue to be hampered by environments which are inherently unsafe.

Smaller interim measures should be considered to instigate the prevention of burn injuries within the existing environmental context and capability of households. For instance, there is a need to consider the potential social support that households can provide for each other amongst their communities as a means to increase their capacity on the whole to prevent injuries. As observed in this study, household compounds and their associated cooking areas can be placed in close proximity to each other. Therefore even if one household takes action to prevent injuries others may not and consequently the same risks remain present. As such, parents should be encouraged to assist in raising awareness of these risks across their village. Moreover, the wider community, particularly in small and close knit villages may be able to develop a more formalised support system in which children, especially infants, can be supervised. However, further research is required to develop an understanding of what 'adequate supervision' equates to in these areas so as to recognise the potential to use this method as a form of protection.

The capacity of health professionals also requires attention. For example, as demonstrated by the practitioners who took part in this study, the lack of resources and high demands on curative services means that they do not have the capacity to disseminate health advice. Moreover, it was highlighted that, when advice was provided this was based on the practitioners assumptions and experiences rather than training. As a result, this study proposes that where possible:

- Following the implementation of a robust injury surveillance system, health professionals should be made aware of the types of risks which lead to injuries in their areas, and methods in which to reduce these risks so as to pass on to families
- Training should be provided throughout a practitioner's clinical education on health risks and effective injury prevention. This should be supported by resources, such as pictorial

representations of burns risks within the home and the potential methods to protect children from these hazards

- The existing health messages passed on by CHW/HSA requires consideration based on attendances to the local health facilities. To ensure that training is directed towards the most pertinent issues affecting the area, patient groups and seasonal variations.
- In addition to this thesis, further research is required to raise an awareness of the burns problem in order to target additional investment into health facilities to develop the capacity for, or increase the number of, staff who can implement injury prevention strategies

The processes in which to increase capacity in low-resourced settings is a challenge. Therefore, further research is needed to enhance the quality and quantity of data on burns injuries in these areas, to create strong advocates who have the ability to integrate injury prevention within national policies and resource allocation (Hyder et al., 2009).

12.3.5. Adopting interventions to make them more beneficial

This study has demonstrated that the adoption of interventions can be mixed and relies on the development of other key areas to have the potential to create desired health benefits. Therefore, this study recommends that further exploration is needed to identify a means to improve the overall design of cooking locations and fire use, in addition to the development of singular devices such as ICS.

Nevertheless, this study has also demonstrated that ICS initiatives have the potential to inadvertently assist in protecting the cooks and their children from burn injuries. In order to do this it is proposed that ICS programmes, especially during demonstration and within user manuals, should promote behaviours consistent with burns prevention, such as:

- The correct use of operational parts which may become hot during the cooking process
- To extinguish cookstoves after use
- To keep water or sand available to quickly extinguish fires which become out of control
- To promote the concept that excess flames are not conducive to preparing meals faster
- To ensure that infants are kept under control near areas where food is being prepared or fires are in use

Moreover, to instigate passive prevention measures the international community whose focus is to disseminate ICS should continue to develop and peer review their protocols to ensure that the safety of ICS is measured as close to real life application as possible. In addition, the input of stove users should be considered in finalising a stove design to ensure the preventative measures built into the stove function as desired.

Thus, the integration of safety and injury prevention information should be considered, modelled and integrated into existing and future ICS interventions, demonstrations and user manuals with the potential to reduce the occurrence or severity of burn injuries. Furthermore, where possible, organisations should monitor the cause, incidence and outcome of those who have sustained burn injuries using their ICS so as to develop their design features and teaching. Such monitoring could be integrated into the organisation's existing monitoring and evaluation procedures required for carbon credit schemes.

12.3.6. Evaluation of injury prevention strategies

There is a severe lack of robust data which reports on the effectiveness of burns prevention initiatives in LMICs (Atiyeh et al., 2009, Harris et al., 2016, Parbhoo et al., 2010, Peck et al., 2008b, Rybarczyk et al., 2016). As a result there is a large gap in both quantitative and qualitative research, which indicates the usefulness of any sort of intervention to reduce

childhood burn injuries in this setting (Outwater et al., 2013). Moreover, given the lack of treatment and rehabilitative services available, the limited protection provided for these injuries is a concern (Hyder et al., 2009). Therefore, it is recommended, when possible, any new initiatives are carefully evaluated to determine their effectiveness (Hyder et al., 2009).

It is understood that to ensure that prevention strategies are effective, they must be tailored to the environment accounting for specific risks and behaviours, and therefore it is not practical to assume that burns prevention strategies which have been successful in other more economically stable circumstances can be simply transferred to LMICs (Outwater et al., 2013). Such issues have been recognised by the WHO who has called for further investigation into the potential strategies and promising interventions that may mitigate the occurrence of burn injuries in these settings (Mock et al., 2008). Consequently, there is a need to encourage donor organisations and development agencies to make a place for childhood injury prevention alongside existing health campaigns and research (Hyder et al., 2009), the implementation of which could be used to convince policy makers that injury prevention has the potential to reduce the costs on curative health services and therefore requires further attention and resource allocation.

12.4. Transferability of study findings

Although this study was conducted in four communities in Malawi the findings and research process could be applied to other similar contexts and situations for uncovering the factors associated with burn injuries. For instance using a qualitative approach, the study presented a number of factors which may impede the development of injury prevention strategies, particularly if the cultural context is not considered. For instance, protective behaviours can be prohibited by poor environmental infrastructure and the need for non-electrical appliances for heating,

lighting and cooking. Moreover, the developmental and socio-cultural factors associated with burn injuries presented by this study might also be generalised to areas in which children have little access to safe or designated play areas and become responsible for household tasks, which expose them to fire from a very young age.

The findings also suggest that this qualitative approach would be beneficial to organisations that are currently developing or implementing ICS programmes across areas that are reliant on traditional biomass stoves. More especially, this study has re-emphasised the need for ICS programmes to consider the wider context in which the stoves are used, the integration of safety into their design and the importance of including standardised safety advice in their dissemination and distribution campaigns.

12.5. Conclusion

Burn injuries continue to disproportionally affect the world's poorest populations (Peden et al., 2008). However, the allocation of funds for the development of burns prevention strategies are inhibited by a lack of existing data that reflects the true extent of burn injuries and the value of prevention initiatives (Alonge and Hyder, 2013). As a result the burden and level of response needed to address these injuries has long been underestimated (Alonge and Hyder, 2013, Mock et al., 2008).

The first objective of this thesis was to identify factors which expose children to burn injuries in Malawi. The conclusions related to this objective re-emphasise that the exposure to burns risks have been attributed to: household infrastructure and environments which are conducive to the ignition and spread of fires, flammable methods to cook, heat and light rural homes, rapid changes in children's developmental capacity and will to play, children's household responsibilities and health conditions which may result in seizure activity. Whilst parental supervision may be able to provide some

protection against these injuries, the ability to maintain close observation of children is complex and compounded by household demands and parents' perception of these risks.

The second study objective was to explore parental perceptions of burn injuries and their prevention in order to understand the current methods, if any, utilised by households to protect children from such injuries. The findings of this study, in corroboration with existing literature, has demonstrated that parents are able to recognise a number of potential burns hazards around the home, but due to their limited financial capacity and knowledge of burns prevention can face challenges in implementing strategies to avoid these injuries occurring. Although a proportion of parents expressed a fatalistic attitude towards burns injuries, this outlook was also related to the environment participants lived and the degree to which these hazards were part of necessary household activities.

The third study objective was to explore health professionals' perceptions of paediatric burn injuries and their prevention. In response to this objective it has been concluded that, the factors health professionals associate with the occurrence of burn injuries concurred with that of prior research and included: poor parental supervision, children's developmental capacities and play, season, poor housing infrastructure and secondary health problems. The practitioners in this study were also able to provide valuable insight into: the methods employed to prevent burn injuries, the barriers to providing and implementing injury prevention advice and potential recommendations for future injury prevention strategies. For example, in addition to a lack of training, resources and time, practitioners identified that parental education, attitude, knowledge and financial capabilities might impact the success of future burns prevention programmes. Nonetheless, practitioners considered that community education and sensitisation programmes might be useful in preventing burn injuries. However, such campaigns

would be limited to a proportion of the population who had the capacity to initiate preventative actions and behaviours in the home.

The fourth and fifth study objectives were to: examine households' perceptions of safety in relation to their cooking methods and identify existing quality control and safety standards utilised by ICS initiatives in Malawi. The purpose of which was to understand how safety is considered in relation to ICS by householders and key stakeholders, as well as identifying existing methods to maintain stove quality. As a result this study concludes that while quality control is considered in relation to ICS development, the existing methods used to measure this, particularly in relation to safety, do not necessarily reflect the issues that users are presented with in real-life. The study also takes into account that, although ICS might have the potential to offer some protection against burn injuries, there are a multitude of other hazards and risks associated with the broader household environment. In addition, although information about the prevention of childhood burn injuries might be inadvertently provided through user manuals and demonstrations, the impact of them has not been measured. Furthermore, the study has indicated key issues associated with the diffusion of ICS technology in rural and peri-urban Malawi. These factors might be applied to inform the development of future technological and behavioural injury prevention initiatives.

The themes generated from each of the study objectives were applied to the Haddon Matrix presented in Chapter 11. This Matrix provides a starting point from which to understand the contextual factors associated with paediatric burn injuries which had primarily, until now, been restricted to quantitative and hospital based methodologies. This concluding chapter has illustrated the practical application of these findings and identified areas that require further investigation. However, if burns prevention initiatives are going to be developed in Malawi and other LMICs, further support is needed from donor agencies,

international organisations and academic institutions to recognise the true extent these injuries have on children and their families.

This study indicates that there is considerable potential to prevent burn injuries in children by firstly, raising awareness of the burns problem and potential prevention measures to policy makers, key stakeholders, health professionals and parents. Secondly, by encouraging communities, households and parents to practice behaviours that could prevent burn injuries. Thirdly, through providing families with the support to make changes to their homes and fourthly, to engineer products which can restrict or reduce the amount of hazard produced.

13. Appendices

Appendix 1: Participant information sheet: Householder

Participant Information Sheet: Householder

Dear Householder,

My name is Maria Beard I am researcher from the University of Nottingham, UK. I am working on a project that aims to investigate factors which contribute to accidents in the home. I will be talking to a number of households about the use of different cookstoves and heating sources in the home. If you wish to contact me about this work please find my contact details on the final page of this document.

Before you decide whether to take part it is important for you to understand why this research is being done and what it may involve. Please take time to read or listen to the following information carefully, you may also discuss this with friends or relatives if you wish to. Please ask if there is anything that is not clear or if you would like more information. If you decide to take part you may keep this leaflet for your reference.

What is the purpose of this study?

The purpose of this study is to gain a better understanding of day to day cooking practices in the home in order to identify factors that may contribute to the causes of injuries in children. The researcher will be based in Malawi for approximately 6 months (November 2014 to May 2015) during this time they may visit your community to speak with you and other households in the area.

Why have you been chosen?

- You have been recruited for one or more of the following reasons;

- Your community is either in a peri-urban or rural area
- You are a community leader
- You are using traditional cooking methods
- Your community has been exposed to improved cookstove interventions

Do you have to take part?

No, participation is voluntary. It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign or print a consent form. If you do decide to take part you are still free to withdraw at any time without giving a reason. You may request that all or some of your data be destroyed and will not be used in the study. There are no consequences to deciding that you no longer wish to participate in the study.

What will taking part involve?

Participation in this research may involve

The completion of a household questionnaire this should take 5-10 minutes to complete. If you require assistance with any of the questions a research assistant will be happy to assist you.

You may be asked to take part in a further interview with the primary researcher and translator. These interviews will be arranged around your time and can take place at your home or a community meeting point. Discussions will be based around your day to day cooking practices, safety practices, experiences of different cooking technologies and factors which have resulted in a burn injury for yourself or a family member. Interviews may last 30-60mins depending on the time you have available and the information you wish to share. Participation may involve the tape recording of the interview, note taking and photography. The use of photography is at your discretion. All personal information will be

removed from your interview data to ensure your accounts remains completely confidential and anonymous.

The researcher may ask you to show them around your home and spend some time observing your household during food preparation and cooking periods. This observation will be informal and you should feel free to share thoughts and opinions about risk within the household. In this time the researcher may record information on a checklist or by using photography. This will only be done at your discretion. All information and photos will be kept confidential and anonymous.

Are there any hazards, inconveniences and risks associated with this study?

No, the researcher would like to see how you typically prepare and cook food within the home. You will not be asked to do anything different or put yourself at risk during this study.

What are the possible benefits of taking part?

The benefit of taking part in this study will help us to achieve a greater understanding of the factors associated with burn injuries in children. This will allow the development of recommendations for future cooking and health interventions. There are no financial payments attached to taking part in this research.

What if something goes wrong?

Participation is voluntary. If you change your mind about taking part in the study you can withdraw at any point without explanation. If you decide to withdraw you can decide whether to withdraw some or all of your data. If you decide to withdraw your data this will be destroyed and will not be used as part of the study.

Will my taking part be kept confidential?

All information collected about you and your household during the course of the research will be kept confidential. Your data will be given a participant code that will be unidentifiable to you. Your consent form will not be used to identify you and will be filed separately from all other information.

Field notebooks will be locked in a secure filing cabinet at the researcher's base in Malawi or the University of Nottingham in the UK. All transcribed or recorded interview data will be kept on a password protected computer.

With your consent photographs may be taken to gather an accurate record of the household setting, placement of cookstoves and heat sources. Photographs may include yourself or other members of your household. These images will be used as part of conferences, publications, working papers and presentations to local organisations and agencies. Photos taken as part of the study will not be placed on social media sites or any other medium that is not directly related to the academic publication and dissemination of this study. If you are happy for photography to be used during the data collection please sign or print next to the appropriate statement on the consent form.

What will happen to the results of the research study?

The information collected from your interview will be used to identify common themes or issues related to burn injuries in children. It is anticipated the final report will be completed by October 2016 and will be made accessible electronically on the University of Nottingham eThesis archive. This information may also form part of publication or conference presentations. The information will not be used in a way that will not allow you or your family to be identified individually.

Who is organising the research?

This study forms part of a research project being undertaken by Maria Beard at the University Of Nottingham. Maria is supervised by Dr Mike Clifford and Dr Michael Watson both Associate Professors at the University of Nottingham, United Kingdom.

Who has reviewed this study?

The study has been reviewed and approved by the Faculty of Engineering Ethics Committee (University Of Nottingham, UK) and the College of Medicine Research Ethics Committee (University of Malawi).

Who can I complain to?

In the case you have a complaint about the researcher, the research assistant or any aspect of the study you can initially approach the lead researcher (Maria Beard). If this does not achieve a satisfactory outcome, and you wish to make a formal complaint about the conduct of the research then please contact The University of Nottingham Engineering Faculty Research Ethics Officer, Dr Gary Burnett, Room 51 Coates, University Park, Nottingham, NG7 2RD, (+44) 0115 95 15030, gary.burnett@nottingham.ac.uk

Contact for Further Information

Lead Researcher Maria Beard

Email – maria.beard@nottingham.ac.uk

Phone (UK) – (+44) 7921193122, Phone (Malawi) 099189124

Should you want to find out more about participants rights within research please contact; COMREC Secretariat

College of Medicine

P/bag 360

Blantyre 3

01876498 etx 334

Appendix 2: Participant consent form: Householder

CONSENT FORM 1 HOUSEHOLDS

TITLE OF RESEARCH PROJECT: "An exploration of the factors associated with burn injuries in rural and peri-urban Malawi"

NAME OF INVESTIGATOR: MARIA BEARD, PhD RESEARCHER UNIVERSITY OF NOTTINGHAM, FACULTY OF ENGINEERING

RESEARCH SUPERVISORS: DR MIKE CLIFFORD AND DR MICHAEL WATSON

PURPOSE OF THE RESEARCH: The purpose of this study is to gain a better understanding of day to day cooking practices in the home in order to identify factors that may contribute to the causes of burn injuries in Malawian children.

PARTICIPATION IN THIS RESEARCH: Participation in this research will consist of one or both of the following components;

The completion of a household survey. This survey will ask about accidents within your household during the last 4 months.

An informal interview. These discussions will be based around your day to day cooking practices, home safety practices, experiences of different cookstoves and factors which have resulted in a burn injury for yourself or a family member. If you choose to take part you will have an interview with the researcher, this can be organised at your home or community meeting point the interviews will last approximately 30 minutes to 1 hour.

A tour of your house/living area. After the interview the researcher may ask you to show them around your home particularly your living, cooking and sleeping spaces. During this time the researcher would like you to demonstrate and talk about the types of heating, lighting and cooking equipment you use within the home. If you would prefer the researcher

did not access some or all of the rooms within your house this will be respected.

Informal observations. The researcher will be based in your community for two weeks during this time they may visit your home during periods of food preparation to observe how you cook and prepare meals at different times during the day. If you would prefer the researcher did not visit your home during this time this will be respected.

Participation **MAY** involve audio-recording, note taking and photography. This will be at the discretion of the participant. Any information provided in the interviews will be completely confidential and anonymous. Photographs will be taken to obtain an accurate account of the household setting, placement of cookstoves and heat sources. Photographs may include yourself or other members of your household as long as you are happy to be in the pictures. These images will be used as part of conferences, publications, working papers and presentations to local organisations and agencies. Photos taken as part of the study will not be placed on social media sites or any other medium that is not directly related to the academic publication and dissemination of this study.

WHAT WILL HAPPEN TO THE DATA: This research forms part of an academic study. Information collected from your interview will be used to identify common themes or issues related to burn injuries in children. It is anticipated the final report will be completed by October 2016 and will be made accessible electronically on the University Of Nottingham eThesis archive. This information may also form part of publication or conference presentations. Your name will not be included within these reports.

Please read or listen to the following information in this form;

To confirm each box has been read and understood please tick the box following each statement below	
I voluntarily agree to take part in this study	
I confirm that I have been given a full explanation by the above named investigator or research assistant and that I have had the chance to read or listen to the information provided in the participant information sheet.	
I have been given the opportunity to ask questions and discuss the study with the investigator or research assistant on all aspects of the study and have understood the advice and information given as a result.	
I authorise the investigator to disclose the results of my participation in the study but not my name.	
I understand that information about me recorded during the study will be kept in a secure database. If data is transferred it will be made anonymous. Data will be kept for 7 years after the results of this study have been published.	
I understand that I can ask for further instructions or explanations at any time during the investigation.	
I understand that I am free to withdraw from the study at any time without penalty.	
I have been informed there will be no payments for the participation in this research.	
I understand that if information is disclosed during the interview that indicates intentional abuse or harm of a minor the investigator has obligation breach confidentiality and pass this information to the relevant authorities.	

Photos: please read or listen to the following statements and tick the box next to statement most relevant to you.

I grant the researcher named above the right to take photos to illustrate my cooking and heating equipment. These photographs may include me and/or my family in connection with the above study/technology. I agree that they may use these photographs	

without my name for any lawful purpose this will include thesis, publications and conference presentations.	
I grant the researcher named above the right to take photos to illustrate my cooking and heating equipment. These photographs may include me and/or my family in connection with the above study/technology. I agree that these photographs may be published and request that any faces seen within the image are covered or blurred.	
I do not grant the researcher named above the right to take photos of me and my family in connection with the above study.	

Participant

signature ..... Date .....



Participant thumb print

I, the researcher, confirm that I have fully explained the purpose of the study and what is involved.

Researchers signature .....

Date.....

The signed copy of this form is retained by the researcher, and at the end of the project passed on to the principal investigator. A Participant Information Sheet will be given to the participant for their own records.

Should you want to find out more about participants rights within research please contact:
COMREC Secretariat
College of Medicine
P/Bag 360
Blantyre 3
01876498 ext 334

Appendix 3: Sample interview guide: Householders

Introduction

Participants will be introduced to the researcher and research assistant.

The participant information sheet and consent form to be read aloud in local dialect.

Opportunity for participant to ask questions about the forms and the study

Tape recording and photography

Ask interviewee for permission to tape record the interview. Explain that it is important to capture their words and ideas and using a tape recorder will allow the researcher to do this.

If interviewee does not permit tape recording ask if it is ok to take written notes.

Re-inform the interviewees they will remain anonymous and the notes and recordings will be kept strictly confidential. Tape recordings, written notes and equipment will be kept in a locked safe and transferred to a password protected computer as soon as possible.

Ask the interviewee for permission to take photographs during the interview and observational process. Explain that;

- Photos are useful to provide an accurate record of the household setting, placement of cookstoves and heat sources.
- Photographs may include yourself or other members of your household as long as you are happy to be in the pictures.
- You do not have to be in the photograph.
- Photographs taken may be used for any lawful purpose including publications, thesis and conference posters.
- Photos will **not** be printed with participant names.

- If interviewees do not permit the use of photography no-photography equipment will be used.
- For more information about the use of the photographs please refer participant to the information sheet.

Consent

Before signing the consent for to ensure that;

- The participant has been given time to ask questions about the tape recorder and/or photography.
- Participants are re-informed that they may withdraw all or parts of their data. There would be no consequence of withdrawing information and no reason is required.
- Participants are provided with the information sheet and copy of consent form in either English or Chichewa.
- Identify contact details of researcher should participants wish to make contact following their interview.
- Ensure participant is happy to continue with the study and to sign or print on the consent form.

Researcher to co-sign the consent form

Turn on the tape recorder and test it together

Begin interview

Explain to participants where possible to give examples to help explain their experiences.

For the purpose of providing examples the definition of a child will be anyone under the age of 16 years.

There are no wrong answers

Demographic household information

Inform names will be changed for participant codes in transcription process. This below information is for the researchers use only and will remain confidential and kept separate from the interview notes/recordings.

Family Name

Family members present at the interview

Family Participant Code

Community Name

Primary cooking technologies employed by the household

Length of time using this technology

Other equipment used for cooking, heating and lighting in the household

Contact details for the family

Date of interview

Background – The Household

Could you tell me more about who lives in the house by helping me complete the following table?

Name	Age/Gender	School completion	Primary/Occupation or source of livelihood	Other

Typical Day

- **Other than your primary occupations/livelihood activities could you tell me more about the roles you have within the household?**
- **What roles do the children have within the household?**

Please use the following table as a prompt to describe a usual day for the members of the household, think about when you undertake activities, when you cook and where people are during the day?

Time/Prompts	Adults	Children	Other
Early Morning What time do you get up? When/where do you prepare breakfast? Do you prepare bathwater?			
Mid-Morning Where do you go mid-morning? Where are the children at this time, who cares for them?			

Mid-Day Where do you prepare lunch? Where do the children eat lunch?			
Early Afternoon What activities are you involved in the afternoon? What time do the children leave school, who cares for them? Where do the children go to?			
Late Afternoon What activities are you involved in the afternoon? When do you need to use lighting in the household Where are the children are at this time are there any activities they take part in during the evening?			

Evening/Night What time do the children go to bed? Is there anything you do before you go to bed?			

- **Other than the tasks that have been described above, are there any other duties or tasks that you need to undertake on a regular basis? If so please could you also describe these and when they are undertaken?**
- **How might your day change during religious days/events, celebrations and family gatherings?**

The House

- **Tell me about your house/living space;**
- **How long have you lived here, is there anything that you have changed about the living space during your time here and why?**
- **Where is your favourite place to be within your compound?**
- **Why is this?**

Children: Spaces and play

- **What types of games do your children like to play?**
- **Where do your children like to play?**
- **When it is dry season where do the children spend most of their time?**
- **When it is cold season where do the children most of their time?**
- **Where do children spend most of their time during wet season?**
- **Where do you think children are the most safe and why?**
- **What makes this space safe?**
- **Where do you think children are most at risk of injuries?**
- **What makes this space dangerous?**
- **Is there anything that you do to reduce these risks? Is this sufficient?**

Children: Development and learning

- **At what age were your children independently mobile?**
- **At what age did the children start to reach and climb for objects?**
- **Can you give an example of the child learning these skills.**
- **At what age did your children learn about fire?**
- **How do you know that they were aware of the fire ?**
- **At what age do the children start to make their own fires?**
- **What are these fires used for?**
- **At what age did they become aware of the dangers of fire?**

Heating

- **Using the table we made earlier as a prompt could you explain further where and how the family keep warm during each of the seasons?**
- **What influences your choice of heating method?**
- **Are these methods of heating sufficient? If not is there anything else you do?**

Lighting

- **Using the table we made earlier as a prompt could you explain further what lighting is kept and used within the home?**
- **What influences your choice of lighting method?**
- **Are these methods of lighting sufficient? If no is there anything else you do?**

Cooking

- **Using the below table as a prompt could you;**

- **Explain further where and when the household cookstove(s) are used during the day/night**
- **Describe who is involved in the cooking process during each of these times?**

Cooking Methods

- **What influences your choice of cooking method?**
- **Do you ever experience any problems cooking with your cookstoves? If yes, could you explain these for each of the stoves that you use?**
- **Do you ever experience any benefits of cooking with different cookstoves? If yes; please could you explain this for the stoves that you use?**
- **Of the cookstoves that you use, which do you prefer and why?**
- **How do you decide where to put the cookstoves in your house/kitchen spaces?**
- **Once you have completed the cooking process what do you do with your stove?**
- **Are the stoves kept lit?**
- **What is done with waste ash/fuel?**

Stove interventions

- **Have any government organisations, charities, national or international programmes promoted the use of improved cookstoves in your area?**
    - ***Prompts***
    - **If yes, what cookstoves were promoted? Please describe these in as much detail as possible**
    - **What information were you provided with?**

    - **How long has/had the organisation been promoting these programmes in your area?**
    - **How were the stoves provided to the household (paid, donated, already installed in the house)**
- **Have/did you ever purchased or taken up an improved cookstove?**
    - ***Prompts***
    - **If yes, what influences your decision to purchase the stove?**
    - **If no, what are you using at the moment and why have you chosen this method?**
    - **Where/are there any obstacles that prevent you from installing or using the improved cookstoves?**

Home Hazards

What do you think are the top 5 causes of child injuries in the home? Please list them in the below table so they can be used as prompts for later questions

Cause	Description/Rating

- **Once you have listed the top 5 causes, please rate them in order that you think is the most likely to least likely to cause injuries to a child in the home**
    - **When doing this please explain why these are the main causes?**
    - **Are there any other contributing factors that can increase the risk of child injury in the home?**
    - **When are injuries most likely to occur?**

Safety Practices

- **Do you think that injuries can be prevented?**
    - ***Prompts***
    - **How can the causes be managed? Discuss each one in turn.**
    - **Who is responsible for managing these issues?**
- **Is there anything that you or your family do specifically prevent injuries from happening in the home? If, yes please provide a list in the space below**
- **Is there anything that people outside your family could do to prevent child injuries occurring in the home?**
- **Is there anything that stops you from preventing injuries in the home?**
- **What would enable you to prevent injuries around the home and during the cooking process?**

Safety Training

- **Have you ever received training formal or informal on preventing injuries around the home?**
    - ***Prompts***
    - **Who provided this training?**
    - **Why was this provided?**

- **When was the training provided?**

Burn Injuries

- **When would you say someone has had a burn injury?**
- **Are there different levels?**
- **Are some burns expected? If so why?**
- **Are there burns that are not expected? If so why?**
- **Who in your household do you think is the most at risk of burn injuries and why?**
- **What makes these people most vulnerable?**

During the household questionnaire you identified that a member of your family or yourself had a burn injurie in the last year. In this next section of the interview we would like to talk about that event, what happened before, during and after the injury. Please take your time to answer and remember the event, if you become upset or distressed by this questioning please let us know and the interview can be paused or rescheduled at an agreeable time.

Pre-event

- **Please could you explain what events lead to the burn injury?**
  - ***Prompts***
  - ***What was happening just before the injury occurred?***
  - ***Think about the person – what were they doing?***
  - ***The heat source they were using or near?***
  - ***The space where were they?***
  - ***Was anyone with them?***
  - ***Did the person involved have any existing impairment that you are aware of? How does this affect them? (Did the person have seizures mobility problems or an illness at the time i.e. malaria or pneumonia?)***

The event

- **Please could you explain what caused the injury/how the injury happened?**
    - ***Prompts***
    - ***Did the person know about the danger?***
    - ***The space, could the person escape the danger?***
    - ***Could help be called or reached?***
    - ***Was the person alone or with other people, if so who?***

Post event

- **What happened after the injury?**
    - ***Prompts***
    - ***What treatment did you provide initially?***
    - ***Did you attend a health facility? If so please complete the following table;***

Distance to Health Facility approx.	Name of facility	Mode of transport	Length of stay

- **Were there any physical or physiological changes for the victim or the family?**
- **What immediate impacts did this have on the family?**
- **After the injury did you change anything about your environment or practices?**
    - **What did you change?**
    - **How do you think this change may help? Do you think this change will be sustained?**
- **Do you think similar events are likely to occur again?**
- **Have your opinions on child injury changed since the event?**

Final Questions

- **At present, do you think you are able to change your home surroundings/livening spaces to prevent injuries from occurring in the home or during your cooking processes?**
- **How did you find answering the questions in this discussion?**
- **Is there anything you would like to add that we have not already discussed?**
- **Is there anything you would like to ask the researcher?**

Appendix 4: Household observation guide

Before conducting the observation translator will explain to the householder;

If they would be happy to give the researcher (and research assistant) a guided tour of their home and living spaces. This will include the living, sleeping and cooking spaces. Participant will be informed that it is at their discretion to allow the researcher access to each of these spaces. They should feel free to allow access to all or some of these areas.

Participants should feel free to express or explain hazards they see around the home and how these are managed.

Participants will be asked again if they consent to the use of photography during this tour. Photographs will be used to provide an accurate record of the household setting, placement of cookstoves and heat sources. Photographs may include the participant or other members of their household if they are happy to be in the pictures. These images will be used as part of conferences, publications, working papers and presentations to local organisations and agencies. Photos taken as part of the study will not be placed on social media sites or any other medium that is not directly related to the academic publication and dissemination of this study. If participants do not consent to the use of photography during this part of the research this will be respected and recorded appropriately on the consent form.

Demographic Information

Before continuing with the tour of the home the researcher would like to clarify the following information about household. This information will be kept confidential; names will be changed for participant codes in the transcription process. This below information is for the researcher's use only and will remain confidential and kept separate from the interview notes/recordings.

In order to understand where and how the living spaces are used by the household the researcher would like to take some drawings and pictures of your compound. During this exercise it is hoped that you will work alongside them to make the drawings as detailed and accurate as possible.

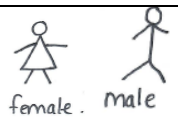
Room Function

Before drawing a map of your living spaces could you explain to the researcher what rooms/spaces you have in your house and how they are used?

Room	Function/s

Map of the household

Now we have discussed the use of each room the researcher would like to create a map of your house and living space/s this can be sketched on the following page. To ensure the drawing is clear please use the following symbols to identify different objects and people;

Object	Symbol
Adult	
Child	
3 stone fire	
Candle	
Torch	
Open fire	
TLC fixed stove	
Charcoal Mbaula	
Chitetezo Mbaula	

Map of your house/Living space

Where do you spend your time?

- On the map please can you identify the following?
- Where do you place the cookstove/s in dry season?
- Where do you place the cookstove/s in wet season?
- Where do you place the cookstove/s in cold season?
- If applicable, please locate on the map where any other fires may be lit during wet, dry and cold season?
- Is lighting placed outside when it is dark? If so please indicate what is used and where this is typically placed on the map. Does this change over the seasons?
- Please add to the map where your family will spend most of their time when at home, for this use a different colour for;

Wet season

Dry season

Cold season

As we draw/walk round your house/space please could you identify factors that might cause injuries to yourself or children?

Sitting Room Space: In the space below please assist the researcher in making a drawing of your living area.

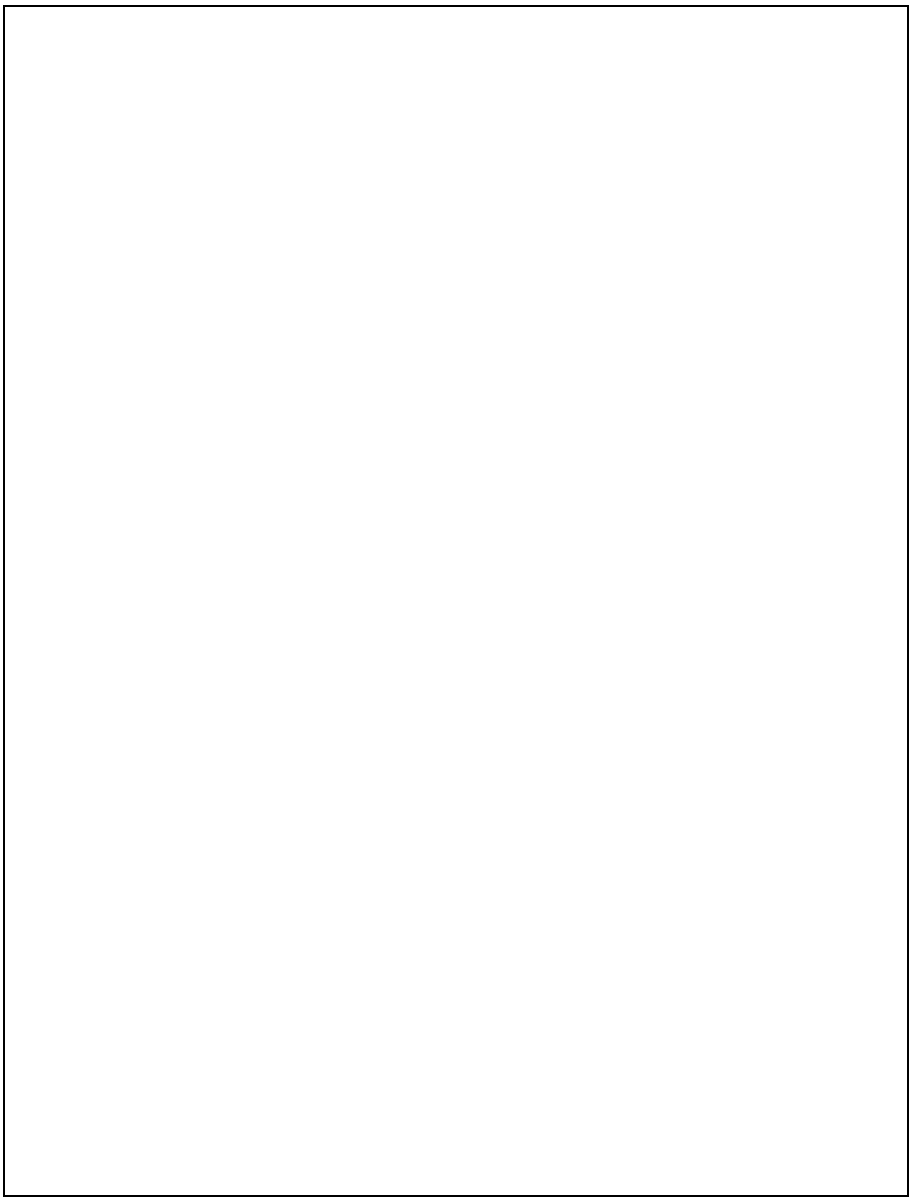
On the Map please indicate the position of in both wet and dry seasons;

Candles

Heating equipment

Hot water

Other areas you note as a hazard in the room



Sitting Room Space Continued

The following spaces should be used to provide further explanations of potential hazards in the living space including how they are managed in this household.

Sitting Room Space		
Potential Hazards	**Comments**	**Not applicable**
Candles i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where they could be knocked over*		
Kerosene lamps i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where they could be knocked over*		
Flooring i.e. *- No hazards* *- Safety measures taken* *- Uneven* *- Untidy/trip hazards*		
Heating equipment i.e. *- No hazards* *- Safety measures taken* *- Placed in an area where they can be knocked over* *- Close to flammable materials and/or combustibles*		
Hot water i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where it could be knocked over*		
Other		

Kitchen Space: In the space below please assist the researcher in making a drawing of your living area.

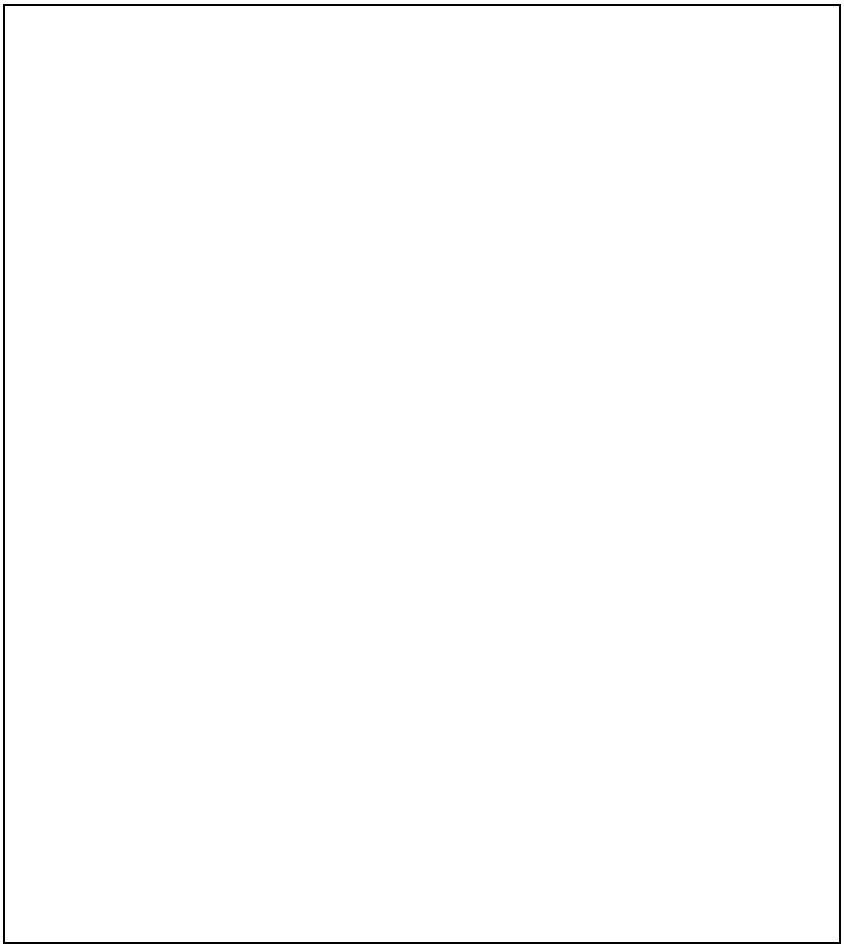
On the Map please indicate the position of in both wet and dry seasons;

Candles

Heating equipment

Hot water

Other areas you note as a hazard in the room



Kitchen Space Continued

The following spaces should be used to provide further explanations of potential hazards in the kitchen space including how they are managed in this household.

Kitchen Space		
Potential Hazards	**Comments**	**Not applicable**
Candles i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where they could be knocked over*		
Kerosene lamps i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where they could be knocked over*		
Flooring i.e. *- No hazards* *- Safety measures taken* *- Uneven* *- Untidy/trip hazards*		
Heating equipment i.e. *- No hazards* *- Safety measures taken* *- Placed in an area where it can be knocked over* *-Close to flammable materials and/or combustibles*		
Hot water i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where it could be knocked over*		
Non-cooking equipment i.e. *- No hazards* *- Safety measures taken* *- On or near cookstove* *- Visibility for cooking*		

Cooking area i.e. *- No hazards* *- Safety measures taken* *- Tripping hazards/ obstructions*		
Disposal of ash firewood i.e *- Where is ash/used firewood disposed of* *- What happens to the fire after cooking?* *- Safety measures taken*		
Other		

Sleeping Space: In the space below please assist the researcher in making a drawing of your living area.

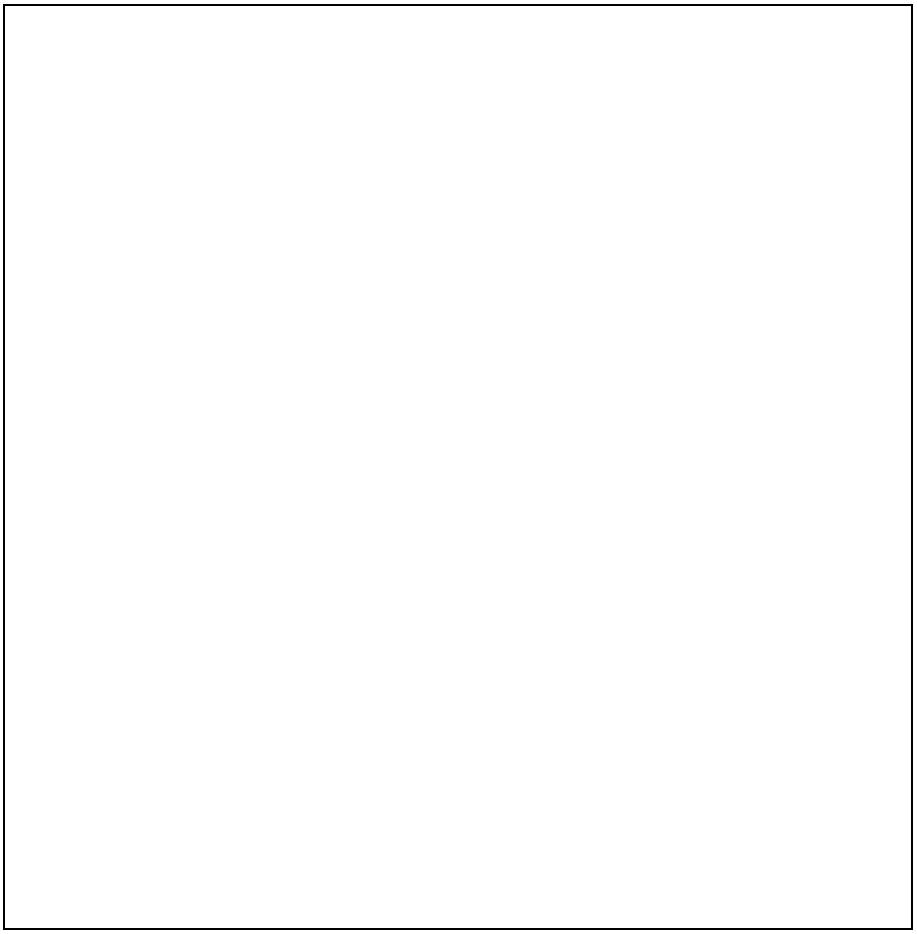
On the Map please indicate the position of in both wet and dry seasons;

Candles

Heating equipment

Hot water

Other areas you note as a hazard in the room



Sleeping Space Continued The following spaces should be used to provide further explanations of potential hazards in the sleeping space including how they are managed in this household.

Sleeping Space		
Potential Hazards	**Comments**	**Not applicable**
Candles i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where they could be knocked over*		
Kerosene lamps i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where they could be knocked over*		
Flooring i.e. *- No hazards* *- Safety measures taken* *- Uneven* *- Untidy/trip hazards*		
Heating equipment i.e. *- No hazards* *- Safety measures taken* *- Placed in an area where they can be knocked over* *- Close to flammable materials and/or combustibles (Mosquito netting)*		
Hot water i.e. *- No hazards* *- Safety measures taken* *- In reach of children* *- Placed in an area where it could be knocked over*		
Other		

Kitchen Appliances

With your permission the researcher would now like to use the following table to assess your cookstoves, please feel free to add comments about the stove from your personal experience.

Kitchen - Appliances (cookstove/s)		
Potential Hazards	**Comments**	**Not applicable**
No Hazards		
Safety equipment		
Edges of the cookstove i.e. *- No hazards* *- Sharpe/smooth edges present on the cooking pot/cookstove*		
Stability of cookstove i.e. *- No hazards* *- Safety measures taken* *- Top heavy* *- Light weight* *- Easily tipped*		
Fuel Chamber i.e. *- No hazards* *- Safety measures taken* *- Fuel expelled or spilled from cooking chamber (i.e. ash, paraffin, charcoal)* *- Flames exiting the fuel chamber* *- Incorrect fuel administration*		
Cooking surface i.e. *- No hazards* *- Safety measures taken* *- Obstructions on or near cookstove* *- Open flames surround the cook pot*		

Chimney i.e. *- No hazards* *- Safety measures taken* *- Insulated chimney*		
Condition of Cookstove i.e. *- No hazards* *- Safety measures taken* *- Damaged fuel aperture* *- Broken metal cladding* *- Cracks*		
What is done with the cookstove after the cooking has been completed?		
Other		

Electrical Appliances

If applicable and with your permission the researcher would now like to use the following table to assess your electrical appliances, please feel free to add comments from your personal experience.

Appliances – electrical		
Potential Hazards	**Comments**	**Not applicable**
Wiring i.e. *- No hazards* *- Safety measures taken* *- Damaged electrical cords*		
Electricity outlets i.e. *- No hazards* *- Safety measures taken* *- Damaged sockets* *- Overloaded sockets* *- Incorrect plug for socket*		
Other		

Other Hazards

Please use the following table to identify any other hazards and safety measures in the living space/s

Other Potential Hazards		
Hazard	**Comments**	**Not applicable**
Gas cylinders i.e. *- No hazards* *- Safety measures taken* *- Inappropriate storage of gas cylinders (not in house or shaded safe area)*		
Liquid fuel i.e. *- No hazards* *- Safety measures taken* *- Inappropriate storage(i.e. in water bottle, in-correct labelling)* *- Accessible to children*		
Clothing i.e. *- No hazards* *- Safety measures taken* - long sleeves or clothing worn during cooking process		
Other		

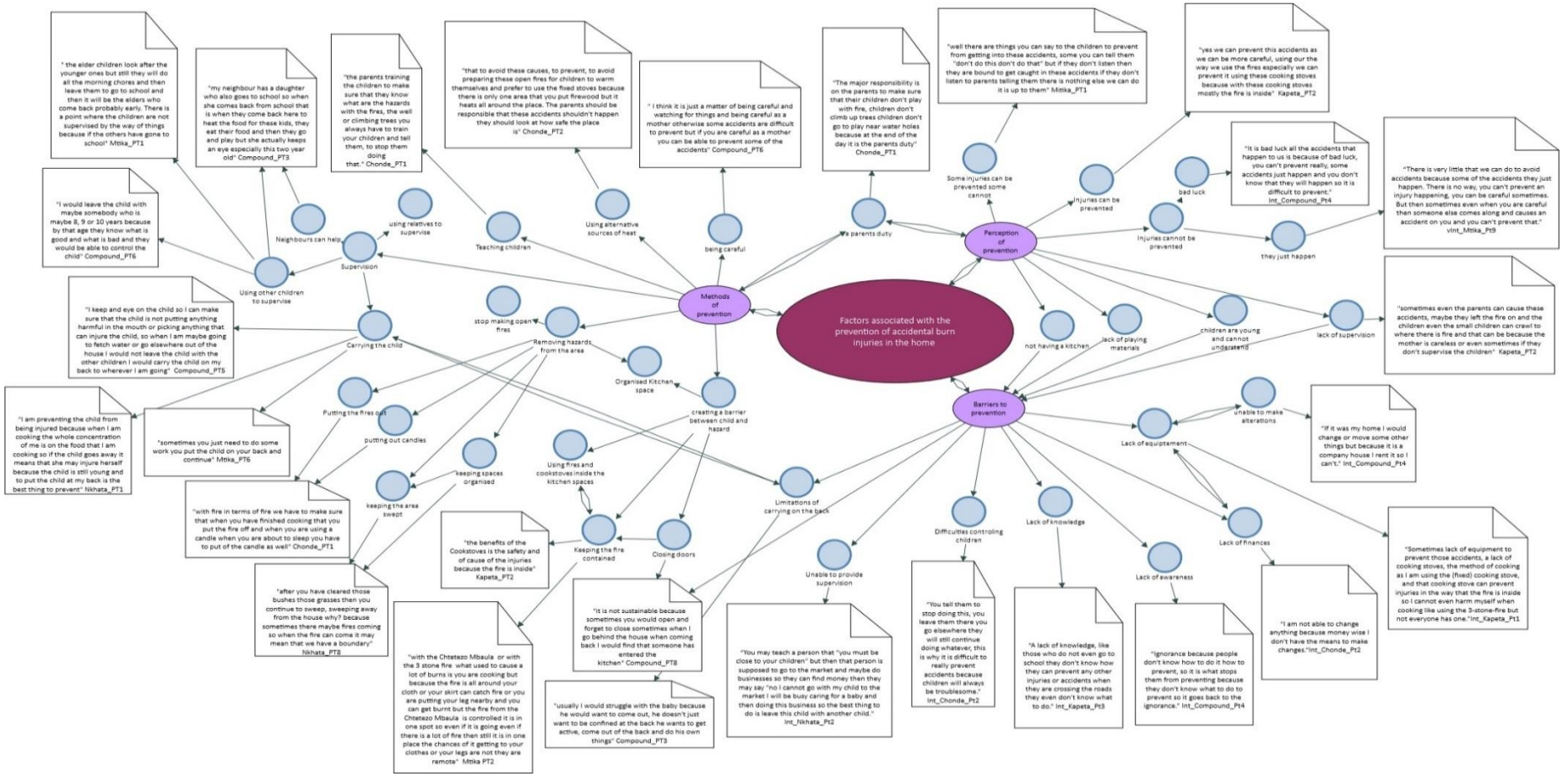
Access to Safety Equipment

Access to Safety Equipment	
Equipment	**Comments**
First Aid Equipment *What do you use in an emergency?*	
Water Access i.e. *- Is there water connection or water collection point nearby* *- Where is water kept?*	
emergency numbers i.e. *- Access to phone* *- Knows numbers to call in emergency*	
Firefighting equipment i.e. *- If there is a fire what do you use?*	
Other	

Appendix 5: Example of the initial coding process of household data

Quote from interview transcript	Initial Codes
Many of them like the young ones the burns are from scalds because they try to follow their mother when they are cooking so the mother is away and the fire is burning and then that is when the child can tamper with the boiling water and then they get the scalds.	Burns in young children: Scald burns Following mothers Supervision near fires Access to boiling water
Then we have a number of patients in the cold season because everybody seems to be warming themselves so like you know you see someone is warming themselves and then they have say epilepsy then they get an attack like and epilepsy attack and then the fall on the fire and even the smaller ones they are trying to warm themselves close to the fire where their mother is cooking and unfortunately, they can tip out the boiling water or the fire itself they get burns.	Seasonality and burn injuries Epilepsy – pre-existing medical conditions Methods to keep warm: cooking fires Burns in young children: Flame burns
In the villages, it is difficult because these parents they need to go to do things like farming because they cannot be every time taking the kids to the farming field so they have to leave the kids with maybe their siblings at home and those siblings they also go to play so they leave even the smaller siblings at home so it is difficult *C0_KCH*	Difficulties providing supervision Using siblings to provide supervision

Appendix 6: Example of theme development from household data using nVivo concept mapping



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